The Village: Infrastructuring Community-based Mentoring to Support Adults Experiencing Poverty

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ABSTRACT

Mentorship and other social and relational support have been vital to poverty alleviation and transformative change. It is crucial to understand the underlying factors in the success of mentoring models and subsequent programs to support them. Thus, we conducted a mixed-methods study consisting of longitudinal surveys of community participants followed by semi-structured interviews with 28 community members, eight mentors, and two coaches participating in a community-based mentorship program. Drawing from community-based participatory research in partnership with a non-profit located in a Midwestern United States (U.S.) city, we unpack how the program supported self-sufficiency and economic mobility among adults experiencing financial hardships. Through an infrastructural lens, we attend to individuals' infrastructuring work in social support, flexibility, and trust to support a "village" model of community-based mentorship. Our results show how the village model differs from traditional mentorship models that assume dyadic, one-to-one, often didactic, and hierarchical relationships (e.g., expert and protégé, adult and child) and are used primarily in the workplace and educational settings. The village mentorship model advocates for less hierarchical and more balanced relationships in non-institutional settings and flexible communication and technological needs. We discuss new research opportunities and

design strategies for rethinking technology-mediated mentorship to support poverty-stricken adults in the U.S.

CCS CONCEPTS

• **Human-centered computing** → **Empirical studies in HCI**.

KEYWORDS

mentorship, community-based mentorship, community-based participatory research, social support, economic mobility, infrastructure, infrastructuring

1 INTRODUCTION

One of the most significant economic and social problems today is poverty [14]. Conventional programs designed to help individuals facing financial barriers have focused on providing individuals with education and training, work experience and job search skills, and transportation and childcare access [5]. Mentors or more senior advisors might be assigned within educational and employment contexts. While often overlooked, mentorship and other means of reducing *social barriers* (e.g., a lack of social and relational support and engaging partnerships) are pivotal to poverty alleviation, and transformative change [14]. Indeed, addressing social barriers presents a vital opportunity because many individuals who experience poverty are socially isolated [49, 70, 71, 76]. Information and communication technologies (ICTs) have the potential to enhance community and social connectedness among families

[43, 66, 68], often through mentorship [95]. E-mail communication, texting, video conferencing (e.g., Zoom, FaceTime), and posting messages to online forums can facilitate communication between mentors and mentees. Some mentorship programs even use proprietary platforms, which might use a combination of these technologies. However, mentorship-based technology applications (i.e., technology-mediated mentorship or e-mentoring) are primarily limited to education, workplace, and healthcare domains [4]. Despite the vast amount of research in this area, few researchers have sought to understand what technological-based mentorship models might look like for communities facing severe financial hardships. It is unknown what the design of such technologies would entail. Acknowledging that those facing financial hardship might not have access to stable Internet, new and innovative solutions must be considered to provide mentorship support among these groups. We explore what opportunities exist for technologies to support mentorship particularly as it relates to self-sufficiency[1] and economic growth or mobility.[2] Individuals and families who are working toward self-sufficiency are also moving toward achieving greater economic growth.

Therefore, we, the university team, partnered with a local non-profit organization (NPO) in a large Midwestern city in the U.S. to begin our investigation. Broadly, the NPO's goals are to achieve sustainable neighborhood growth by way of developing people, and communities. The NPO aimed to provide social and relationship support to community members experiencing poverty for this specific project. These community members and families experienced homelessness, unstable income and employment, and limited access to healthcare and other resources. To support these community members, the NPO adapted a version of the Economic Mobility Pathways (EMPath) Mentoring model [8], details of which we discuss in the next section. EMPath informs the programs of more than 100 organizations around the world [28]. Building on this model, the NPO aimed to connect community participants to young and mid-career professionals and retirees with a service orientation. Through an evaluation of a mentoring program designed to support self-sufficiency, we, the university team and community partners, qualitatively explored how those receiving mentorship perceived the program's impact and how community-based mentorship was implemented in practice. Building on prior HCI literature on infrastructure and infrastructuring (e.g., [32, 52, 84, 91]), we turn to the "infrastructuring work" undertaken by each individual involved in community-based mentoring (including mentors, coaches, and community participants) to achieve individual and collective goals in mentorship. Therefore, we posed these research questions:

- (RQ1) What types of infrastructuring work do individuals involved in community-based mentoring have to conduct?
- (RQ2) How does this help us to re-envision mentorship in HCI?

To address these questions, we conducted a mixed-methods study consisting of a longitudinal survey with community members followed by 38 semi-structured interviews with all stakeholders (i.e., 28 community members, eight mentors, and two coaches). Our findings suggest a fundamental shift in how we think about e-mentoring technologies, especially in support of those who face severe economic hardships. Such technologies should move away from standalone designs and towards models supporting more balanced power and shared accountability. "It takes a village to raise a child", was a phrase used heavily among community stakeholders. The origin of the saying is related to deep-seated cultural practices, and customs among individuals of African and indigenous descent, which highlight that an entire village is necessary to raise a child [29]. The phrase also reduced the hierarchical implications of what it means to have a "mentor." We found that infrastructuring the village required village members to foster social support, enable flexibility, build trust, and stitch together fragmented technology use and broken technical infrastructure.

While traditional technology-mediated mentorship assumes dyadic, one-to-one and often didactic and hierarchical relationships (e.g., expert and protégé) [64], our results suggest the need to rethink technologies that aim to support mentorship. We must reimagine technologies that (1) facilitate a networked group of people who provide values such as social support, flexibility, and trust and (2) move away from designing for goals managed within a hierarchical structure (and especially within standalone designs [3]) and toward designing for relationships, emotions, and care. Our work contributes:

- Empirical results of a community-based mentorship program implementation in a new and diverse setting extending past research, which has primarily investigated predominately White institutions [65];
- Empirical results, which uncover the necessary infrastructuring work conducted by individuals in community-based mentoring, and contribute an understanding of how infrastructuring work can orient towards inscribing community values;
- New HCI and CSCW research opportunities and design strategies for rethinking and fundamentally shifting how we support technology-mediated mentorship, supporting resource-constrained individuals and communities (see Table 1).

2 BACKGROUND CONTEXT

2.1 Economic Mobility Pathways and Mobility Mentoring®

We begin with an overview of the Economic Mobility Pathways (EMPath) Mobility Mentoring® approach. EMPath is a U.S.-based non-profit that aims to disrupt poverty through advocacy, research, and direct services. Our NPO partner selected EMPath's mentoring approach to achieve self-sufficiency and support poverty alleviation in the community.

One of the services that is integrated throughout EMPath is mobility mentoring, an approach to economic mobility and stability. The approach involves a partnership among community organizations and consists of four elements: the Bridge to Self-Sufficiency®

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[1]Self-sufficiency is a multifaceted term that in this article refers to "the dynamic interaction of the psychological development with the economic progress of the welfare leavers' trajectory off of welfare" [37, p.371] Self-sufficiency involves psychological empowerment, skill acquisition and training, and reaching financial goals [37].

[2]We refer to economic or upward mobility as improving economic status, which is often measured by income [79].

EMPath
Economic Mobility Pathways

BRIDGE TO SELF-SUFFICIENCY®

	FAMILY STABILITY		WELL-BEING		FINANCIAL MANAGEMENT		EDUCATION & TRAINING	EMPLOYMENT & CAREER
	Housing	Family	Physical & Mental Health	Networks	Debts	Savings	Educational Attainment	Earnings Levels*
THINKING ABOUT THE FUTURE	No subsidy, housing costs 1/3 or less of household gross pay	Fully able to engage in work, school, and family life; children or family needs don't get in the way (OR) No children or dependent family members	Fully able to engage in work, school, and family life; health and mental health needs don't get in the way	Can always rely on networks to provide useful advice, guidance, and support; advocates for others	No debt other than mortgage, education, and/or car loans, and current in all debts	Savings of 3 months' expenses or more	Bachelor's degree or higher complete	Earnings = 80%+ AMI (Family-Sustaining Wage) Household Size of: 2: $62,550+ 3: $70,350+ 4: $78,150+
	No subsidy, housing costs exceed 1/3 household gross pay	Mostly able to engage in work, school, and family life; children or family needs rarely get in the way	Mostly able to engage in work, school, and family life; health or mental health needs rarely get in the way	Can often rely on networks to provide useful advice, guidance, and support	Current in all debts and making more than minimum payments on one or more debts	Savings of more than 2 months' expenses, but less than 3 months' expenses	Associate's degree or professional certification complete	Earnings = 50% - 79% AMI Household Size of: 2: $41,400 - $62,549 3: $46,550 - $70,349 4: $51,700 - $78,149
	Subsidized Housing - pays $300+ towards rent	Somewhat able to engage in work, school, and family life because of children or family needs	Somewhat able to engage in work, school, and family life because of health or mental health needs	Can sometimes rely on networks to provide useful advice, guidance, and support	Making minimum payments on all debts	Savings of at least one month's and up to 2 months' expenses	Job training or certificate complete (beyond high school)	Earnings = 30% - 49% AMI Household Size of: 2: $24,800 - $41,399 3: $27,900 - $46,549 4: $31,000 - $51,699
	Subsidized Housing - pays $0 - $299 towards rent	Barely able to engage in work, school, and family life because of children or family needs	Barely able to engage in work, school, and family life because of health or mental health needs	Can rarely rely on networks to provide useful advice, guidance, and support	Behind in payments of 1 or more debts and making payments on at least 1 debt	Savings of less than one month's expenses	High School Diploma or GED/HiSET complete	Earnings = < 30% AMI Household Size of: 2: <$24,800 3: <$27,900 4: <$31,000
	Not permanently housed	Not able to engage in work, school, and family life because of children or family needs	Not able to engage in work, school, and family life because of health or mental health needs	Can never rely on networks to provide useful advice, guidance, and support	Has debts; currently not making any payments	No savings	Less than High School Diploma or GED/HiSET	Not currently employed *Income ranges are for Suffolk County, MA. Data from HUD's 5/14/17 AMI tables

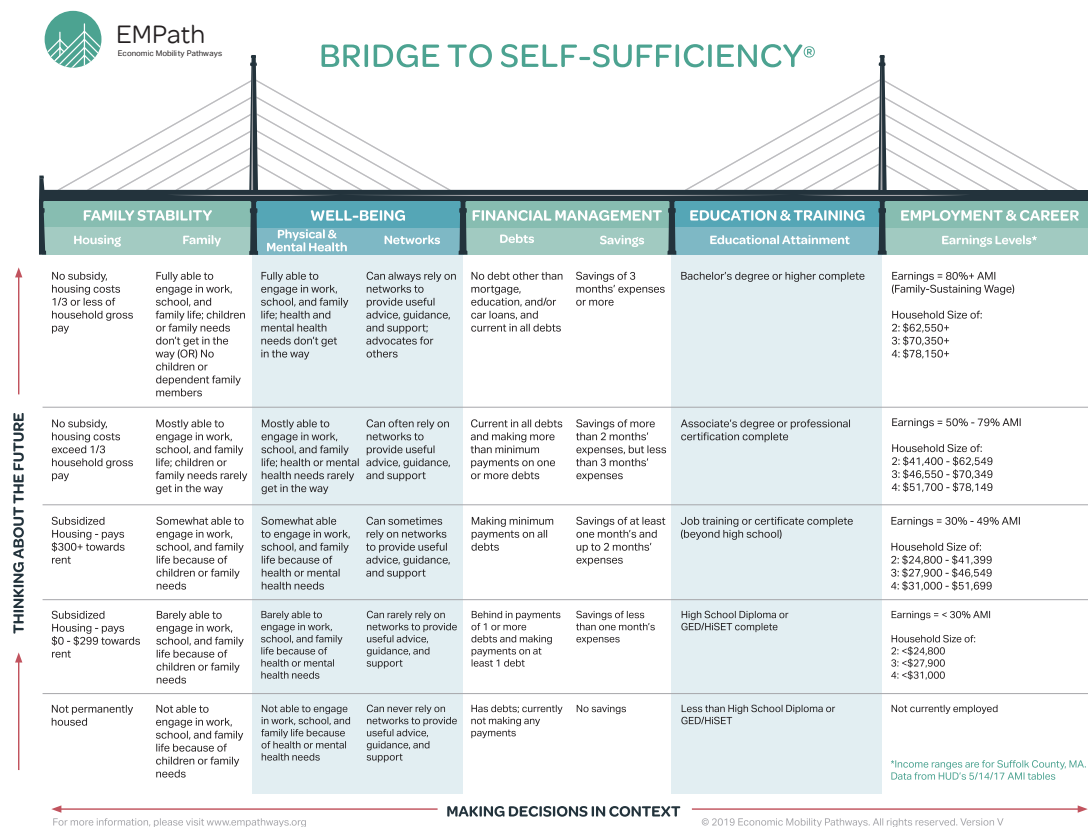**MAKING DECISIONS IN CONTEXT**

For more information, please visit www.empathways.org

Figure 1: Bridge to Self-Sufficiency® (created by Economic Mobility Pathways (EMPath), www.empathways.org)

(see Figure 1), coaching, goal-setting, and recognition. As stated earlier, self-sufficiency involves psychological empowerment, acquiring skills and educational training, and reaching financial goals. The Bridge to Self-Sufficiency® uses this comprehensive approach to achieve independence and consists of five pillars: family stability, well-being, financial management, education and training, and employment and career. Trained EMPath coaches use the bridge as a framework to support participants' resilience and persistence. Over time, the goal is for participants to become their own agents and to be able to coach themselves. Mobility mentoring relies on goal-setting as a critical component and uses Specific, Measurable, Attainable, Relevant, and Timebound (SMART) goals for participants to achieve their desired outcomes. This process enables the nonprofit organization to collect measurable data (e.g., goals met) to identify trends and overall model effectiveness. Finally, EMPath relies on a system of tangible and intangible positive rewards to support goal achievement. This recognition allows participants to celebrate wins, big or small. While we conducted our study in a specific U.S. geographic area, EMPath has informed the programs of organizations worldwide [28].

2.2 Research Partnership

For context, we use community member participants (i.e., community mentors who received mentoring and coaching) or community participants in this article because community mentors and coaches were also community members. For simplicity, we refer to community mentors as mentors. The NPO *formally* assigned the two individuals trained in the EMPath approach as *coaches* and *informally* assigned other community members as *mentors*. Mentors did not receive official EMPath training to support community participants in achieving their goals but coaches did. The key differences between coaches and mentors were that the coaches were paid NPO staff who received formal EMPATH training. Mentors did not receive this training, they were unpaid, and their role was that of a peer mentor. All coaches and mentors lived in the same community. We refer to the university team as the university/academic team partners throughout the article. One academic team member, the last author received EMPath training.

In January 2017, the non-profit organization (NPO) partner secured seed funding from a local foundation to develop a mentoring program that connected residents (i.e., community members) with mentors. However, the NPO's initial grant did not provide financial support for program assessment. Therefore, the NPO reached out to the university team to find opportunities to subsidize financing and explore overlapping interests for opportunities to collaborate.

The goal of the program was to provide social support for addressing known barriers to stable employment such as low self-efficacy and limited access to social support [89]. As stated earlier,

the NPO adapted the Economic Mobility Pathways (EMPath) Mentoring® program [8], which informs the programs of more than 100 organizations around the world [28]. In partnering with the NPO, the university team's goal was to assess mobility mentoring while attending to the oft-invisible work undertaken by community members involved in this community-based mentorship approach, including mentors, coaches, and mentees. In this way, we were able to make visible and advocate for the infrastructuring work that underlies the implementation of community-based mentorship. The university team was also interested in identifying a model for supporting community- and technology-based mentorship among people experiencing financial hardships and assessing the direct benefits of mentorship because very few studies had already done so [4]. The team submitted a community-based participatory research (CBPR) proposal and received funding to support the assessment of the program.

2.3 Local Context and Program Details

The EMPath program evaluated by the university team was implemented in a Midwestern city predominated by African American residents. About 28.5% of the homes in the community were vacant, and 47.4% of residents in the neighborhood owned their homes [16]. The midwestern city's average household income was about $42,105 [15] and the median home value $51,600 [16].

The program evaluated included community-partner-hosted meal clubs held three times each month (one breakfast and two dinners). At the meal clubs, speakers provided information about financial management, subsidized housing, criminal record management, and other topics. The meal clubs were an essential socializing experience where participants could hear about the problems facing others like them and realize that their problems with poverty were not theirs alone. These activities helped normalize the experience of poverty and gave participants a place to feel safe and welcome. Meal clubs also provided an opportunity to hear about other program participants' positive experiences and achievements, providing them with frequent recognition, inspiration, and hope.

There were 121 program participants: 94 community participants who were enrolled in the program, 25 mentors, and two coaches. Community partners included coaches, the local director of the mentorship program, and the NPO director.

Community participants were expected to meet with coaches weekly and communicate with them as needed. The coaches managed many roles to support community participants; however, their primary role was to help community participants set and accomplish their goals. Community participants set their goals during the intake process; however, the university team did not receive their specific goals. Community partners shared aggregate data such as community participants' mean age and income to supplement the university team's data. We did not have access to community participants' levels of education. Finally, as a part of the community-based participatory research process, the academic and community partners met regularly via virtual meetings and shared aggregate results to reflect on the interpretation of our results as a form of member-checking. There were also mid-year and end-of-year face-to-face check-ins with our funding organization and other teams who received funding from the same CBPR research-granting body.

Check-ins allowed the academic and community partners to reflect on the partnership and make adjustments as needed. These insights are available in Appendix A. Although the funding for this program ended in 2019, the model was sustained; however, since the COVID-19 pandemic in 2020, phone check-ins still occur, but no face-to-face sessions have been conducted. Resources are provided as needed (e.g., support for unemployment filing, financial assistance, water activation services). Community participants still receive mentorship for resources and social support.

3 RELATED WORK

To situate our work, we first review past literature on mentoring and the design of mentorship technologies in HCI and neighboring fields. We unpack the shift in power dynamics in mentorship and the kinds of prioritized knowledge. We then review past HCI studies on infrastructuring to situate our investigation on individuals' infrastructuring work in community-based mentorship.

3.1 Mentoring, Mentorship, and HCI

3.1.1 Reconfiguration of Power Relationships in Mentoring and Mentorship. Even though mentoring is a common practice adopted in varied social contexts, the term mentorship, or mentoring, itself is ambiguous [41]. The term's use across diverse settings, including education, community, and business, has led to conceptual confusion [4]. Traditionally, mentorship refers to the support-based "intense relationship" between a senior and junior personnel pair. Typically the more senior individual (i.e., mentor) helps the lesser skilled or experienced individual (i.e., mentee or protégé) navigate their "career advancement and psychosocial development" [46, p.229]. In this sense, traditional mentoring often assumes a hierarchical power relationship between the senior and the junior. This arrangement positions mentors in dominant positions (i.e., as a teacher), and subjects mentees to subordinate roles (i.e., the learner) [46, 65]. A wealthy body of literature has cautioned us of the power, authority, and control embedded in this traditional one-way mentor-mentee relationship. The literature raises critical questions of what ways of knowing are prioritized. From a feminist perspective, DeMarco questioned the marginalization of mentee's situated knowledge and lived experiences [22]. While the success indicator of mentoring is often quantified into specific goals, necessary success and support factors (e.g., reciprocity, empowerment, and solidarity) go unnoticed [22]. In addition, traditional mentoring arrangements perpetuate the hegemonic reasoning along the lines of gender and race through the historical exclusion of non-White groups in numerous institutions and organizations [75].

To combat these harms, scholars have advocated for alternative mentoring structures with a lens of equity, inclusiveness, and social justice [60, 65]. According to Mullen and Klimaitis, contemporary mentorship intends to facilitate mutual learning between the mentor and mentee, thereby broadening the possibilities of what either person can achieve alone. Contemporary mentoring aspires to remove traditional mentorship's inflexible roles and diversity barriers [65]. In other words, modern mentoring aspires to shift from rigid senior-subordinate relationships to dynamic and networked configurations among varied actors, aiming to bring forth the situated knowledge of each actor.

3.1.2 Technology-mediated Mentoring and Un-platforming. Integrating Information and Communication Technologies (ICTs) into mentorship requires such technologies to become more socio-technical. The most common form of technology-mediated mentorship is electronic mentoring or e-mentoring. A systematic review of e-mentoring programs found that the majority of programs supported clinical skills training, followed by personal and academic support, and career and networking opportunities [19]. Our literature review suggests shifting from using single mentorship platforms to using various digital tools (e.g., email, cell phones, video conferencing, tracking technologies) to facilitate the growing adoption and necessary transitions.

iPeer is a mental-health-based mobile platform developed explicitly to support veterans' mental health during the process of civilian reintegration [72]. This e-mentoring tool tracked veteran status in real-time and sent regular reports to veteran mentors who shared similar experiences. In another study to promote gender representation of STEM in the workforce, Alhadlaq, Kharrufa and Olivier found with young Saudi Arabian women that participants' generation, more so than cultural norms, affected the design of e-mentoring [3]. According to the article, traditional face-to-face mentorship programs are rare in Saudi Arabia. However, the young women valued flexible and independent relationships and connected with multiple mentors through multiple existing digital means. They wanted to hold the power of initiating such relationships themselves. These authors coined the term *un-platforming* to describe relying upon multiple technologies and loosely couple media (in their case, social media platforms and audio/video communication tools) that are familiar to individuals to facilitate mentoring [3]. Un-platforming creates new spaces and allows young women to use more familiar technologies to initiate and build relationships, share content, and manage visibility. In this way, un-platforming advocates for developing frameworks on top of existing technologies that individuals already adopt versus standalone designs. Similarly, a study explored what was needed to build successful intergenerational mentorship via elementary school students, and older adults [95]. The authors found that relationship-building, mentor skill acquisition, and broader teacher and school support were critical for building successful mentorship in this context. From a technology perspective, the authors proposed supporting mentorship-related activities in multiple formats like offering remote mentoring sessions and the use of asynchronous communication technologies to signal support and ways for systems to increase teacher capacity.

Building on an emergence of *un-platforming* cases (i.e., [48]) and as we discuss later, infrastructuring, entrepreneurs (specifically those in cities with high rates of inequality and low-income residents) have used social media platforms like Instagram to find mentors [7]. The HCI and CSCW space have developed career-development technologies to initiate connections with mentors (e.g., crowdsourced mentorship [74, 87] for skill development and connecting with potential experts [39]). Indeed, designing for technology-mediated mentorship in HCI helps to promote inclusion and diversity in computing and technology, but little is known about the power dynamic that the use of these technologies can unfold. Meanwhile, because these technologies have been used primarily in institutional and more formal settings (i.e., training, education, and employment), the beneficiaries of such efforts are more likely to be financially stable (i.e., individuals and groups with stable housing, jobs, and Internet access). Our study complements the previous work and focuses on a different set of stakeholders—particularly those experiencing poverty—*and* in a non-institutional and less formal setting.

3.1.3 Community-Based Mentorship and Economic Mobility. One essential question that past research raised is: how those who do not have formal access to mentorship achieve mentorship and the opportunities for technology-mediated mentorship to provide support in these contexts. To address such inequities, recent HCI and CSCW research has investigated technology's role in supporting social support and economic mobility among ethnically diverse communities facing economic insecurity due to limited social connections and isolated work [7, 23–25, 34, 38, 58]. Our work builds on these contributions.

While much of this work aims to support economic development, the importance of trust, strong social networks, and support, especially to digital engagement, is an underlying finding. For instance, Hui et al. showed how digital tools should not be the sole pathway for economic support. These authors conceived the concept of a *community collective* to describe how entrepreneurs from under-resourced areas rely on their *offline* community's social ecosystem. The ecosystem described consisted of assets such as resource-connecting organizations, regular in-person meetings, paper planning tools, and practice and validation [38]. Here, Hui et al.'s community collective illustrates a kind of community-based mentorship, where cohorts of informal and formal networks [54] come together in support of each others' growth [47], mentor across differences [55], and value learning while being action-oriented. Situating this work in community assets and knowledge, community-based mentorship centers on flexibility, inclusiveness, shared knowledge, interdependence, broader vision of organization, widened external networks—a safe place—team spirit and skills, personal growth, and friendships [56]. Taken together, community-based mentorship aims to bring forth and embody the qualities of reciprocity, horizontal and vertical collaboration, and a flattened hierarchy [65].

Yet, this line of research has been limited to the workplace and academic settings [65]; support for financially-constrained populations has been, for the most part, nonexistent. While newer HCI and CSCW research speaks to mentorship alternatives in economic mobility and social support, no investigations have assessed community-based mentorship in the context of economic mobility and social support from a technology-mediated perspective. Our work contributes to this knowledge gap.

Broadly, our work aims to address the calls for a deeper understanding of mentoring relationships that extend beyond conventional one-on-one relationships [20], calls for more equitable and inclusive forms of mentorship [64], and contributes an understanding of the opportunities for technology to support these efforts.

3.2 Infrastructure and Infrastructuring Work

In our work, community-based mentoring and mentorship can be regarded as an infrastructure. This infrastructure provides support and services to community members experiencing poverty and challenges in accessing and using technologies. An infrastructural lens lets us foreground the relations and configurations

among various technology artifacts and human actors involved in community-based mentoring. This lens draws attention to the human infrastructure that supports these relations and arrangements. An example of an infrastructural approach is our earlier discussion of un-platforming and how young Saudi Arabian women relied upon multiple technologies and loosely coupled media to facilitate their mentoring [3]. We use Lee and Schmidt's definition of infrastructure as "an assemblage of artifacts, activities, and users in operation as providing support to some social system" [53, p.30]. Here, infrastructure is essentially networked in nature. Star and Ruhleder's seminal work stresses that infrastructure is relational, situational, and practical: "it becomes infrastructure in relation to organized practices" [84, p.4]. This calls attention to both the social and technical aspects of infrastructure in HCI and nearby areas. This socio-technical perspective directs researchers' focus onto how infrastructure comes into being, how it is maintained and used, and how it becomes visible upon infrastructural breakdowns. HCI scholars are particularly interested in the human infrastructure (e.g., [17, 32, 52, 88])—"the arrangements of organizations and actors that must be brought into alignment in order for work to be accomplished" [52, p.484]. In this light, human infrastructure plays a critical role in undertaking the coordination work and maintaining information infrastructures, especially in the contexts where information infrastructures constantly break down [27, 52].

HCI scholarship has also turned to the notion of *infrastructuring* to understand the processes and practices through which infrastructures evolve, are made, built, and maintained [53]. Developed from Star and Ruhleder's question of "when is an infrastructure" [84], this understanding of infrastructuring sees infrastructure as an ongoing process [44, 53] that involves "activities of changing and improving collaboration through the means of existing information infrastructures" [80, p.115]. HCI scholars have looked into technology use through the lens of infrastructuring to unpack how particular information systems are adopted in local socio-technical processes [42, 59, 69]. These infrastructuring activities often encompass end users' appropriation and reconfiguration of infrastructures in the context of existing and envisioned systems [69]. Attending to infrastructuring work also opened the space for HCI scholars to attend to the mundane and situated practices that individuals put into the making and remaking of social infrastructures, such as health care systems [32, 45], participatory design [11, 21, 34], cultural dissemination and engagement [6], navigating disruptive life events and crises [26, 27, 77]. For instance, Semaan considers relying on technologies to build everyday resilience during disrupted living conditions as "routine infrastructuring" [77]. Routine infrastructuring undertaken by minoritized individuals and communities generates competence, reflexivity, security, alternative pathways that existing social infrastructures fail to offer. Gui and colleagues investigated the patients' and caregivers' practices of navigating and stitching the fragmented health care infrastructure in the U.S. [32, 33]. Patients and caregivers took on infrastructuring work to repair infrastructural breakdowns on the micro level. These breakdowns resulted from individual health care providers, the failed coordination among healthcare organizations, and systematic constraints of the broad health care infrastructure (such

as the conditions resulting from strict policy and financial requirements) [32]. This research uncovered the types of infrastructuring work undertaken by caregivers and patients, which are often emergent and forced by the problematic design of the health care infrastructure. At the same time, individual emotional struggles remain invisible and unacknowledged in today's functioning health care economy. In another study, Vlachokriakos et al. looked into solidarity movement through the lens of infrastructuring [91]. This study provides a detailed case study on how solidarity movement coalitions negotiated the design and adoption of technologies with external stakeholders to navigate the balance between utilizing available resources and maintaining the coalition's strategies.

Our work extends the discourse on infrastructure and infrastructuring to the context of community-based mentorship and ongoing poverty. We look into the infrastructuring work carried out by individuals involved in community-based mentoring and the implementation of EMPath. Doing so allows us to nuance our understandings of the oft-invisible work in community-based mentoring. Foregrounding individuals' infrastructuring work and how such infrastructuring work is situated in community's practices enables us to strengthen community-based mentoring infrastructure design in resource-constrained contexts in the future.

4 METHODS

We took a mixed-methods approach to address our two key research questions. First, we conducted a longitudinal survey to assess the EMPath Mentoring Program. We then conducted a series of semi-structured interviews with the community participants, mentors, and program coaches to understand opportunities for technology to support mentorship programs aimed to improve well-being and employment among our participants and to inform and supplement our survey results. Our institutional review board marked our study protocol as exempt, and we explained our consent form. We describe our participants and data collection, longitudinal survey, and semi-structured interviews in the following subsections.

4.1 Data Collection

4.1.1 Longitudinal Survey. Longitudinal surveys support data collection from the same sample on multiple instances over time [61]. While there are many advantages to using this method, disadvantages such as panel attrition and non-response are a risk [61]. Because there were no precise scales to assess each pillar of self-sufficiency, the university team turned to the literature for corresponding constructs. Therefore, the survey evaluated changes in psychological self-sufficiency [37] in three waves. Psychological self-sufficiency is a concept developed from ethnographic and participatory research with low-income populations [37] and is a significant factor for long-term economic success in the context of workforce development programs [35].

The survey also assessed self-efficacy [9], hope [83], and social support [78]. Based on the community partner's expertise and grounded in past literature, this choice represented the most significant barriers to employment and economic independence. We do not detail the items used in each scale here because we were not able to determine statistical significance in our results; however, they are available in Appendix B. The community partner advertised

and distributed the surveys, which took approximately 45 minutes to complete. Community participants were compensated $10 for completing the baseline survey and $10 at each 3- and 6-month follow-up.

4.1.2 Interviews. At the end of the longitudinal survey data collection, the university team conducted 1-hour semi-structured interviews with community participants, coaches, and mentors to address our research questions. The goal of interviewing all stakeholders was to triangulate our data to strengthen the validity of our qualitative findings. In total, the university team interviewed 38 program participants (out of the total 121 participants): 28 interviews with community participants (15 men and 13 women), eight interviews with mentors (3 men and 5 women), and two interviews with the coaches who were both women. The university team reached data saturation among community participants around interview 20—no new empirical findings relating to our inquiry emerged. This number represented 31% of all program participants (i.e., community participants, mentors, and coaches). All interviews were recorded and professionally transcribed.

The academic and community partners collaboratively developed the interview protocol, focusing on the participants' assessment and perceptions of the program and how the program affected community participants' self-sufficiency, self-efficacy, social support, career development, and overall economic situation. Additional questions sought to understand community participants' expectations of the program, their activities, their coach, how they set goals with their coach, and how they benefited from the program overall. Academic partners asked community participants about their mentors, their mentor expectations, and how their mentors supported them. Finally, academic partners asked community participants and mentors about their Internet and smartphone access, whether or how they used technology in their mentoring-related interactions, and what they used the Internet for primarily.

The university team also interviewed the two coaches and eight mentors to understand their roles in working with the program members. We also asked about the most challenging aspects of their work, the types of issues they saw the program members face, and their perceptions of technology, and any role, if applicable, technology played in managing their relationships with their community participants. We compensated mentees and mentors who participated in interviews $15.

4.2 Analysis

The university team members led the data analysis for each phase of the project and met with their community partners at the initial phases of analysis. The university team analyzed surveys by comparing participants' responses to the variables of interest at 0-months, 3-months, and 6-months into the program using a one-way repeated measures analysis of variance (ANOVA; within-subjects). The university team examined the following variables of interest: hope, self-efficacy, social support, and psychological self-sufficiency.

Two members of the university team qualitatively analyzed interview data using structural coding as a first coding cycle. We applied a conceptual phrase to represent our topic of inquiry to data segments representing the research questions we used to frame our interviews [62, p.124]. We chose this method of analysis because our

study consisted of semi-structured interviews involving multiple participants. This approach helped guide the development of our mentorship model and, as an exploratory investigation, helped build an understanding of the ways e-mentorship can support similar programs [73, p.84]. Structural coding generated a large qualitative data set and enabled us to quickly access the relevant data based on our question-based codes [67, p.141]: *What types of infrastructuring work did individuals involved in community-based mentoring conduct?* To better address our second research question, we also coded for the question: *How does this help us to re-envision mentorship in HCI?* We then moved on to more focused coding as our second cycle coding to categorize the most frequent codes into our codebook. We conducted additional rounds of focused coding to identify and develop salient themes through ongoing discussions and refinement with another university team member. A total of three members of the university team met regularly to discuss coding conflicts and reach agreement. Finally, the university and community partners discussed results to ensure accurate interpretation.

4.3 Participants

Community participants earned an average annual income of $10,553 (standard deviation [SD]=$6,225.18), much less than that of the city's average, and some experienced homelessness within the duration of the study period. Their average age was 48.5 years (SD=11.4 years). Mentors' lowest reported incomes ranged from $35K-$45K and the highest was greater than $95K. Mentors' average age was 61.5 years (SD=7.1 years), and their education levels ranged from high school or GED to master's degrees. All reported having prior volunteer experience in interviews. Because there were only two coaches who we interacted with regularly, we, the university team, did not request their education, age, or income data.

5 FINDINGS

We saw that the community's implementation of EMPath led to a community-based mentorship infrastructure that provided a level of advocacy and support far beyond that described in any program outlined in our related work. Each individual (including mentors, coaches, and community participants) undertook infrastructuring work to facilitate and build social support, flexibility, and trust. And this work served as the "glue" that bound community participants together.

Before discussing the details of infrastructuring work in fostering social support, flexibility, and trust, we discuss the discrepancy in how community partners translated the program's "mentoring" aspect to community participants, which was informative. When asked to name their mentors, all program participants referred to the two coaches, as opposed to their community peers, as their mentors. While the academic team expected to hear about their interactions with the 20 (peer) mentors, the community participants discussed the two coaches. This discrepancy might suggest an imposed hierarchy; however, the NPO never introduced coaches to community participants in this way. When asked about this discrepancy, the community partners explained to the academic team that they had not used the word "mentor" with community participants for concern that the term conveyed hierarchy and could be perceived in a pejorative way. They explained that they introduced

mentors as "village" resources to participants, which aligned with our findings. Thus, community participants perceived that the academic team interviewers asked about their relationship with their coaches and were unaware of the inconsistency. We modified our protocol accordingly.

The core of our results represents interviews with community participants, their coaches, and mentors. Our qualitative results report data from each participant in this order. However, we begin our findings by providing an overview of our survey results. Survey trends suggest that the program was successful[3], and interview results confirm this trend. After our summary of survey results, we unpack how infrastructuring fostered social support, trust, and flexibility in community-based mentoring. Afterward, we turn to the breakdown of the technical aspect of community-based mentoring infrastructure, highlighting individuals' infrastructuring work to navigate the technical failures.

5.1 Overview of Survey Results

Because of the limited data points collected at each survey period (*initial*, 0-months, N=31; *mid-point*, 3-months, N=7; *final*, 6-months, N=2), we were not able to determine statistical significance. We were unable to reach community member participants for several reasons. In some cases, these were indicators of success. For example, some participants relocated to more stable housing, which was outside of the organization's service area. Thus, they were unable to utilize the organization's transportation program to reach the office. In other cases, participant contact information changed or phones were not in service at the time. While we are not fully certain, it is possible that there was interference between our study and other community-wide meetings and programming. Therefore, we briefly discuss the positive trends that emerged from our quantitative survey results to better situate our qualitative results that related to our two research questions.

Overall, the community partners discussed improvements in their community participants' economic mobility and well-being. Community partners noted that only 56 of the total 94 community participants (59.6%) were active (i.e., coach-community participant communication at least once every 30 days). Of these, 16 community participants had taken steps to improved well-being (28.6%), 12 found employment (21.4%), 13 increased their income (23.2%), and nine acquired new education or certifications (16%). Only four improved their housing situations (7.1%). We found that the underlying structure of goal-setting and accountability, as outlined by the EMPath and Mobility Mentoring model, worked well. Community participants set goals across the range of categories represented in the Bridge-to-Self-Sufficiency® *Employment and Career* (N=15), *Education and Training* (N=13), *Securing Transportation* (N=7), and *Housing* (N=6). Community participants set SMART goals[4] that ranged from buying a home to receiving assistance with paying bills to cooking.

Consistent with the community partners' findings, general trends in quantitative survey results, when comparing initial results to

3-month results and then 3-month results to 6-month results, suggested fewer employment barriers and increases in adult hope, self-efficacy, and employment hope. Although there was a slight initial decrease in social support, analyzing the data after 6-months, which is when mentors were assigned, would have been preferable. Unfortunately, there were only 2 data points at the 6-month mark. Nevertheless, our qualitative findings suggest that providing social support was crucial to the program's success.

5.2 Fostering Social Support through Infrastructuring

Our initial survey results saw a decline in social support, which was a point of discussion among the university and community teams. Community partners discussed how this initial decline was consistent with some of their past results. They explained that the second survey results often represent an adjustment in initial baselines. Participants often realize that they do not have as much support as they initially thought.

Indeed, interview results from community participants suggest that many of them had limited access to social networks, which equated to only having one or two people they trusted in their lives. Thus, as our interview data suggested with community participants, social support was central to the program's success, with at least more than half (N=19) of community participants raising this as a positive aspect of the program. In general, community participants appreciated the program because they had someone to talk to and described coming out of their shyness, feeling connected to their communities, and having fun. Socially, community participants felt welcomed into the program, respected, and encouraged, and did not feel as though they were being judged.

The need to feel connected was salient among the majority (N=16) of community participants and crucial given that they had few people they could trust. Results from community participants, mentors, and coaches suggested that regular meal clubs and networking events, and classes held in the community, provided a space for community participants to share their stories and celebrate their progress toward their goals and offered a supportive environment. Meal club events also provided community participants an affordable and stress-free space to network, share "testimonies," solve everyday problems, "open up," and, as discussed later, build trust. According to P24, a community participant:

> You need things, diversions, that still make you feel good. It may have absolutely nothing to do with your financial picture or the death, but you feel less stress...You may just be going to a dinner, that you normally couldn't afford, that's available to you. You may just congregate with other people in the class. Sometimes we network and we come up with solutions. You'd be surprised, just networking is a wonderful thing. Networking is the bomb, actually. Cause you don't know unless you talk about it and get out there...at some point you feel yourself opening up because others have shared. You don't feel like you're alone in this. So you kind of build, like I said, a network, a partnership, new friends. [Community participant]

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[3]We note that there was no single metric of "success." Broadly, success was based on whether the program helped participants to work toward and achieve their desired goals. This may included participants moving into stable housing, finding jobs, and strengthening social networks to build a support system.
[4]SMART stands for Specific, Measurable, Achievable, Relevant and Time-based.

P24's description of their role in "building a network, a partnership, new friends" is telling here. To foster social support in community-based mentoring, each individual had to participate in the collective work of constructing a shared space and making each other comfortable in this space.

These findings coincided with interview results from our mentors and coaches. One mentor, P8, described that community participants (mentees) felt they didn't have anyone to talk to. This feeling was due to a lack of interpersonal trust (i.e., they were unwilling to be vulnerable and held low confidence in others) and is consistent with prior work [23, 25, 93]. The program provided a way for them to talk with people—from all walks of life—who could help them think of solutions to issues they were managing. One coach believed that some community participants joined the program to be more engaged in the community and connected, so it had the additional benefits of helping with their mental health. In explaining their role as a mentor, P4 described:

> To be a supportive person. They say it takes a village to raise a child, but it also takes a village to support the community. So I think the role here has been good. I've met a lot of community people, I've talked to, some were less fortunate than myself and have been able to, I hope, encourage them and influence them in a healthy way. [Mentor]

It is worth highlighting "It takes a village to support the community" as described by P4. Put it differently, supporting the community requires the village to engage in infrastructuring. Through ongoing infrastructuring work, resources within the village can be developed and (re)arranged to meet the community needs. Taken together, we see that such social support was not one-directional from "mentors" to "mentees". Instead, participants engaged in infrastructuring to create a shared space and supportive environment for each actor—including community participants, mentors, and coaches—to support one another. In other words, infrastructuring requires a network of individuals to each become part of the human infrastructure that serves as the foundation for community-based mentorship.

5.3 Enabling Flexibility through Infrastructuring

The EMPath program was primarily structured around goal-setting and accountability, and this aligned with traditional mentorship programs. However, the program's success relied on the flexibility of mentors and coaches to go beyond serving as weekly accountability partners. Our interview results from community participants, mentors, and coaches showed flexibility in the frequency of interactions among community participants and their mentors and coaches, their willingness to share various strategies for achieving goals, and their ability to personalize experiences. Mentors and coaches supported community participants' well-being and provided instrumental support beyond traditional mentorship expectations. They offered community participants emergency rides to the hospital and arranged transportation to their doctors' appointments. They even made arrangements to provide them with access to free meals. P1, a mentor, saw their role as supporting community participants with whatever they needed to work towards their goals (e.g., writing, giving a ride).

Whereas formal mentorship models are more structured around the check-ins between mentors and their mentees (i.e., weekly or every other week), community participants reported reaching out to their mentors and coaches as frequently as needed. Some reported every day, while others reported every few days, once a week, or once a month. More than half of the mentors (N=5) and both coaches reported being flexible around their interactions with their assigned community participants. P5, a mentor, did not believe in a cookie-cutter approach to mentorship and stressed that establishing a relationship with each person better tailors an experience.

Community participants described receiving social support and the benefits of mentorship in general, regardless of formal mentor assignments. This type of flexibility was beneficial in the context of community-based mentoring. Community participants described an inherent system of support and care irrespective of whether they had an official mentor or coach. P12, a community participant, shared how a coach offered him a ride home. This quote demonstrates how the participant believed in the program given the coach's check-in and follow-up. This connection helped P12 to ask for a health advocate after another check-in and follow up from the coach:

> ...just that type of friendship and connection made me say, "I can believe in this program."...and then also to have [the coach], to call me and say, "Hey, [P12] I haven't seen you in a while, how you doing?" Just recently she called me... I said, "I need a medical advocate because I'm having problems trying to get my medication with my disability. I need somebody to at least call my medicine in for me." [Community Participant]

Here, participants like P12 received instrumental support, despite not being paired with a specific coach. P12's case illustrates how coaches' infrastructuring work extended their role as an EMPath coach. While such infrastructuring work was perhaps forced by the broader systematic constraints (such as inflexible health care policies), it also manifested how infrastructuring was built upon the intention of reciprocity and care. Flexibility in support was not limited to *who* was providing the support or the *type* of support provided but also *when* and *how* the support was provided. One coach provided mentorship while also cooking together with a community participant:

> We have a kitchen down there. Did that in the basement, and we cooked. And he enjoyed it, I enjoyed it. It was time-consuming, but we took that time not just to cook, but I used it for a follow-up with him, so we also talked about his goals during ... You know, while we're cooking and doing the recipe, and things like that. [Coach]

Again, we see that the community-based mentorship relied on and contributed to power dynamics different from the traditional one-way mentor-to-mentee relationship. In our case, while mentors and coaches served as the main proxies to resources for community participants, they emphasized a shared sense of accountability and flexibility in the relationship among actors. The provision of social support and flexibility helped establish a sense of community and

family, which led to community participants' comfort with their mentors. Such interactions show how these factors helped to foster trust with mentors and coaches.

5.4 Building Trust through Infrastructuring

As previously mentioned, people felt welcomed because of the social support and the flexibility led by each actor's collective infrastructuring. In addition to social support and flexibility, we believe that mentors and coaches were able to build trust with community participants by sharing aspects of their own lives and were open to learning from community participants. Trust, although not explicitly highlighted in EMPath, was central to our community-based mentoring infrastructure. Trust is especially important in our context, because there is often a lack of interpersonal trust among people living with financial constraints [23, 25, 81, 93].

Almost half (N=11) of community participants explicitly expressed their sense of trust in the program because they felt comfortable in it. One approach to building trust was making people feel welcome. A community participant, P19, described receiving a warm welcome into the program, being treated equally, and feeling supported:

> Well, I believe just making the person feel warm; they really made you feel warm and welcome here. It wasn't like, okay well you just somebody off the street or whatever, or somebody from somewhere, and then this is all you gonna—they really made you feel warm and welcome and also they inspire you and you can like, okay you a teacher, you gonna be a teacher. [Community Participant]

While some community participants described having a lack of interpersonal trust in general, most described developing a trusting relationship with their mentors and coaches and were comfortable disclosing personal information. Community participants did mention challenges associated with sharing personal topics with strangers and not having experience doing so. Their initial perceptions were that mentors and coaches might also be uncomfortable sharing such intimate details; however, community participants, mentors, and coaches formed reciprocal relationships, and mentors and coaches shared personal information.

For example, one coach disclosed information about her personal life and background as a way to establish trust and reciprocity with mentees. She did this because it was noticeable to her that there were community participants who lacked trust. She discussed how she had to be careful about how she worded things and interacted with them:

> But once I continued to laugh and continued to just be natural, because I'm not about to just not be me, and I would get him to laugh sometimes. To see him smile, it's like, "Oh you can smile huh?" I would tease him and after a while after the conversations after him living life and things happening and me just emailing him checking [in on] him, let him know I'm here to support him still... For him, just coming at him at a different angle, talking to him and supporting him and encouraging him and not giving up on him. And including him in our meals and stuff even when he's not able to

> do it. That actually helped him to start reaching out to me more. [Coach]

This example illustrates how trust could be built and inscribed into the community-based mentoring infrastructure through mentors' and coaches' ongoing effort to be respectful, non-judgmental, genuinely concerned, and encouraging. Another mentor, P5, similarly discussed the importance of treating community participants equally, which eventually led to them running parts of the program themselves, thereby achieving social cohesion. Mentors and coaches described how community participants began facilitating their classes and planning and running the meal clubs. For instance, one coach said:

> [W]e were just here to support, to support whatever it is that they were doing, just to support them and help them however we could... When you treat them just like you treat their peers, then it empowers them and they felt comfortable that we weren't these people and they were these people. I was just amazed at how they ... by the end, they ran the program. [Coach]

This quote describes the shift in the arrangement of the human infrastructure in community-based mentoring enacted by mentors' and coaches' ongoing work in stitching the village together. Overall, the local community and neighborhood were common spaces; community members, mentors, and coaches shared prior experiences crucial for building trust. Our analysis's emerging success factors foregrounded a need to advocate for infrastructuring work that attends to human emotions, affect, and relations.

5.5 Stitching Together Fragmented Technology Use through Infrastructuring

Because of regular breakdowns of the community's technical infrastructure and community members' limited digital literacy, the technologies used in community-based mentoring were in states of fragmentation and constant uncertainty. During our interviews, community members expressed shared struggles over the access and use of digital technologies. In particular, no community participant reported using the Internet frequently, although some searched for jobs and used social media (including Instagram, Facebook, YouTube). Only two community participants reported owning a computer, and one of these two did not have home Internet access. One participant owned a tablet and described the program, "Bring Your Own Device" (BYOD)[5], to benefit their learning of technology.

Yet, several community members did describe setting goals to learn more digital skills, and one community participant wanted to explore how technology could support their finances. One community participant who attended a technology-related training (outside the mentorship program) described the patience required to teach basic computer literacy and the frustration they felt as a result of the facilitators' lack of patience:

> Well, a lot of the people didn't even know how to cut on the computer, let alone use it. Which I knew because, I mean not that I grew up with computers, but [computers] were just starting when I was in my twenties. And so

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[5]BYOD was like open office hours and provided a space for community participants to access university partners as technology consultants.

I knew a little bit more. It just seems like the facilitator was just getting really frustrated with them [community members] because they didn't [know]. [Community Participant]

While mentors and coaches used technology to reach community participants, it was challenging due to community participants' varied communication preferences and needs. In this case, mentors and coaches had to be flexible in their accommodations to the different levels of digital proficiency and preferences for communication modes. As one coach noted:

It's definitely a mixture. Email, text all that stuff is immediate. Face-to-face, some people just really enjoy the presence of another person. I'm not too much of a face-to-face person. I think sometimes we make more progress in person, because while you have me, and I have you, let's get as much done as we can, and it produces a lot of work then, but if you don't need it, then that's fine. I think it's really a mixture because I could shoot you a link to a job application, you do it, if you get stuck let's do it together. If I come across something over the weekend I'm going to send it to you if I have your email address. I'm not going to hold it in until Monday. I'm going to send it, because my mind is always thinking about "I have people that can benefit from this," so that's how I communicate too. [Coach]

As this quote suggests, to accommodate varied needs in technology use, individuals had to negotiate with other actors in the village to ensure seamless communication. This negotiation process also requires mentors to judge how to utilize the limited options best to mobilize and maximize the benefits of available scarce resources.

In only one example, a mentor described acting as an information broker based on their technology use. According to mentor P1:

Understanding the information on the pamphlet, learning about some of the programs, just like the young lady out there, even though she's not a mentee, if someone asked a question and I had some of the information, I would give them the information about it. I would know about the programs coming up because I would get it sent to my phone. [...] When I signed up for the mentorship, they said we have a newsletter, but also we're going to send you the calendar. So, they sent it to my phone and they also mailed it to my home. I have it, so when I'm out and I see individuals [community participants], I have the information at my fingertips. [Mentor]

As an information broker, the mentor quoted above served as a gatekeeper of community resources. And as the quote suggests, mentors had to take on the work of preparing for spontaneous inquires. While information brokering in this way was not identified consistently as a type of infrastructuring work, there are opportunities for community mentors and coaches to use technology to help to keep the community members informed about external resources available. Together, aligning with the trend mentioned above of un-platforming [3], our analysis similarly suggests the benefit of utilizing multiple technologies and loosely coupled media to facilitate mentorship. Un-platforming became especially important when mentorship happened in a community prone to breakdowns. And as we have shown in this case, un-platforming had to rely on human effort to coordinate what, when, and how to use multiple technologies and media.

6 DISCUSSION

In this paper, we investigated how EMPath, a community-driven mentorship program, was implemented among community members experiencing poverty and how its infrastructure was implemented. We attended to the infrastructuring work undertaken by individuals involved in community-based mentoring (including mentors, coaches, and community participants) to (1) foster social support among community members, (2) enable flexibility in the arrangement of people, technical artifacts, and mentoring practices, (3) build trust in the community, and (4) stitch together fragmented technology use and broken technical infrastructure (RQ1). Our results draw attention to the networked structure of community-based mentorship, which consists of shared resources, accountability, and mutual support. Building upon P4's quote "it takes a village to support the community," we propose the notion of "the village" to ascribe the community-based mentoring infrastructure observed in our work (see Table 1). Seeing community-based mentoring through the village foregrounds its underlying qualities of being safe, encouraging, non-judgemental, and notably, less hierarchical than conventional approaches to mentorship (i.e., more balanced power arrangement and shared accountability).

In this section, we synthesize our findings to address the second question *How does this help us to re-envision mentorship in HCI?* In the sections that follow, we first discuss what it means to incorporate "the village" approach into community-based mentoring and how this understanding can help us to rethink mentoring in HCI. We then unpack the infrastructuring work conducted by each village member, attending to the invisibility of such work. Finally, our results revealed that technologies might need to fundamentally shift toward more contemporary models and those described in Table 1 if they are to impact communities that could significantly benefit from them positively. We conclude by deriving implications on how to better support the infrastructuring of community-based mentoring, particularly in a resource-constrained context.

6.1 Community-based Mentoring as the Village

"It takes a village to raise a child" is a phrase that deeply resonated with community stakeholders in our study. For us, a close read of this phrase reveals two nuanced underlying traits. First, it takes the village's collective knowledge and mobilizing the village's resources to support the needs and well-being of a child's upbringing. Second, the upbringing of a child is meaningful to the village. Besides the child's parents, each member of the village comes together and shares the accountability and commitment in taking care of the child who needs support. Members include senior members with more resources or other members who are currently experiencing or have experienced similar situations, be they aged or young. And in our resource-constrained context—recall from P4 that "it takes a village to support the community"—these two traits manifested in community-based mentoring.

New Mentorship Models	Description	Context
Un-platforming	Instead of standalone designs seen in conventional e-mentoring settings, new mentorship frameworks are built alongside existing technologies	Education, Business, Career Development (young women [3], entrepreneurs [38], and crowdsourced expertise for career development [74, 87])
Community Collectives	Cohorts of informal and formal networks come together in support of each others' growth, mentor across differences, and value learning while being action-oriented	Business/Entrepreneurship (Entrepreneurs living in financially constrained areas [24, 38])
"The Village"	Community-based networks support each others' needs and well-being relying on the shared accountability of each village member, the village's collective situated knowledge, and the mobilization of the resources within and external to the village	Community/Neighborhood-based (racialized minorities who experience severe poverty; varied and limited tech expertise; and prolonged states of technical infrastructural breakdown)

Table 1: New mentorship models identified in literature reviewed and from our study

First, ascribing community-based mentoring to a village allows us to ask what knowledge means and what counts as knowledge in mentorship. The village is fundamentally different from conventional mentoring that places the knowledge of the "expert" at the center of the relationship to help the protégé develop knowledge and skills valued by the expert [46, 65]. While past HCI and social computing studies have emphasized the social aspects of learning and knowledge sharing, knowledge is often tightly defined to shared domains and practices that connect like communities [1, 92]. In what Lave and Wenger described as community of practices, one has to go through a process of "legitimate peripheral participation" to learn and become a legitimate member of the community [50]. Instead, the village perspective in the context of poverty alleviation foregrounds every persons' situated knowledge and recognizes each person as a "legitimate" community expert in their situation. In other words, what the village perspective is trying to contend is the "center-periphery" binary in knowing and learning. In the village there is no mentor at the center or mentee at the periphery. Knowledge, practices, and power, as a result, are embodied and situated within a network of individuals who learn and reciprocate knowledge back into the network. Besides rethinking what kinds of knowing are recognized and valued in mentoring, the village perspective demands that we expand our understanding of how knowledge and resources are produced and mobilized in a community-based mentoring setting. Existing HCI mentorship scholarship focuses on connecting novices to experts (e.g., [39, 74, 87]) for pre-specified goals; however, they still rely on experts and are designed for more formal settings like the workplace. Our results showed that individuals received village support, a collective process of identifying situated needs and mobilizing resources within the community to address these needs. The method of locating when and how to mentor was spontaneous, ongoing, and ever-evolving. In the context of a resource-constrained community, this required continuing mobilization and coordination of existing resources within the village (e.g., means of transportation or medical knowledge) and the sharing of available external resources.

Second, just as a child's upbringing requires the shared commitment of each member of the village, community-based mentoring relies on the shared accountability of the village. We have shown that mentorship occurred across differences and consisted of informal networks; the relationships were flexible, inclusive, and interdependent. Dyadic, or one-to-one relationships, were neither expected nor effective in our case. Like a village, relationships were often many-to-many, and roles sometimes changed—i.e., community participants often became "mentors," and "mentors" were community members. Besides seeking support from mentors and coaches, community participants also sought assistance or emotional support from other community members as peers who experienced similar environments and situations. This is also evident in our findings of how community participants began running the program on their own, which exemplifies *situated learning* and how learning in practice takes place [51]. While community participants received village support, they also held themselves accountable for taking care of others. Such care does not need to come into the form of material and instrumental support from more-resourced individuals. Instead, it could orient towards what P24 described as "building a network, a partnership, new friends." This shared accountability in the village, in a way, mirrors what Bennett et al. called *interdependence* [10]. Interdependence attends to the collective work that people with disabilities do to create access, which challenges the subject position of people with disabilities as the passive recipient of care [10]. In our case, seeing community-based mentoring through the village allows us to advocate for the often-underrepresented and understated contributions from all village members. Doing so positions community participants as accountable village members eligible to receive and provide care, support, and mentoring, while interrogating the hierarchies embedded in mentoring.

Furthermore, we draw from more recent HCI work that identified non-technical requirements such as social capital, social networks,

and incubation from organizations as necessary to activate digital engagement in lower-income and in lean communities [24, 38]. Hui et al. found digital engagement via a *community collective* that consisted of resource-connecting organizations and regular in-person meetings [38], which many of our community participants desired. Taking into consideration our findings and past work, the use of the term *village* incorporates both *interdependence* [10] and *community collective* [38], which signals to us, as researchers and technologists, the need for technology to embrace and realize such ecosystems. Our findings mirror Yuan and Yarosh's observation that the elements critical for building successful mentorship between older adults and children included more support from teachers and schools [95]—i.e., the broader community. While their context focused on intergenerational mentorship and learning, our work extends this finding to the context of community-based mentorship with the goal of self-sufficiency for adults experiencing poverty. This means that technology-mediated mentorship must support interactions in environments where fewer stakeholders than expected have regular Internet access, and many stakeholders have none. Our results further show variations in digital proficiency (e.g., community participants seemed to be less proficient in some cases, while mentors and coaches seemed to be more proficient) and ways in which the village recognized and accommodated these variations. While community resources are available, they are often unknown to those who are disconnected *socially* and *digitally*. Drawing from past work, perhaps more collective approaches, like that of the village, with careful consideration for care as a means to achieve interdependence, can help to fill these infrastructural gaps and lead to community successes.

6.2 Infrastructuring the Village

Central to our study is the infrastructuring of the village for community-based mentoring. Our work exemplifies how infrastructuring community-based mentoring is an ongoing process of scaffolding and (re)arranging human actors, technical artifacts, and practices. We have shown how the configurations of human infrastructure shifted along the way: while mentors and coaches took the initiative to construct a welcoming space and inscribe support, flexibility, and trust into community-based mentoring, we see how community participants also started taking more essential roles in supporting and sustaining the infrastructure. Aligning with past HCI literature on invisible work [32, 85, 86], the infrastructuring work carried out by each member of the village is often hidden. Our results show that such invisible infrastructuring involved the emotional labor committed to fostering social support and building trust and the coordination work in maintaining technical breakdowns and stitching together fragmented technology use. For example, recall from one coach that she had to continue to laugh and "tease" a community participant to build initial rapport with them; another coach took extra time to talk about a community participant's goal while cooking. We must recognize and better support that each village member's (especially those with more resources) infrastructuring work was often invisible. It was such ongoing labor in infrastructuring that made the community-based mentoring infrastructure operate successfully.

In investigating patients' and caregivers' infrastructuring work to navigate the health care system, Gui and Chen posed the critical question of "*why infrastructuring work and for whom?*" [32, p.11]. The authors conceived infrastructuring work as an individualistic effort in avoiding negative consequences brought about by infrastructural failures (such as misdiagnosis and unreasonable charges) [32]. In contrast, our community-based mentoring case shows how infrastructuring work can be well done out of situated culture and a sense of reciprocity long embraced by the village. The infrastructuring work carried out by village members is conditioned by broader infrastructural breakdowns (such as the systematic failures in Internet connections and labor markets). However, we argue that infrastructuring can also channel village members to inscribe community values into community-based mentoring, which leads to characteristics such as reflexivity and versatility [69, 77]. This contrast perhaps speaks to the differences in who owns the infrastructure, who benefits from infrastructuring work, and whose voice is upheld [12, 91]. In Gui and Chen's case, patients' and caregivers' infrastructuring work eventually served a neoliberal health care economy [32]. In our case, infrastructuring the village upheld the community's infrastructure and served the community's collective needs. In line with Semaan's notion of routine infrastructuring [77], we believe infrastructuring the village offers insights into building community resilience, enacting everyday care, and locating alternative ways to challenge everyday systemic and institutional marginalization experienced by individuals and communities in poverty.

6.3 Implications for HCI: Design Strategies for Community-Based Mentorship

Individuals' infrastructuring work is often temporary and only produces "fleeting moments of alignment" that address particular needs at the micro-level [32, p.11]. If this is true, HCI researchers must consider how to reliably improve the infrastructure for community-based mentoring while advocating for the infrastructuring work happening in the village.

While traditional technology-mediated mentorship involves multiple forms of technology such as email, cell phones, chat, and video conferencing, the underlying intention is to connect mentors to mentees in a closed system or dedicated one-to-one space, typically within an institutional or more formal environment. However, our findings suggest that such technologies might assume an open space, with options to communicate one-to-one, but only when needed. Such open spaces allow for mentees to follow up with their assigned mentor (or coach), and more importantly, get support from and provide support to others in their entire village. Our results show that mentors and coaches established reciprocity offline, through face-to-face communication, to build trust [63] with community participants. This level of trust-building suggests that simply deploying technology-mediated mentorship within *any* community might not work. Instead, such technologies might work best within established communities where trust is already embedded, and norms have already been established. Our findings are consistent with Veinot et al.'s recommendation that interventionists address trust "as a system of collective meaning" and "concern themselves with positioning their efforts in collaboration with people and institutions that the audience at hand already trusts..." [90, p.762-763]. Our findings also align with past research that states that

some interactions must occur offline to initiate trust [24, 38, 40, 90]. Thus, while developing technology to support the many-to-many infrastructure is straightforward, it might not be sufficient on its own to build the values, such as trust, that are crucial to the success of community-based mentorship programs.

In addition, benefits from social media platforms like Facebook are only possible for those with stable Internet or smartphone access and those who are adept with technology, which was not always the case for our community participants. Coaches and mentors had to be flexible; they reported managing multiple technologies to communicate, provided around-the-clock availability, and at least one reported using technology to broker information to community participants. Technology to support many-to-many relationships would exhibit some level of flexibility by enabling one-to-one, one-to-many, and many-to-many interactions. However, it would be difficult for a single technology alone to fill the infrastructural gaps revealed in our findings, particularly given the flexibility shown in support of coaches and mentors. Our results show how *Un-platforming* [3] (e.g., with the use of existing e-mentorship technologies or even social media applications like Facebook, if used to support mentorship) in this context, might not sufficiently integrate into the existing infrastructure. Doing so would require that such technologies account for the local knowledge, resources, and culture. Our investigation revealed a non-hierarchical distributed network and identified infrastructural breakdowns (i.e., via devices and Internet access). Our work uncovers how the village model could inform how new technology designers might overcome these infrastructural shortcomings.

6.4 Limitations

Our research explored mentorship and coaching among adults experiencing poverty. While our community was limited to a single geographical region in the U.S., it extends findings on populations that have been predominately investigated in past mentorship literature (i.e., advantaged and educated youth and students, working adults) and confirms some of these findings. While the university team believed that the use of longitudinal survey collection within a community-based participatory research study, per the recommendation of prior research [94], would alleviate the risks of panel attrition, we experienced high attrition rates in the third wave of our longitudinal survey. We acknowledge this limitation of our work and further highlight that the high attrition rate speaks to the complexity of engaging populations not well represented in HCI and related studies (i.e., those from historically excluded groups in the U.S. who experience access challenges to transportation, digital literacy, and financial capital) [94]. We recommend employing additional strategies to minimize attrition and increasing the likelihood of reaching participants such as collecting detailed contact information [13] and the names and contact information of close friends or family if possible. We also suggest offering additional forms of compensation like transportation costs, food, community events, and childcare. Finally efforts to better integrate survey completion with other community-wide events might prevent the possibility of program interference.

7 CONCLUSION

The fact that group behavior often focuses on handling unanticipated events is one of the key contributions to HCI from ethnographic studies [31]. Technologies are often not designed to deviate from "standard work processes" and thus fail when deviations from such models exist. In the context of technology-mediated mentorship, we contribute a study that identifies where such deviations, might exist. We found, through a 6-month longitudinal survey and interviews with 38 community participants, mentors, and coaches, that the implementation of the EMPath Mobility Mentoring® program was successful among community participants. In our assessment of the EMPath Mobility Mentoring® program to provide mentorship support among people experiencing poverty, we found that the underlying factors contributing to the success of the program included a village approach to community-based mentoring (outlined in Table 1) and its focus on fostering social support, enabling flexibility, building trust, and mobilizing available resources. We revealed these factors and often-underrepresented contributions by attending to infrastructuring work conducted by each member of the village.

Going forward, we aim to develop and design future technology-mediated mentorship for more balanced power arrangement and shared accountability under this arrangement that may change over time, keeping in mind the village metaphor and the need to design for care. We plan to consider the use of participatory infrastructuring to uncover gaps that are often missed when designing for mainstream populations.

Our work extends a collection of HCI literature that has investigated the potential for technology to enhance community and social connectedness among families [43, 66, 68] and contributes to mentorship theory [65] by proposing a new mentorship model among communities facing severe financial hardships. This is essential given that one of the greatest economic and social problem today, is poverty [14].

REFERENCES

[1] Mark S Ackerman and Thomas W Malone. 1990. Answer Garden: A tool for growing organizational memory. *ACM SIGOIS Bulletin* 11, 2-3 (1990), 31–39.

[2] Icek Ajzen. 1985. From intentions to actions: A theory of planned behavior. In *Action control*. Springer, Berlin, Heidelberg, 11–39.

[3] Aseel Alhadlaq, Ahmed Kharrufa, and Patrick Olivier. 2019. Exploring e-mentoring: co-designing & un-platforming. *Behaviour & Information Technology* 38, 11 (2019), 1122–1142.

[4] Tammy D Allen and Lillian T Eby. 2007. *The Blackwell handbook of mentoring: A multiple perspectives approach.* Blackwell Publishing, Malden, MA.

[5] Mary Anne Anderson, Elizabeth Brown, Elizabeth W Cavadel, Michelle Derr, Jacqueline F Kauff, et al. 2-18. *Using psychology-informed strategies to promote self-sufficiency: A review of innovative programs.* Technical Report. Mathematica Policy Research.

[6] Sam Addison Ankenbauer and Alex Jiahong Lu. 2022. Making Space for Cultural Infrastructure: The Breakdown and Maintenance Work of Independent Movie

Theaters During Crisis. In *Proceedings of the 2022 CHI Conference on Human Factors in Computing Systems*. Association for Computing Machinery, New York, NY, USA, 1–13.

[7] Seyram Avle, Julie Hui, Silvia Lindtner, and Tawanna Dillahunt. 2019. Additional Labors of the Entrepreneurial Self. *Proceedings of the ACM on Human-Computer Interaction* 3, CSCW (2019), 1–24.

[8] Elisabeth D Babcock. 2012. *Mobility Mentoring®*. Boston, MA: Crittenton Women's Union.

[9] A Bandura. 1991. Social cognitive theory of self-regulation. Organizational Behaviour and Human Decision Processes, 50(2), 248–287.

[10] Cynthia L. Bennett, Erin Brady, and Stacy M. Branham. 2018. Interdependence as a Frame for Assistive Technology Research and Design. In *Proceedings of the 20th International ACM SIGACCESS Conference on Computers and Accessibility* (Galway, Ireland) *(ASSETS '18)*. Association for Computing Machinery, New York, NY, USA, 161–173. https://doi.org/10.1145/3234695.3236348

[11] Erling Björgvinsson, Pelle Ehn, and Per-Anders Hillgren. 2012. Agonistic participatory design: working with marginalised social movements. *CoDesign* 8, 2-3 (2012), 127–144.

[12] Geoffrey C Bowker and Susan Leigh Star. 2000. *Sorting things out: Classification and its consequences*. MIT press.

[13] Annabel Boys, John Marsden, Garry Stillwell, Kevin Hatchings, Paul Griffiths, and Michael Farrell. 2003. Minimizing respondent attrition in longitudinal research: practical implications from a cohort study of adolescent drinking. *Journal of adolescence* 26, 3 (2003), 363–373.

[14] Heather E Bullock. 2014. Social barriers to poverty reduction. *Barriers to and Opportunities for Poverty Reduction* 135 (2014), 135–160.

[15] United States Census Bureau. 2018. Income in the past 12 MONTHS (In 2018 Inflation-adjusted dollars). https://data.census.gov

[16] United States Census Bureau. 2018. Selected Housing Characteristics: American Community Survey 5-year Estimate. https://data.census.gov

[17] Rajesh Chandwani and Neha Kumar. 2018. *Stitching Infrastructures to Facilitate Telemedicine for Low-Resource Environments*. Association for Computing Machinery, New York, NY, USA, 1–12. https://doi.org/10.1145/3173574.3173958

[18] Gilad Chen, Stanley M Gully, and Dov Eden. 2001. Validation of a new general self-efficacy scale. *Organizational research methods* 4, 1 (2001), 62–83.

[19] Jia Yan Chong, Ann Hui Ching, Yaazhini Renganathan, Wei Qiang Lim, Ying Pin Toh, Stephen Mason, and Lalit KR Krishna. 2019. Enhancing mentoring experiences through e-mentoring: a systematic scoping review of e-mentoring programs between 2000 and 2017. *Advances in Health Sciences Education* 25, 1 (2019), 1–32.

[20] David A Clutterbuck, Frances K Kochan, Laura Lunsford, Nora Domínguez, and Julie Haddock-Millar. 2017. *The SAGE handbook of mentoring*. Sage, Thousand Oaks, CA.

[21] Christopher A Le Dantec and Carl DiSalvo. 2013. Infrastructuring and the formation of publics in participatory design. *Social Studies of Science* 43, 2 (2013), 241–264.

[22] Rosanna DeMarco. 1993. Mentorship: a feminist critique of current research. *Journal of Advanced Nursing* 18, 8 (1993), 1242–1250.

[23] Tawanna R Dillahunt. 2014. Fostering social capital in economically distressed communities. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. ACM, ACM, New York, NY, USA, 531–540.

[24] Tawanna R. Dillahunt, Vaishnav Kameswaran, Desiree McLain, Minnie Lester, Delores Orr, and Kentaro Toyama. 2018. Entrepreneurship and the Socio-Technical Chasm in a Lean Economy. In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems* (Montreal QC, Canada) *(CHI '18)*. Association for Computing Machinery, New York, NY, USA, 1–14. https://doi.org/10.1145/3173574.3173814

[25] Tawanna R Dillahunt and Amelia R Malone. 2015. The promise of the sharing economy among disadvantaged communities. In *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems*. ACM, New York, NY, USA, 2285–2294.

[26] Michaelanne Dye. 2021. Un Grano de Arena: Infrastructural Care, Social Media Platforms, and the Venezuelan Humanitarian Crisis. *Proceedings of the ACM on Human-Computer Interaction* 4, CSCW3 (2021), 1–28.

[27] Michaelanne Dye, David Nemer, Josiah Mangiameli, Amy S. Bruckman, and Neha Kumar. 2018. *El Paquete Semanal: The Week's Internet in Havana*. Association for Computing Machinery, New York, NY, USA, 1–12. https://doi.org/10.1145/3173574.3174213

[28] EMPath. 2018. Economic Mobility Pathways (EMPath), 2018 Annual Report. https://www.empathways.org/about/annual-reports.

[29] Stanley O Gaines Jr, Judy Larbie, Sheena Patel, Larissa Pereira, and Zayed Sereke-Melake. 2005. Cultural values among African-descended persons in the United Kingdom: Comparisons with European-descended and Asian-descended persons. *Journal of Black Psychology* 31, 2 (2005), 130–151.

[30] Mark Granovetter. 1983. The strength of weak ties: A network theory revisited. *Sociological theory* 1 (1983), 201–233.

[31] Jonathan Grudin and Steven Poltrock. 2013. Computer supported cooperative work. *The Encyclopedia of Human-Computer Interaction, 2nd Ed.* (2013).

[32] Xinning Gui and Yunan Chen. 2019. *Making Healthcare Infrastructure Work: Unpacking the Infrastructuring Work of Individuals*. Association for Computing Machinery, New York, NY, USA, 1–14. https://doi.org/10.1145/3290605.3300688

[33] Xinning Gui, Yunan Chen, and Kathleen H Pine. 2018. Navigating the Healthcare Service" Black Box" Individual Competence and Fragmented System. *Proceedings of the ACM on Human-Computer Interaction* 2, CSCW (2018), 1–26.

[34] Christina Harrington, Sheena Erete, and Anne Marie Piper. 2019. Deconstructing Community-Based Collaborative Design: Towards More Equitable Participatory Design Engagements. *Proc. ACM Hum.-Comput. Interact.* 3, CSCW, Article 216 (Nov. 2019), 25 pages. https://doi.org/10.1145/3359318

[35] PYP Hong, S Choi, and W Key. 2014. Psychological self-sufficiency: balancing cognitive and non-cognitive factors in workforce development. In *Meeting of the Society for Social Work Research*. JSSWR, San Antonio, TX.

[36] Philip Young P Hong, Sangmi Choi, and Joshua R Polanin. 2014. A multisample confirmatory factor analysis of the Short Employment Hope Scale (EHS-14). *Journal of Social Service Research* 40, 3 (2014), 339–352.

[37] Philip Young P Hong, Vamadu A Sheriff, and Sandra R Naeger. 2009. A bottom-up definition of self-sufficiency: Voices from low-income jobseekers. *Qualitative Social Work* 8, 3 (2009), 357–376.

[38] Julie Hui, Nefer Ra Barber, Wendy Casey, Suzanne Cleage, Danny C. Dolley, Frances Worthy, Kentaro Toyama, and Tawanna R. Dillahunt. 2020. Community Collectives: Low-Tech Social Support for Digitally-Engaged Entrepreneurship. In *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems* (Honolulu, HI, USA) *(CHI '20)*. Association for Computing Machinery, New York, NY, USA, 1–15. https://doi.org/10.1145/3313831.3376363

[39] Julie S Hui, Darren Gergle, and Elizabeth M Gerber. 2018. IntroAssist: A Tool to Support Writing Introductory Help Requests. In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems*. ACM, New York, NY, USA, 22.

[40] Aarti Israni, Nicole B. Ellison, and Tawanna R. Dillahunt. 2021. 'A Library of People': Online Resource-Seeking in Low-Income Communities. *Proceedings of the ACM on Human-Computer Interaction* 5, CSCW (April 2021), (to appear).

[41] Maryann Jacobi. 1991. Mentoring and undergraduate academic success: A literature review. *Review of educational research* 61, 4 (1991), 505–532.

[42] Mohammad Hossein Jarrahi, Gemma Newlands, Brian Butler, Saiph Savage, Christoph Lutz, Michael Dunn, and Steve Sawyer. 2021. Flexible work and personal digital infrastructures. *Commun. ACM* 64, 7 (2021), 72–79.

[43] Holly B Jimison, Krystal A Klein, and Jennifer L Marcoe. 2013. A socialization intervention in remote health coaching for older adults in the home. In *2013 35th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC)*. IEEE, Piscataway, NJ, USA, 7025–7028.

[44] Helena Karasti, Karen S Baker, and Eija Halkola. 2006. Enriching the notion of data curation in e-science: data managing and information infrastructuring in the long term ecological research (LTER) network. *Computer Supported Cooperative Work (CSCW)* 15, 4 (2006), 321–358.

[45] Elizabeth Kaziunas, Michael S Klinkman, and Mark S Ackerman. 2019. Precarious Interventions: Designing for Ecologies of Care. *Proceedings of the ACM on Human-Computer Interaction* 3, CSCW (2019), 1–27.

[46] Kathy E Kram. 1983. Phases of the mentor relationship. *Academy of Management journal* 26, 4 (1983), 608–625.

[47] Jonathan Kroll. 2016. What is meant by the term group mentoring? *Mentoring & Tutoring: Partnership in Learning* 24, 1 (2016), 44–58.

[48] Daniel Lambton-Howard, Patrick Olivier, Vasilis Vlachokyriakos, Hanna Celina, and Ahmed Kharrufa. 2020. Unplatformed Design: A Model for Appropriating Social Media Technologies for Coordinated Participation. In *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems* (Honolulu, HI, USA) *(CHI '20)*. Association for Computing Machinery, New York, NY, USA, 1–13. https://doi.org/10.1145/3313831.3376179

[49] Giulio E Lancioni, Mark F O'Reilly, Nirbhay N Singh, Jeff Sigafoos, Doretta Oliva, Gloria Alberti, and Russell Lang. 2011. Two adults with multiple disabilities use a computer-aided telephone system to make phone calls independently. *Research in Developmental Disabilities* 32, 6 (2011), 2330–2335.

[50] Jean Lave and Etienne Wenger. 1991. *Situated learning: Legitimate peripheral participation*. Cambridge university press.

[51] Jean Lave and Etienne Wenger. 1999. Legitimate peripheral participation. *Learners, learning and assessment, London: The Open University* (1999), 83–89.

[52] Charlotte P. Lee, Paul Dourish, and Gloria Mark. 2006. The Human Infrastructure of Cyberinfrastructure. In *Proceedings of the 2006 20th Anniversary Conference on Computer Supported Cooperative Work* (Banff, Alberta, Canada) *(CSCW '06)*. Association for Computing Machinery, New York, NY, USA, 483–492. https://doi.org/10.1145/1180875.1180950

[53] Charlotte P Lee and Kjeld Schmidt. 2018. A bridge too far?: Critical remarks on the concept of "infrastructure" in computer-supported cooperative work and information systems. In *Socio-Informatics*. Oxford University Press.

[54] Kenneth Leithwood and Vera Ndifor Azah. 2016. Characteristics of effective leadership networks. *Journal of Educational Administration* (2016).

[55] Shaobing Li, Joel R Malin, and Donald G Hackman. 2018. Mentoring supports and mentoring across difference: Insights from mentees. *Mentoring & Tutoring:*

Partnership in Learning 26, 5 (2018), 563–584.

[56] Claudia A Limbert. 1995. Chrysalis, a peer mentoring group for faculty and staff women. *NWSA Journal* 7, 2 (1995), 86–99.

[57] Songqi Liu, Jason L Huang, and Mo Wang. 2014. Effectiveness of job search interventions: A meta-analytic review. *Psychological bulletin* 140, 4 (2014), 1009.

[58] Alex Jiahong Lu and Tawanna R Dillahunt. 2021. Uncovering the Promises and Challenges of Social Media Use in the Low-Wage Labor Market: Insights from Employers. In *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems*. Association for Computing Machinery, New York, NY, USA, 1–13. https://doi.org/10.1145/3411764.3445774

[59] Thomas Ludwig, Volkmar Pipek, and Peter Tolmie. 2018. Designing for collaborative infrastructuring: Supporting resonance activities. *Proceedings of the ACM on Human-Computer Interaction* 2, CSCW (2018), 1–29.

[60] Laura Gail Lunsford, Gloria Crisp, Erin L Dolan, and Brad Wuetherick. 2017. Mentoring in higher education. *The SAGE handbook of mentoring* 20 (2017), 316–334.

[61] Peter Lynn. 2009. *Methods for longitudinal surveys*. Wiley Online Library, Wiley, Chichester, UK.

[62] Kathleen M. Macqueen and Eleanor Mclellan-Lemal. 2008. Team-based codebook development: Structure, process, and agreement. *Handbook for team-based qualitative research* 119 (2008), 119–135.

[63] Linda D Molm, David R Schaefer, and Jessica L Collett. 2007. The value of reciprocity. *Social Psychology Quarterly* 70, 2 (2007), 199–217.

[64] Carol A Mullen. 2020. Does modality matter? A comparison of aspiring leaders' learning online and face-to-face. *Journal of Further and Higher Education* 44, 5 (2020), 670–688.

[65] Carol A Mullen and Cindy C Klimaitis. 2021. Defining mentoring: a literature review of issues, types, and applications. *Annals of the New York Academy of Sciences* 1483, 1 (2021), 19–35.

[66] Elizabeth D. Mynatt, Jim Rowan, Sarah Craighill, and Annie Jacobs. 2001. Digital Family Portraits: Supporting Peace of Mind for Extended Family Members. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (Seattle, Washington, USA) (*CHI '01*). Association for Computing Machinery, New York, NY, USA, 333–340. https://doi.org/10.1145/365024.365126

[67] Emily Namey, Greg Guest, Lucy Thairu, and Laura Johnson. 2008. Data reduction techniques for large qualitative data sets. *Handbook for team-based qualitative research* 2, 1 (2008), 137–161.

[68] Linda Phipps. 2000. New communications technologies-A conduit for social inclusion. *Information, Communication & Society* 3, 1 (2000), 39–68.

[69] Volkmar Pipek and Volker Wulf. 2009. Infrastructuring: Toward an integrated perspective on the design and use of information technology. *Journal of the Association for Information Systems* 10, 5 (2009), 1.

[70] Sarah D Pressman, Sheldon Cohen, Gregory E Miller, Anita Barkin, Bruce S Rabin, and John J Treanor. 2005. Loneliness, social network size, and immune response to influenza vaccination in college freshmen. *Health Psychology* 24, 3 (2005), 297.

[71] Anabel Quan-Haase, Guang Ying Mo, and Barry Wellman. 2017. Connected seniors: How older adults in East York exchange social support online and offline. *Information, Communication & Society* 20, 7 (2017), 967–983.

[72] Rizwana Rizia, Zeno Franco, Katinka Hooyer, Nadiyah Johnson, ABM Kowser Patwary, Golam Mushih Tanimul Ahsan, Bob Curry, Mark Flower, and Sheikh Iqbal Ahamed. 2015. ipeer: A sociotechnical systems approach for helping veterans with civilian reintegration. In *Proceedings of the 2015 Annual Symposium on Computing for Development*. ACM, New York, NY, USA, 85–93.

[73] Johnny Saldaña. 2015. *The Coding Manual for Qualitative Researchers* (3 ed.). SAGE Publications Ltd, Thousand Oaks, CA, USA. 368 pages.

[74] Niloufar Salehi and Michael S Bernstein. 2018. Ink: Increasing Worker Agency to Reduce Friction in Hiring Crowd Workers. *ACM Transactions on Computer-Human Interaction (TOCHI)* 25, 2 (2018), 10.

[75] William E Sedlacek, Eric Benjamin, Lewis Z Schlosser, and Hung-Bin Sheu. 2007. Mentoring in academia: Considerations for diverse populations. *The Blackwell handbook of mentoring: A multiple perspectives approach* (2007), 259–280.

[76] Kristin S Seefeldt. 2016. *Abandoned families: Social isolation in the twenty-first century*. Russell Sage Foundation, New York, NY, USA.

[77] Bryan Semaan. 2019. 'Routine Infrastructuring'as' Building Everyday Resilience with Technology' When Disruption Becomes Ordinary. *Proceedings of the ACM on Human-Computer Interaction* 3, CSCW (2019), 1–24.

[78] Cathy Donald Sherbourne and Anita L Stewart. 1991. The MOS social support survey. *Social science & medicine* 32, 6 (1991), 705–714.

[79] Anne B Shlay. 1993. Family self-sufficiency and housing. *Housing Policy Debate* 4, 3 (1993), 457–496.

[80] Jesper Simonsen, Helena Karasti, and Morten Hertzum. 2020. Infrastructuring and Participatory Design: Exploring infrastructural inversion as analytic, empirical and generative. *Computer Supported Cooperative Work (CSCW)* 29, 1 (2020), 115–151.

[81] Sandra Susan Smith. 2007. *Lone pursuit: Distrust and defensive individualism among the black poor*. Russell Sage Foundation, New York, NY, USA.

[82] C Richard Snyder. 2002. Hope theory: Rainbows in the mind. *Psychological inquiry* 13, 4 (2002), 249–275.

[83] Charles R Snyder, Cheri Harris, John R Anderson, Sharon A Holleran, Lori M Irving, Sandra T Sigmon, Lauren Yoshinobu, June Gibb, Charyle Langelle, and Pat Harney. 1991. The will and the ways: development and validation of an individual-differences measure of hope. *Journal of personality and social psychology* 60, 4 (1991), 570.

[84] Susan Leigh Star and Karen Ruhleder. 1996. Steps toward an ecology of infrastructure: Design and access for large information spaces. *Information systems research* 7, 1 (1996), 111–134.

[85] Susan Leigh Star and Anselm Strauss. 1999. Layers of silence, arenas of voice: The ecology of visible and invisible work. *Computer supported cooperative work (CSCW)* 8, 1 (1999), 9–30.

[86] Lucy Suchman. 1995. Making work visible. *Commun. ACM* 38, 9 (1995), 56–64.

[87] Ryo Suzuki, Niloufar Salehi, Michelle S Lam, Juan C Marroquin, and Michael S Bernstein. 2016. Atelier: Repurposing expert crowdsourcing tasks as micro-internships. In *Proceedings of the 2016 CHI conference on human factors in computing systems*. ACM, New York, NY, USA, 2645–2656.

[88] Charlotte Tang, Yunan Chen, Bryan C. Semaan, and Jahmeilah A. Roberson. 2015. Restructuring Human Infrastructure: The Impact of EHR Deployment in a Volunteer-Dependent Clinic. In *Proceedings of the 18th ACM Conference on Computer Supported Cooperative Work & Social Computing* (Vancouver, BC, Canada) (*CSCW '15*). Association for Computing Machinery, New York, NY, USA, 649–661. https://doi.org/10.1145/2675133.2675277

[89] Michelle Van Ryn and Amiram D Vinokur. 1992. How did it work? An examination of the mechanisms through which an intervention for the unemployed promoted job-search behavior. *American Journal of Community Psychology* 20, 5 (1992), 577–597.

[90] Tiffany C Veinot, Terrance R Campbell, Daniel J Kruger, and Alison Grodzinski. 2013. A question of trust: user-centered design requirements for an informatics intervention to promote the sexual health of African-American youth. *Journal of the American Medical Informatics Association* 20, 4 (2013), 758–765.

[91] Vasillis Vlachokyriakos, Clara Crivellaro, Pete Wright, and Patrick Olivier. 2018. *Infrastructuring the Solidarity Economy: Unpacking Strategies and Tactics in Designing Social Innovation*. Association for Computing Machinery, New York, NY, USA, 1–12. https://doi.org/10.1145/3173574.3174055

[92] Etienne Wenger, Richard Arnold McDermott, and William Snyder. 2002. *Cultivating communities of practice: A guide to managing knowledge*. Harvard business press.

[93] Earnest Wheeler and Tawanna R Dillahunt. 2018. Navigating the job search as a low-resourced job seeker. In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems*. ACM, New York, NY, USA, 1–10.

[94] Xuecong Xu, Xiang Yan, and Tawanna R Dillahunt. 2019. Reaching Hard-To-Reach Populations: An Analysis of Survey Recruitment Methods. In *Conference Companion Publication of the 2019 on Computer Supported Cooperative Work and Social Computing*. ACM, New York, NY, USA, 428–432.

[95] Ye Yuan and Svetlana Yarosh. 2019. Beyond Tutoring: Opportunities for Intergenerational Mentorship at a Community Level. In *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems (CHI '19)*. ACM, New York, NY, USA, 1–14.

A LESSONS LEARNED

The academic and university team reflected on the lessons learned from our partnership and the challenges we faced, some of which we briefly discussed in the article. We also reflect on how these lessons will inform our partnership in the future. We share these lessons here for transparency and in hope that others can learn from our work.

A.1 Survey Collection

A challenge we faced that made the quantitative data analysis difficult was that participants did not consistently use their assigned participant numbers (last 5-digits of their phone numbers) for each phase of the survey. Therefore, aligning those who completed the initial surveys with their final surveys would have been impossible (even if the number of post-surveys completed had been sufficient for calculating statistical significance). In the future, we may wish to use IDs such as the last 4 digits of a social security number or the first 4 digits of a respondents' childhood address. This might be easier for participants in terms of remembering because some

people do not have phones and phone numbers can change. In addition, it might have helped to have more time to recruit respondents (at least 2 months before the start of the program) to complete the initial surveys and perhaps to offer a larger incentive to complete the post surveys is desirable. We also suggest developing survey designs that would allow participants to complete paper surveys instead of completing them online.

Finally, the academic and community investigators believe that qualitative insights likely provide more insight than survey assessments. Using established measures/scales from other communities might not translate well in all settings.

A.2 What-if's

After reflecting, we believe that a session of "what-ifs" would have been beneficial. This is a time that would allow us to ask questions such as, "What if we don't receive 100 survey responses?" or "What if we lose someone on the team?" We believe that this exercise could be valuable in future efforts.

B SURVEY CONSTRUCTS

We did not have a large enough sample size to analyze our survey data as expected. However, we discuss and contribute the assessment measures for researchers to consider in their future studies.

B.1 Overview of Measures

The concept of hope was developed by Snyder et al. [83] and has been employed as an alternative construct for self-efficacy [82]. Self-efficacy is a central construct for both Social Cognitive Theory [9] and the Theory of Planned Behavior [2] and has been asserted as a vital component for interventions that aim to improve job search outcomes [57]. Empirical research has consistently found that individuals with higher hope tend to have more goals and more pathways and agency to achieve those goals [83]. Similarly, a lack of social support has been identified as a major barrier to job search and employment, particularly for low-income populations [23, 30, 57, 81]. Such scales, identified collaboratively, might be important for future researchers conducting similar research to assess in the future.

B.2 Adult Hope

The survey included the 12-item Adult Hope Scale, which assessed a respondent's level of hope with two sub scales—agency and pathways [83]. The 12-item scaled asked respondents to select the option that best describes themselves on an 8-point scale of Definitely False to Definitely True. Items included "My past experiences have prepared me well for my future," "I have been pretty successful in my life," "Even when others get discouraged, I know I can find a way to solve the problem," and "There are lots of ways around any problem."

B.3 Self-Efficacy and Social Support

The New General Self-Efficacy scale, an 8-item assessment of general self-efficacy [18], included items such as "I will be able to achieve most of the goals that I have set for myself" and "Even when things are tough, I can perform quite well" on a 5-point scale of Strongly Disagree to Strongly Agree. The Social Support Questionnaire, which was used in the RAND Medical Outcomes Survey, is an 18-item, 5-point frequency scale (None of the time to All of the time) with four subscales (emotional support, tangible support, positive support, and affective support) [78]. Respondents were asked the following: "People sometimes look to others for companionship, assistance, or other types of support. How often is each of the following kinds of support available to you if you need it?" Example items included "Someone you can count on to listen to you when you need to talk," "Someone to turn to for suggestions about how to deal with a personal problem," and "Someone who shows you love and affection."

B.4 Psychological Self-Sufficiency

Psychological self-sufficiency, which is measured through a combination of the 14-item Employment Hope Scale [36] and the 27-item Perceived Employment Barrier Scale [35]. Respondents were presented with a list of items that had been identified as potential barriers to employment. For each of the items, they were asked to rate how strongly they felt each item was a barrier for them on a 5-point scale from "1-Not a barrier" to "5-Strong barrier". Sample items included, Having less than a high school education, Lack of adequate job skills, past criminal record, lack of stable housing, and physical disabilities.