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RESEARCH ARTICLE

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Community intermediary strategies and tactics to close digital divides and enhance equitable technology use in everyday life

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Abstract

Online technologies are required for accessing essential services, such as healthcare, transportation, and education. Challenges to online technology access can prevent resource-constrained communities from connecting to these services. Human intermediaries who act in the middle space between technology and the person using the technology may help to enhance access and use. Prior information science research has investigated formal intermediation offered by staff at community technology centers and public libraries. However, there is a lack of empirical and theoretical insight into how intermediaries help resource-constrained communities with technology in the informal and semi-formal settings of everyday life. Therefore, this study investigated how community intermediaries (i.e., friends, family members, and volunteers from resource-constrained communities) assist with accessing and using technology. Interviews with community intermediaries ($n = 9$) and those who received intermediary support ("beneficiaries," $n = 30$) in a resource-constrained American city were conducted. Results show that intermediary strategies address four digital access levels: relating to sociocultural and psychosocial motivators; acquiring basic internet and technology; developing and updating skills for ongoing use; and problem-solving tasks for diverse use of evolving technology. Multiple tactics were used to implement these strategies. Findings can inform future training and infrastructure-enhancement initiatives for informal and semi-formal intermediaries from resource-constrained communities.

1 | INTRODUCTION

The proliferation of digital technologies has globally transformed access to healthcare, education, transportation, banking and government assistance (United Nations, 2025). Members of communities with limited resources (henceforth, "*resource-constrained communities*") have unequal opportunities for accessing and using technology, lessening their abilities to obtain such essential services (Deng, 2023; Lythreatis et al., 2022). Thus,

ensuring that everyone can benefit from essential services requires dedicated efforts for accessing and using online (Lee et al., 2023; Van Deursen & Van Dijk, 2011). We define "*access*" as the ability to obtain technology and related essential services and "*use*" as the ability to use these technologies for a particular service or purpose (Paccoud et al., 2021; Ribot & Peluso, 2003).

People from resource-constrained communities may not receive sufficient socioeconomic resources for learning, using, maintaining, updating and sustaining technology (Hui et al., 2023). This lack of resources is often called the "*digital divide*" (Chowdhury, 2002; Lythreatis et al., 2022), and has been considered as four access types: (1) motivational; (2) material; (3) skill; and (4) usage (Van Dijk, 2006, 2017). To address these digital divides "*beneficiaries*" (Taipale, 2019) may seek digital help from people in their community. These human "*intermediaries*" who act in a middle space between beneficiaries and technologies can assist with setting-up, configuring, problem-solving and coping with the use of online technologies (Wyatt et al., 2008). Moreover, intermediaries can facilitate access to the online essential services (Parikh & Ghosh, 2006; Sambasivan et al., 2010; Williamson, Antonio, et al., 2024) needed for full participation in society. Current policy efforts to close digital divides (Government of Canada, 2024; Rodriguez et al., 2022) have recommended including intermediaries for their critical role in facilitating technology access and usage.

Although prior information science research has investigated the role of public libraries and community technology centers for technology intermediation, this work has typically emphasized more formal modes of skill acquisition rather than informal problem-solving and learning (Chowdhury, 2002; Detlor et al., 2022; Durrance & Fisher, 2003; Gustafsson & Wihlborg, 2021; Lenstra et al., 2020; Pettigrew et al., 2002; Strover et al., 2024; Veinot & Williams, 2012). Furthermore, intermediary research has not typically characterized the strategies (i.e., directed sets of actions) and tactics (i.e., ways of performing actions to implement the strategies) used in everyday life or when intermediation is not part of one's formal role. We call individuals providing technology assistance in such informal and semi-formal contexts "*community intermediaries*." Prior work also has not typically included the perspectives of *both* community intermediaries and beneficiaries on how well those strategies and tactics work.

Therefore, the aim of this paper is to systematically characterize community intermediaries' strategies and tactics for closing the digital divide to enable digital participation in essential services in resource-constrained communities. To inform the design of community-based, socio-technical interventions for closing digital divides, we investigate the following questions from the perspectives of both beneficiaries and intermediaries from a resource-constrained community: (1) How do community intermediaries facilitate motivational and material access to technology in everyday life?; and (2) How do community intermediaries assist with technology skill development and usage of digital technologies and services?

2 | BACKGROUND

2.1 | *Technology intermediary models in information science*

The formal intermediary role of paid staff from public libraries, community organizations and private companies has been long recognized in the information science subfield of community informatics (Durrance & Fisher, 2003; Gomez, 2024; Williams et al., 2009). Semi-formal intermediaries can encompass university students (Antonio et al., 2023; Atkinson et al., 2016; Hui et al., 2024), volunteers (Chen et al., 2024; Fields et al., 2021) or community members (Hui et al., 2024) who receive structured training in providing help with technology. There are also informal intermediaries who often help with an immediate problem and can include family members (Bakardjieva, 2005; Courtois & Verdegem, 2016; Taipale, 2019), friends, peers and workplace colleagues (Courtois & Verdegem, 2016) and healthcare staff who do not have intermediation as part of their stated job role (Williamson, Antonio, et al., 2024).

Prior research with community intermediaries has focused on intermediary roles, types of interactions and motivations for providing support. Early research conceptualized informal supports like family members as critical to establishing internet access, noting that people relied on such "warm experts" because they were both knowledgeable and socially accessible (Bakardjieva, 2005). Others have created typologies of intermediary interactions from observational studies with non-profit organizations and community members who assist with access to technology (Parikh & Ghosh, 2006; Sambasivan et al., 2010). Motivations for when intermediaries provide help in informal settings have been detailed in a qualitative study about home computing (Poole et al., 2009). More recent intermediary studies have reported on community-based approaches wherein members of resourced-constrained communities are trained to help entrepreneurs, business owners or public housing residents achieve online access (Hui et al., 2020; Hui et al., 2024; Kotturi et al., 2022; Lee et al., 2023).

Although this work has established the various settings in which intermediaries may assist, little is known about the strategies and tactics that community intermediaries deploy to assist beneficiaries. This is important since expanded efforts to close digital divides may benefit from building upon what is currently working between community intermediaries and beneficiaries.

Efforts to close digital divides may also benefit from a strong theoretical foundation to ensure studies are optimally designed to meet the intervention targets. Yet, limited research uses theory to characterize, explain or select intermediary strategies and tactics to use with beneficiaries. Atkinson's et al. (2016) study drew from social cognitive theory (Bandura, 2001) for an intervention involving student-led digital literacy sessions with older adults. Prior studies with low-income communities were informed by cognitive load theory (Kirschner et al., 2018; Sweller et al., 2011) to illustrate how intermediaries may shield beneficiaries from the cognitive load of completing novel, time-sensitive technology-mediated tasks for a telehealth visit (Antonio et al., 2023; Williamson, Antonio, et al., 2024). Despite these examples, a systematic conceptual understanding of how community intermediaries may help beneficiaries to close digital divides is lacking. Therefore, Van Dijk's (2006, 2017) multiple access model is used to guide this study.

2.2 | *Theoretical framework: technology access for resource-constrained communities*

Van Dijk's (2006, 2017) multiple access model avoids the problematic miscategorization of technology access as an individual-level phenomenon. Rather, it recognizes the social context from which multiple forms of digital divides emerge, thus discouraging full participation in society. As illustrated in Figure 1, Van Dijk's (2006, 2017) model outlines four types of access:

Motivational access focuses on the sociocultural and psychosocial factors, such as privacy and security concerns (Anthony et al., 2017) and lack of perceived value, that can discourage people from wanting to use technology (Van Dijk, 2006, 2017).

Material access recognizes how socio-demographics and socioeconomic position relate to basic access to the internet and information technologies (Benda et al., 2020; Rhinesmith et al., 2022). Although material access is commonly reduced to individual technology ownership and affordability (Lythreatis et al., 2022), the model emphasizes how social allocation of resources can deny communities access to reliable infrastructure like broadband internet and cellphone service that are now needed to connect to essential services (Van Deursen & Van Dijk, 2011; Van Dijk, 2006).

Skill access is defined as the knowledge needed to manage ongoing use of technology; it encompasses the skills needed to work with and optimize a device (Van Dijk, 2006). Skill access is commonly conceptualized as digital literacy (Reddy et al., 2020), and sometimes as the second-level digital divide (Lythreatis et al., 2022).

Usage access is the ultimate access goal; it considers the frequency of use and diversity of technological applications (Van Dijk, 2006). In a digital society, beneficial usage access encompasses essential services like health care, education, transportation, banking, and government assistance.

3 | METHODS

3.1 | *Participants and recruitment*

To increase the likelihood of gathering rich qualitative data this study used an "*extreme case*" sampling strategy to identify participants with high rates of the phenomenon of interest (Schensul & LeCompte, 2012). Therefore,

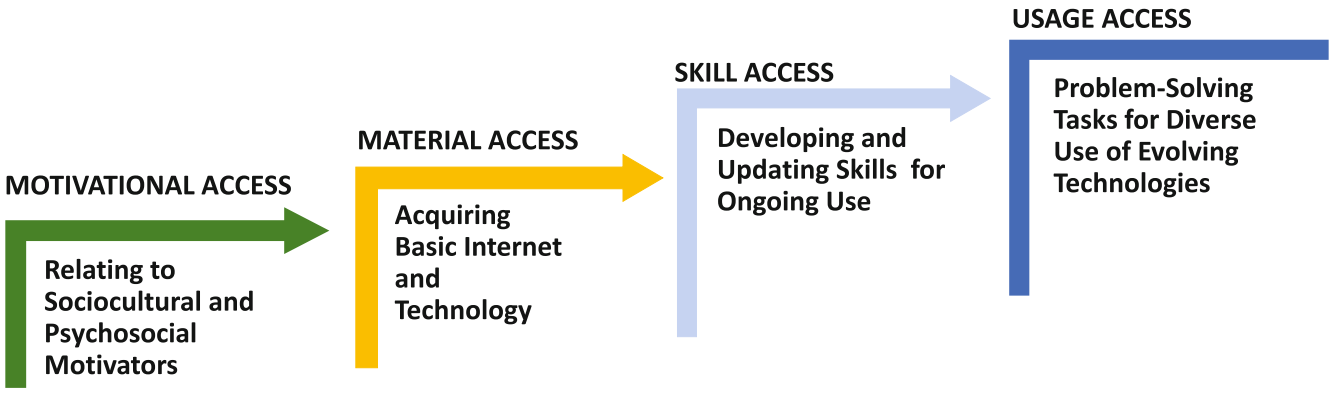

FIGURE 1 Van Dijk's (2006, 2017) multiple access model.

participants were recruited from Detroit, Michigan, a city in which 40% of residents experience cost of living challenges (University of Michigan, 2024), and may also lack access to the resources needed for keeping digital skills and technology updated (Bakuli, 2025; National Skills Coalition, 2024; Reisdorf et al., 2020). Participants were recruited from: (1) a nonprofit community organization focused on neighborhood economic revitalization that offered a technology skill-building workshop; (2) a nonprofit community development organization that connected community intermediaries and beneficiaries; and (3) a Federally Qualified Health Center (FQHC) that offered assistance with a newly deployed telehealth service to patients typically covered by Medicaid public health insurance. These organizations were selected because they offered semi-formal help with technology access for people in resource-constrained communities.

To recruit participants, the nonprofit organizations contacted people who had provided or received help through technology workshops, and the FQHC sent text messages and posted flyers in their clinic that advised patients of the study. To be eligible to participate, participants had to have given or received help with using technology and be at least 18 years old, English- or Spanish-speaking and be living in the resource-constrained community in Detroit.

3.2 | *Data collection*

Interviews with community intermediaries and beneficiaries from the resource-constrained community of Detroit followed three formats: (1) 1-h interviews with community intermediaries being trained by a local nonprofit organization on helping with everyday technological tasks ($n = 9$); (2) 1-h interviews with beneficiaries receiving help through this semi-formal setting ($n = 8$); and (3) 20-min interviews with beneficiaries receiving informal help in their community and semi-formal help from the FQHC ($n = 22$). Appendix S1 provides examples of how the interview questions were designed to expand upon participants' initial responses. Research team members' prior non-profit, community-based and healthcare experience with helping communities connect to resources and technologies, and research dedicated to promoting digital equity and equitable healthcare access informed the study design. All interviews were conducted in either English ($n = 34$) or Spanish ($n = 5$) from August 2020 to July 2022 by master's and doctoral students or a postdoctoral researcher trained in qualitative research. Interviews were audio-recorded over Zoom or the phone, transcribed verbatim by a third-party transcription service, and verified by the research team. Spanish transcripts were transcribed and translated into English by a third-party transcription service and verified by a Spanish-speaker on the research team. Participants were asked to complete a demographic survey post-interview and received a $25 gift card as compensation for their participation.

3.3 | *Data analysis*

Data analyses included inductive and deductive coding in three cycles (Saldaña, 2021). First cycle coding in NVivo software involved creating and using a deductive and inductive codebook. Development of the codebook was an iterative process that encompassed: (1) developing the initial codes after becoming familiar with the data by reading the transcripts multiple time (MGA); (2) using the initial codebook to code three transcripts (AS, MGA, and TCV); and (3) reviewing the three coded transcripts to refine definitions and examples (AS, MGA, and TCV) (see Appendix S2 for an example of coding and mapping the development of the tactics). Once consensus regarding the codebook was reached, the remaining interviews were coded by one researcher (MGA). Subsequent deductive coding cycles involved combining the initial coded data to learning theories and extant literature (see Appendix S3, including Van Dijk's (2006, 2017) model presented in Figure 1). Throughout the coding and analytic process, memos were created and transcripts were revisited and reviewed (Braun & Clarke, 2006). The final coded data and memos were used to categorize and label the strategies and tactics. To establish trustworthiness, research team meetings were held throughout the coding, analytic and writing process. Analysis with the team ended when no new intermediary tactics were identified, and agreement was reached on the names, definitions and categorizations of the intermediary strategies and tactics.

4 | RESULTS

4.1 | *Participant characteristics*

Most beneficiaries (designated as BENF) were women ($n = 20/27$), non-Hispanic Black or African American ($n = 13/24$), Hispanic/Latino ($n = 7/24$) and between the ages of 40 and 49 ($n = 8/26$), 50–59 ($n = 6/26$), or 60–69 ($n = 8/26$). Beneficiaries most often were unemployed ($n = 8/25$), or working full-time ($n = 6/25$) or part-time ($n = 4/25$), and had some high school or diploma/GED ($n = 6/25$), some college ($n = 8/25$), or a postgraduate degree ($n = 11/25$). Most community

intermediaries (designated as INT) were women ($n = 7/8$), non-Hispanic Black or African American ($n = 7/8$), and between the ages of 30 and 39 ($n = 3/8$) or 50–59 ($n = 3/8$). Intermediaries primarily worked full-time ($n = 4/8$) or were unemployed ($n = 3/8$), and had some high school or diploma/GED ($n = 2/8$), some college ($n = 2/8$), or a postgraduate degree ($n = 4/8$) (see Appendix S4 for detailed participant demographics).

4.2 | *Community intermediary roles*

Community intermediaries helped beneficiaries with technology to connect to many essential services. For instance, semi-formal intermediaries helped people with online financial resources and applications. INT07 shared how she "*began to download [a beneficiary's] mobile apps for banking [and] for all the personal apps...and then assisting...three or four people file the [COVID-19] pandemic unemployment*." Similarly, INT05 had helped "*seniors [who] don't really know that they can get the help and they don't know how to get the application filled out*." Beneficiaries found this help was critical for completing online applications, especially when there was an urgency to meet financial resources' deadlines: "*I was applying for AmeriCorps...I had to call another young lady who had done it before, to get me through what I wasn't doing...[the app] takes you through the takes you through the ringer. I was seriously working with time constraint because I had to get it done*" [BENF05].

Study results also demonstrated fluidity between the two roles, wherein beneficiaries gained knowledge from a community intermediary and then passed it onto others. INT03 shared how: "*Everybody helps each other with the Zoom and what you're supposed to do. So, the ones in my circle right now, we are all at the same place right now*." Some intermediary exchanges also benefited both people involved in the interaction. BENF06 articulated how she was able to continue a cherished activity during the COVID-19 lockdown due to helping others use technology: "*I'm going to show you how to use Zoom... So, we can continue our meetings without us having to travel.... it really has created some safety for us, and yet we still experience the joy of studying a lesson together in sharing how we are to help each other in this world*."

4.3 | *Community intermediaries' strategies and tactics for facilitating access*

Informed by Van Dijk's (2006, 2017) model, results were mapped onto four main community intermediary strategies for facilitating access and use of technology: (1) relating to sociocultural and psychosocial motivators (motivational access); (2) acquiring basic internet and technology (material access); (3) developing and updating skills for ongoing use (skill access); and (4) problem-solving tasks for diverse use of evolving technology (usage access). To address the research questions, the remainder of the results describe these strategies and their underlying tactics as detailed in Figure 2.

4.4 | *Research question 1: facilitating motivational and material access*

4.4.1 | *Relating to sociocultural and psychosocial motivators (motivational access)*

The community intermediary strategy of *relating to sociocultural and psychosocial motivators* is focused on countering the messages that may discourage people from resource-constrained communities from attempting novel tasks with technology (Van Dijk, 2017). Both intermediaries and beneficiaries referenced how beneficiaries did not want to be judged by others for their current technological skills or pace of learning when they stated beneficiaries' concerns about "*looking stupid*," "*being a burden*," "*not fitting in*," and "*slowing down the class*." To address such concerns, the three tactics within this strategy encompass *building shared confidence*, *providing emotional support*, and *reflecting on being a novice*.

Building shared confidence: Participants offered multiple examples of building confidence in their abilities to complete tasks. A Spanish-speaking beneficiary demonstrated how a shared cultural background reinforces confidence: "*It's important to know... if the other person is good or bad.... I felt comfortable with [my friend] him, so I asked [for help].... we always talked a lot about traditions from our respective states...[that] helped us be honest*" [BENF13]. BENF21's confidence increased from the help offered by healthcare staff at the FQHC: "*They walked me through... [the telehealth visit and] once I knew what I was doing in there, it was smooth sailing.... the confidence just built up*," BENF02 gained confidence when intermediaries from the nonprofit organization set him up for success: "*They set me on a course where I couldn't fail...They left me on a course to succeed*."

Intermediaries also became more confident as their proficiency in providing help increased. INT08 said: "*Just being able to help someone through that task feels really great. I think that it also feels empowering to me that, wow, I know more than I did*." Intermediaries' confidence in their abilities then transferred to beneficiaries' beliefs in their abilities:

USAGE ACCESS	
Problem-Solving Tasks for Diverse Use of Evolving Technology	Providing continual support with completing complex tasks across the diverse range of online technologies required for accessing essential services.
Reaching a shared understanding	Getting to a common language about the task and setting up a similar visual view as the beneficiary.
Guiding step-by-step	Walking through each section of a task at the pace of the beneficiary.
Limiting extraneous information	Preventing overloading beneficiary's cognitive resources by only presenting the essential information and recommending a quiet place for task completion.
Determining when to seek and provide help	Offering and watching for cues on the availability and receptivity to providing and receiving help.

SKILL ACCESS	
Developing and Updating Skills for Ongoing Use	Keeping a beneficiary current on the skills needed to independently complete complex tasks.
Observing and modeling the task	Vocalizing while demonstrating the task, followed by observing a beneficiary to confirm they can correctly repeat the task.
Being present during hands-on practice and trial and error	Watching a beneficiary work through the task on their own and providing directions when mistakes are made.
Tailoring assistance to current skills and learning curve	Assessing the beneficiaries' knowledge to design the information and pace of the help to their current skill level.
Expanding learning opportunities	Encouraging a beneficiary's skill development by showing the capabilities of technology beyond immediate need.

MATERIAL ACCESS	
Acquiring Basic Internet and Technology	Addressing the basic needs required for ensuring online access.
Quickly resolving the issue	Offering limited instructions to get people online for time-sensitive or rare tasks.
Overcoming internet access barriers	Pursuing opportunities for people to have reliable internet, such as connecting to loan device programs and assisting with technology-service applications.
Maintaining and working around older technology	Keeping beneficiaries online by developing processes to work around challenges with outdated infrastructure, older devices and software updates.

MOTIVATIONAL ACCESS	
Relating to Sociocultural and Psychosocial Motivators	Establishing trustful relationships to reduce beneficiaries' fears and frustrations when encountering a novel task.
Building shared confidence	Building trust and rapport in recognizing that both parties' efforts will help to reach the goal of successful task completion.
Providing emotional support	Encouraging positive emotions through caring environments and discouraging the negative emotions that can arise when encountering a novel task.
Reflecting on being a novice	Returning to the steps and terms that were helpful to learn the task and reminding oneself of the difficulty and frustration when encountering the task for the first time.

FIGURE 2 Community intermediary strategies and tactics: definitions and mapping to Van Dijk's (2006, 2017) multiple access model.

> "*A person has to be not only confident in themsel[ves] but they have to be confident in the person they're asking... It's pretty much an exchange where if the person that's giving the information on how to use the technology is confident..., then it's going to be, 'Okay. I feel confident in this person and she's teaching me.' ...if they don't feel confident in that person... it's going to make them shut down" [INT02].*

Providing emotional support: *Building shared confidence* was linked to the tactic of *providing emotional support*. A beneficiary shared how celebrating successes could encourage positive affect and belief in one's ability: "*[the community intermediary] had called and we were talking and he was telling me how to do this and that on the tablet. I did. I was so happy. He just laughed and said 'listen to the laughter in your voice.' I said, 'I did that!'*" [BENF12]. Intermediaries' positive emotions could counter beneficiaries' fears and frustrations from encountering a novel task. INT07 shared her approach of not being "*a robot, [but] somebody who can relate to... [in] making them feel comfortable with making mistakes*." INT04 noted the need for patience and compassion among intermediaries: "*I hope that the person on the other end have to be patient and knowledgeable enough to be compassionate with whomever [needs help]*."

A few beneficiaries expressed concerns that their performance level might frustrate intermediaries or other beneficiaries who were learning alongside them, and had concerns about accessing future help if they did not learn fast enough. As BENF02 said, "*[I'm] a guy who's willing to learn everything...It was times when they get frustrated... and I would encourage them, 'don't quit me now. Hang on in there with me. I promise to get better.'*" Intermediaries noted that to sufficiently mitigate these fears, they were able to facilitate positive emotions when they had unhurried time with a beneficiary. INT06 said: "*You have to have the patience and the time. You can help anybody you want to help. You can be somebody with no experience period*." Similarly, INT07 saw value in taking the time to walk through a task: "*Especially if they have a hard time and walking them through the ability to log on. It does take a lot of time, because people become frustrated when they don't understand*."

Two older beneficiaries' recent intermediary interactions highlighted how positive emotion was encouraged through multi-generational collaborations within their community. BENF06 found that Zooming with "*a sister circle of all different ages [in the] same space and the same time promoted a social ethic...because it allows us to be able to have a connectiveness*." She envisioned expanding this community network for exchanging expertise on varied topics: "*Like an electric grid, all who each hold a specialty and can come together [and]... become a part of building legacy and enhancing your community and making people feel good about who they are*." Regarding intermediation that took place on a bus, BENF02 was initially asked for change for bus fare by another rider. But then he contributed and then received technology help during this interaction: "*I could see his joy. He got what he wanted from me. He was desperate for some change. And I was just as happy as he was because he brought me and opened up my eyes to technology*."

Reflecting on being a novice: This tactic encompassed intermediaries remembering and empathizing with how it felt to encounter the task for the first time. This tactic was more desired than a reality as it was based on feedback from multiple beneficiaries who found that intermediaries may forget or diminish their past experiences of learning an unfamiliar, complex technology. BENF02 found that "*at times, it could be difficult [for intermediaries] imparting...what [they] know because [they] forget the time when [they] didn't have that knowledge and what it took...to obtain that knowledge*." BENF05 was also frustrated when a community intermediary described a task as "*easy*" that was difficult for her: "*Don't tell me it's easy. It's easy for you because you know how to do it. This is something you do repetitively. I don't do this every day, all day... Because if it's not easy I wouldn't be calling you frantic*." Similarly, BENF06 desired intermediaries who could relate to being a novice: "*you have to share with people what a journey is like, what it's been like, how I felt. I know how they feel. I know what they're experiencing*."

4.4.2 | *Acquiring basic internet and technology (material access)*

Acquiring basic internet and technology (Figure 2) is a strategy which encompasses three tactics for addressing the basic needs required for online access in everyday life. While intermediaries could not provide technology, they could help people navigate the technology to which they *did* have access. To do so, most often intermediaries turned to the tactic of *quickly resolving the issue* for time-sensitive tasks, which involved intermediaries completing the task with limited explanation to get beneficiaries online. Although *overcoming internet access barriers* and *maintaining and working around older technology* were less frequently used tactics, the resource constraints which participants navigated illustrated how both are critical for facilitating access to basic internet and technology.

Quickly resolving the issue: Community intermediary interactions for *quickly resolving the issues* with online technologies were often done over the phone when a beneficiary called someone they knew for help. Beneficiaries viewed these remote interactions favorably when time was limited, and they had an immediate goal. BENF08 appreciated his cousin's help with connecting to Zoom through a single link so "*that he could walk me through without me having to figure it out*." To assist in quick resolution, some intermediaries asked beneficiaries to share their screen on Zoom to find the problem.

However, intermediaries noted that remote sessions were not always successful if beneficiaries did not have the foundational technological knowledge needed to implement the quick solutions. As demonstrated by INT06, intermediaries may need to visit the beneficiary's home: "*Sometimes we have to leave home and go to their residence to help them. Because, no matter how many times you explain it or share screen, they still don't get it*" [INT06]. Intermediaries often interacted directly with the technology when solving an issue in-person. For example, to address the common challenge cited by Spanish-speaking participants of being unable to access information sent in English BENF22's daughter "*went to the internet and started to move things there and said 'look, I am going to put it in Spanish for you' ...and she didn't tell me what she did or anything*." Notably, despite the value of quick resolutions, some beneficiaries expressed frustration with this tactic when their motivation was to learn. BENF12 said: "*They be zoom, zoom, zoom, zoom. They're doing it so fast, how am I supposed to learn?*"

Overcoming internet access barriers: The magnitude of internet access barriers was demonstrated during the study when a third of remote interviews conducted for the study were interrupted by poor connectivity. Beyond the interview context, regular disruptions in internet service prevented people from accessing essential services, such as healthcare: "*It was like poor connection, kept on saying poor connection" [BENF19]*. Service costs also prevented people from being able to fully participate online. BENF09 said, "*it's frustrating being of low income... because to get better internet speed you have to pay for it. So, the accessibility of it...[is] frustrating to me...*" [BENF09]. BENF18 stated that, "*I don't have internet or wireless. What would be helpful [is] me having income*." Community intermediaries from the nonprofit organization were able to bridge internet access barriers to some extent by loaning mobile internet hotspots to community residents. However, INT08 illustrated challenges with sustaining long-term access when she mentioned that after the program ended there was a "*...need to give [WiFi hotspot devices] back...they are not permanently going to stay with those residents*."

Maintaining and working around older technology: Maintaining the technology used by members of the resource-constrained community entailed working with and around aging infrastructure and older devices that were no longer supported by the companies that produced them. For example, for aging infrastructure, the unreliable electricity in BENF04's apartment building meant reconfiguring plugs when using different technologies: "*Because of power conserving, I...disconnect the printer to the electric connection...when I'm not using it... because where I live the power goes out really fast. That's just the way the circuits are in this apartment*." INT01 noted that internet outages were common in their area and could be prolonged "*for like a week*." Consequently, this created a need for INT01 to provide intermediary support to neighbors when the internet came back up after an outage "*a lot of the residents didn't know that you have to actually reset...the modem in order for it to start working again, correctly. I did have quite a few people to ask me how to get back on the internet*." BENF16 had to restart her phone when access failed and was concerned that the required software updates after restoration would require paying for a new phone: "*They're going to tell me to upgrade... when the reboot is not working...these things become outdated... and you can't troubleshoot it*." One beneficiary offered an example of how intermediaries could provide support with troubleshooting older devices when he described a workaround for maintaining access through his government-provided cell phone: "*It won't always let me update. Sometimes I have to clear everything out and start over it again...That would be the problem I would have with low-income phones*" [BENF01].

4.5 | *Research question 2: assisting with technology skill development and usage of digital technologies and services*

4.5.1 | *Developing and updating skills for ongoing use (skill access)*

Developing and updating skills for ongoing use is a strategy that involves intermediaries teaching beneficiaries the skills required to complete technology-mediated tasks on their own. Importantly, this strategy recognizes that with technologies constantly evolving, skill development is never complete. Hence, *ongoing* support for updating skills is needed to ensure access to essential services. Within this strategy, there were four tactics: *observing and modeling, being present during hands-on practice and trial and error, tailoring assistance to current skills and learning curves* and *expanding learning opportunities*

(Figure 2). These tactics were most often conducted by community intermediaries from the nonprofit organizations as they had designated time for intermediation.

Observing and modeling the task: Intermediaries went through a deliberate process of repeatedly modeling the task until the beneficiary could demonstrate the correct sequence of actions. INT02 outlined her process: "*I pretty much [do] the whole steps from beginning to end*," which involve[s] "*...just talking them back, redoing the whole step so they can see where they might've made the mistake*." Beneficiaries appreciated observation when they were attempting a new task. BENF05 said she wanted "*someone standing next to me...[so] that I can ask my question right there, immediately, if I don't get it*." Then, a community intermediary could redirect the steps on a task or help the beneficiaries learn from their mistakes without getting lost.

Multiple beneficiaries viewed notetaking as a valuable tool when observing others using technology. Beneficiaries' notes, with "*key words that would jog my memory*" [BENF05], could be helpful when they were practicing on their own. Notes could also facilitate self-assessment of successful learning, as some beneficiaries noticed when they were no longer needed: "*I've done that often enough now that I can do it by myself without even looking at notes*" [BENF04].

Being present during hands-on practice and trial and error: Many beneficiaries shared the need for "*hands-on*" time for "*practice and repetition*" and "*trial and error*" while the community intermediary was present. As one said, beneficiaries wanted time for intermediaries to "*show me what you did and then take me back out of it and let me do it myself*" [BENF05]. BENF06 also emphasized the value of practice and repetition: "*Once I learn to do something, I will practice it again and again and again. So, I may not be an expert, but my skillset is enough for me to get from point A to point B to point C. I can travel. I can make the journey*." Intermediaries also recognized the importance of repetition, as demonstrated by INT09: "*I just kept being encouraging...do[ing] it over and over again, and after a while, it'll just be like...you know your phone number*."

"*Trial and error*" was a common phrase used by beneficiaries as an eventual pathway to learning: "*you make a mistake and with each mistake there is a learning process... And that's how I've learned how to use systems most of the times. I go ahead and try, something doesn't work so I try a different way, now it works, and so I learn. Trial and error*" [BENF07]. Intermediaries did not use the term "*trial and error*." However, they stressed the importance of being present during hands-on practice when beneficiaries were attempting a new task. INT03 outlined how she shadowed a beneficiary at a community technology center: "*She was with me in the room, so I stayed right with her so she could understand exactly what she's supposed to do, and then when she didn't understand, then she came and asked me questions about it...I was like a shadow with her, right there as support with her until she understood*."

Tailoring assistance to current skills and learning curve: Intermediaries recognized beneficiaries' varying technology knowledge, and thus tailored their help to the different skill levels. Some intermediaries began interactions by assessing beneficiaries' existing knowledge and skills, so that they knew where to begin in furthering developing skills. One beneficiary at the non-profit organization had experienced "*an initial assessment...[and asked] 'where are you right now? What do you know and what don't you know? What can you do and what can't you do'"?* [BENF02]. Such informal assessments could help intermediaries identify gaps or misunderstandings in a beneficiary's existing knowledge. One community intermediary stressed the importance of asking about the beneficiary's knowledge in concrete terms rather than in summative ways that could seem pejorative: "*Some people ask, 'Are you computer illiterate?...if someone called me computer illiterate, I would feel offended. That's not the best way...[rather] asking people questions... 'Do you know how to do this?'*" [INT08]. Intermediaries also investigated what beneficiaries had already tried to resolve a given technology issue. "*I would ask them what is the trouble, because you're going to find the source...and then... what are they trying to do to solve the problem*" [INT03].

Participants' reference to "*learning curves*"—meaning how fast someone could learn technology skills—offered an additional consideration for tailoring instruction. One community intermediary noted that a learning curve could not be determined a priori through obvious personal characteristics, like age: "*Some people are fast learners even though they're older. Then some people are not fast learners even though they're older. It just depends... [the] process they pick up to determine how they're going to learn a technology*" [INT02]. Drawing from a negative experience, BENF05 stressed the importance of careful pacing: "*I had to learn what my level was...Where is my learning curve?*"

Expanding learning opportunities: Intermediaries encouraged beneficiaries to advance their technology skill development by highlighting learning opportunities beyond the original task. For example, BENF02 described how a community intermediary showcased the range of technology capabilities by "*[showing me] several other kinds of apps. Some of them I don't need and don't want, and others I didn't know existed but I'm just glad they're there*." INT01 similarly illustrated a novel capability to expand the beneficiary's learning beyond an immediate problem-solving need. After she resolved the original

issue of the taskbar disappearing, she showed the beneficiary additional capabilities within the taskbar: "*[I] showed her, all you have to do is go up to the taskbar, it'll come down. It was fun because I [then] told her that you could move it, and she was like, 'Wow, I like the way that looks.' I showed her [where to]...change the colors*." However, community intermediaries also recognized the importance of gauging when and when not to expand upon the initial task. They were careful about introducing "*shortcuts*" so that beneficiaries were not overwhelmed. One community intermediary explained that she delayed showing beneficiaries "*copy and pasting stuff...[as it] isn't intuitive*" [INT08].

4.5.2 | *Problem-solving tasks for diverse use of evolving technology (usage access)*

The strategy of *problem-solving tasks for diverse use of evolving technology* recognizes that achievable tasks can become unfamiliar with continual technology upgrades or software updates, and thus require ongoing community intermediary interactions. For example, BENF09 shared how her "*daughter and best friend [helped her with] new features on phones [and] different messengers*." Similarly, INT08 described helping her mother with a phone update: "'*I used to be able to do [a screenshot] on my phone...How do I do that now? Essentially, she knew what she should be capable of being able to do, but needed the guidance of what buttons you click to get there now*." Four intermediary tactics focused on beneficiaries completing complex tasks across the range of evolving online technologies now required for access to essential services: *reaching a shared understanding*, *guiding step-by-step, limiting extraneous information*, and *determining when to seek and provide help*.

Reaching a shared understanding: As the requisite technology-specific language to describe a technology issue may be unfamiliar to beneficiaries, *reaching a shared understanding* was important for first identifying which issue needed resolution. One community intermediary explained: "*You have to figure out what they're talking about...understand exactly what is the need, because when someone doesn't know what the actual elements are, they really don't know how to explain it to you*" [INT01]. Being able to have the same visual view could quicken the process for *reaching a shared understanding*. Screen-sharing such as via Zoom or in person could help people establish a shared technological vocabulary: "'*What are you talking about the button that you cut on and cut off?'... Then, once we got to the screen, she showed me where [the toolbar] was supposed to be*" [INT01]. Sharing the same view also allowed beneficiaries to independently repeat the task at their own pace. For example, BENF09 found that seeing the same view made it "*easier to take notes and go back and do [the task] if I needed to do it on my own*." BENF05 found that remote, asynchronous sessions allowed her to see the community intermediary's screen, while listening to and reading the community intermediary's words: "*If you're like,' what did they say'? Glance over there, be able to see what they said if you can't catch some understanding. You back it up and look at the words*."

Examples of *reaching a shared understanding* through intermediaries setting up a personal, mirrored version of the same device or software used by a beneficiary were also provided. Sometimes family members purchased the same devices so that they could learn and teach their other family members using the same interface: "*My daughter and I get...exactly the same phone, so she can go over and get comfortable with it and then show me*" [BENF04]. INT08 installed programs on her own devices to allow her to see the same view as a beneficiary to guide her more effectively: "*I...set up...a new Gmail for myself... that's really helpful, [in] making sure that you're on the exact same screen...I would just fill in random things into the spots so that I could be one step ahead of her*."

Guiding step-by-step: Intermediaries would sequence and break unfamiliar, complex tasks into manageable segments. As the previous quote suggests, *reaching a shared understanding* and *guiding step-by-step* were often paired. BENF10 explained how these tactics reinforced each other: "*Once everything is installed, you can say, 'Hey, share your screen and I can walk you through this.' So, it's very nice to be able to see the other person's screen*." When conducted without a visual view, *guiding step-by-step* could involve verifying or confirming progress at each step, as INT08 explained: "*Having little check-ins...'Are you at this page now? Is this what your screen looks like?*'" Beneficiaries' gratitude for the patience involved with this tactic was demonstrated by BENF12: "*They would go step-by-step to explain it to me. Then they would show me. They were very patient, and I know they probably got tired of me...but I really appreciate [d] them*."

Limiting extraneous information: For this tactic, intermediaries would have beneficiaries focusing their attention on salient elements of a complex task, thus reducing the distractions that can inhibit learning new skills. One community intermediary described the distractions of working from home during the COVID-19 pandemic: "*At first it was challenging because with me coming home doing my things on my laptop, my daughter had to work... in the living room...and my granddaughter had to be in the bedroom...she already knows to be quiet for a minute*." Beneficiaries also described how verbal instructions were

not always beneficial and could compound frustrations. For example, BENF05 described an interaction when the poor internet connection, and verbal instructions by the community intermediary added to her frustration: "*Aah! It's like 'stop talking. Give me a minute...' But the thing was the internet was acting crazy for everyone over in my area, but not knowing it was the internet messing up*."

Additionally, the number of options available within a technology could be large, and this was experienced as extraneous information that was difficult to sift through. For example, when BENF08 tried to learn how to participate in an online court session, the online tutorials added confusion: "*[I] just want[ed] to have a simple chat, as all kinds of different bells and whistles... just pissed me off. It was that complicated...It's like too many options...I'm just going to go in-person, and I'll learn Zoom at a later date*." INT08 demonstrated countering such overwhelm by selecting the essential information for the current task: "*[the beneficiary] always ask a million questions...here are things you're going to have to use this website for. Let's only focus on that. When you have the computer and full capacity, then we'll get to the buttons that you're never going to use*."

Determining when to seek and provide help: This tactic encompasses the cues beneficiaries and intermediaries provide regarding when to initiate intermediary interactions. Beneficiaries used cues to assess intermediaries' availability and approachability to determine who can help, and when to approach them. INT01 described how she was recognized for helping with technology: "*I don't have like a sign, 'I'll fix your computer or help you with it'...[my neighbors] see me [and] know that I'm available*." Similarly, BENF02 assessed which community intermediary to approach based on their availability and receptivity to providing help: "*[Intermediary #1] was very helpful, but he was so busy. I just didn't feel right just calling him and bugging him all the time. I did what I could. For [Intermediary #2], if she's busy or not. If she's busy, then she'll tell me well, I'll call you back at a certain time*."

Intermediaries also followed cues for recognizing when to pause offering technology help. BENF02 described how "*there's been time when they [were] trying to show me something and I couldn't get it. I said, 'well, I'm through with it. I'm frustrated'...what I had to...overcome...step back*." Similarly, BENF05 shared: "*I don't know what happened to it...I had a complete meltdown...I was devastated...I learned to walk away*." These responses could mean breaking assistance up over time or giving people a rest to allow for help at a more opportune time when frustrations had subsided. As INT05 noted: "*I wouldn't encourage anybody to try to push [beneficiaries], you can explain stuff, but if you feel that they have that hesitancy and that general... fear...go on to the next one...Don't push it...They'll make you come back around later*."

5 | DISCUSSION

Human intermediation offered through informal and semi-formal community settings is critical for people from resource-constrained communities to gain access to the internet and other technologies. This study further demonstrated this, while extending prior work by categorizing the strategies and tactics used by intermediaries within resource-constrained communities. The strategies and tactics identified through both intermediaries and beneficiaries' accounts are compared to prior research from library science, community informatics, human computer interaction, and health informatics in Appendix S3. Notably, the current study revealed two new tactics not previously outlined: *expanding learning opportunities* and *reflecting on being a novice*. Additionally, intermediaries often deployed tactics in response to immediate needs without knowing whether the beneficiary acquired skills. Thus, there is a need for an expanded evaluation of the effectiveness of the tactics. The application of information and learning theory can help explain what did and did not work and guide future intermediary interventions and infrastructure development.

5.1 | *Expanding upon community intermediary strategies and tactics*

Study findings add to prior work (Antonio et al., 2023; Williamson, Antonio, et al., 2024) with beneficiaries from resource-constrained communities who expressed lack of confidence, fear, and frustration when attempting to use technologies. Some older adults in this current study were concerned about being judged for their competency and performance. Prior research has drawn attention to how ageist views of older adults as not being competent with technology can create feelings of being devalued, being abandoned when struggling with complex tasks, and dependency on receiving support (Mannheim & Köttl, 2024). Thus, *relating to sociocultural and psychosocial motivators* involves developing trusting relationships with resource-constrained community members. Further development of relational tactics could draw from ethical principles of critical community informatics (Hackney, 2024) and information science theory regarding relationships between technologies and communities (Veinot & Williams, 2012). The tactics within this strategy can also build upon relational pedagogical approaches which recognize that

encouraging a sense of belonging and treating the beneficiary as a whole person with their own experiences and strengths can alleviate negative emotions (Schoem et al., 2023). Community intermediaries' tactical strengths could thus be reinforced in their work if they were taught how to systematically apply this relational learning theory.

Tactics were not always deployed to their full potential for facilitating access to and use of technology. Both informal and semi-formal intermediaries used common phrases from learning theory to describe tactics that they had developed on their own. Yet, as these tactics were developed ad-hoc in response to an immediate problem, it was unclear whether the elements of the learning theory were followed. For instance, *guiding step-by-step* is commonly found within the literature (see Appendix S3) and is a phrase frequently used by participants. However, in our study it was often unclear what *guiding step-by-step* entailed and when steps were described to help beneficiaries with skill development. Thus, the application of the instructional technique of "*worked examples*" from cognitive load theory (Sweller et al., 2011) may provide direction for improving the application of this current tactic. Worked examples guide the correct steps for problem-solving with verbal explanation, which benefits learning more than independent trial and error (Kalyuga et al., 2010). In addition, worked examples that begin with a high-level picture of the task before moving into more specific aspects can help beneficiaries develop a systematic approach to trial and error when they need to independently problem-solve future unfamiliar tasks (Kalyuga et al., 2010). Long-term skill development can also be facilitated by varying the worked examples to other domain-related tasks (Kalyuga et al., 2010). Accordingly, worked examples are an instructional approach that could be introduced to community intermediaries to help them be more effective.

Learning theories illustrate how the two novel intermediary tactics identified could be expanded to more systematically facilitate the use of and access to technology. *Reflecting on being a novice* aligns with the Dreyfus (1980) model of skill acquisition which explains how people develop proficiency by moving through five stages from novice through to expert. Novices do not have requisite knowledge for its performance when encountering a new task, and thus they can be slowed down when problem-solving unfamiliar steps (Dreyfus, 1980). In comparison, experts may view the task as intuitive and unknowingly skip steps or use unfamiliar, task-specific language when explaining how to complete the task to novices (Dreyfus, 1980). Thus, this newly-identified tactic could encompass encouraging intermediaries to reflect upon how they completed the task for the first time to remind them of the complexity of the task, the terms to use when communicating the essential steps, and what knowledge is needed for novices to move to the next stage of skill development (Dreyfus, 1980).

The second novel tactic of *expanding learning opportunities* complements Van Dijk's (2006, 2017) model. Specifically, the model asserts that people from resource-constrained communities have been denied opportunities to learn about technology, and thus providing these opportunities can facilitate ongoing access and fuller participation in society. Informal learning theory (Callanan et al., 2011; Marsick, 2009; Sayago et al., 2013; Tannenbaum et al., 2009) offers a possible future direction for grounding how intermediaries can assist during episodic help sessions. Instructors could encourage community intermediaries to watch out for the "*teachable moments*" for beneficiaries to learn about something that was beyond their original need (Tannenbaum et al., 2009). Moreover, the theory's dynamic learning model offers an alternative to linear modes of instruction (Tannenbaum et al., 2009), which beneficiaries did not always appreciate when they were receiving help with setting up a technology. An extension of the dynamic four constructs in informal learning theory (intent to learn-experience-action-feedback-reflection) (Tannenbaum et al., 2009) could provide intermediaries with a more intentional approach for facilitating beneficiaries' skill development. This could be done by moving between the stages of identifying the need, providing hands-on experience with the task, offering feedback, and having beneficiaries reflect on their understanding of the task.

5.2 | *Investing in intermediary resources and infrastructure for training community intermediaries*

Although a majority of people in the world use the internet (Petrosyan, 2025) participants shared how maintaining online access can be difficult when they may not have the resources to stay updated. Indeed, this was reflected in the two upper-level strategies of *updating* and *evolving* with technology. Unlike prior research that located security and functional problems within individual users' poor understanding of how to install updates (Mathur et al., 2018; Mathur & Chetty, 2017; Nicholson et al., 2021), this study showed that such issues may be partly located in use of older devices. Specifically, installing software updates on such devices requires learning advanced tasks of resetting devices and deleting files to make space. The constant software updates now pushed by vendors create ongoing support needs, as prior knowledge of how to perform a task may become irrelevant.

The need for ongoing help with software updates is further illustrated by Kameswaran's (2024) study with people with visual impairments that found access to essential services can be lost when updates break accessibility hooks between multiple applications. Similarly, Williamson, Li, and Veinot's (2024) research with low-income people with mental illness noted that access is a process in need of ongoing attention due to broken or lost devices and use of public or otherwise temporary internet access. Thus, the strategic category of *updating* and *evolving* emphasizes how intermediation should be part of a long-term approach to facilitating technology access and usage for resource-constrained communities.

Three intermediary tactics incorporated considerations regarding the timing of help. Beneficiaries often spoke about community intermediaries' pace to *quickly solve the issue* and desired slower presentation of material to give them time to absorb the information. To be better prepared for future tasks, beneficiaries expressed the need for more time for intermediaries to be *present during hands-on-practice and trial and error*. Similarly, both intermediaries and beneficiaries acknowledged the importance of gauging when *not* to provide help, and when to return to the task when feelings of being overwhelmed have subsided. Notably, the time considerations within these tactics contrast with prevailing commercial models of technical support (e.g., Geek Squad) in which an informal intermediary's assistance is episodic and geared only towards quickly solving a specific problem (Poole et al., 2009; Rosales & Blanche-T, 2021). Moreover, as community intermediaries may share the same social disadvantages of those they are helping, (Courtois & Verdegem, 2016; Li & Chen, 2021), they may have limited skills themselves and thus may require more time to work through a task than they can afford (Strazdins et al., 2016), or be unable to provide sequenced, long-term support.

Accordingly, we contend that the development and availability of paid intermediaries is critical for enabling resource-constrained communities' engagement with essential services. Such intermediaries could facilitate longer-term actions by deploying tactics to facilitate movement from immediate tasks to updating digital literacy skills. Recent investigational models of intermediary support for resource-constrained communities include leadership labs (Rhinesmith et al., 2022), and "*Models of Community-led Connectivity*" (Weeden et al., 2025) and "*the Village model*" (Dillahunt et al., 2022) that offer flexibility and adapt to the needs of community members.

Although public libraries have long been sources of free internet access for resource-constrained communities (Becker et al., 2010), their long-term financial strain (Hoffman et al., 2012; Sin, 2011) may prevent the staff training needed to stay "*digital-savvy*" (Detlor et al., 2022). Similarly, formal technology intermediary roles are often funded through temporary grants (e.g., Rodriguez et al., 2024; Strover et al., 2024) which are vulnerable to funding cuts (Partners in Health, 2025). For ongoing success of these programs, there is a need for sustained investment in intermediary resources for teaching digital skills on the older devices that people often use in resource-constrained communities (Lythreatis et al., 2022; Ramírez et al., 2013). Public and nonprofit organizations in the US need more opportunities to expand intermediary support and make them a part of a community-based technology infrastructure that is available on a lasting basis. Building on the 2021 Infrastructure Investment and Jobs Act (IIJA) (Rodriguez et al., 2022), which targeted broadband access for resource-constrained communities, offers one way forward. Additional investment in resources such as employment centers, public libraries, and senior centers may better equip community intermediaries as they attempt to meet beneficiaries' current needs.

5.3 | *Future research*

Building upon the strategies and tactics outlined in Figure 2 is needed. This can be done by conducting subsequent studies to determine their applicability to other resource-constrained communities, and beyond. Of particular interest is applicability to other groups that may experience technology access disparities, such as formerly incarcerated individuals (Ogbonnaya-Ogburu & Israni, 2024), people with chronic illnesses and disabilities (Kameswaran, 2024), older adults (Rosales & Blanche-T, 2021), and immigrants and refugees (Guberek et al., 2018). This is critical since not all technologically disadvantaged individuals live in resource-constrained areas, and infrastructure varies by locale. Furthermore, there is value in identifying when particular strategies and tactics are used/not used, or when they are considered helpful/not helpful. Novel interventions could leverage prior research, the current findings, and the experiential knowledge of beneficiaries and intermediaries to more systematically train and support community intermediaries. Interventional research to establish the link between specific strategies and tactics and sustained technology access and use, and to equitable service access is also critically needed.

5.4 | *Limitations*

A strength of this study is that participants were recruited through three US organizations that represent informal and semi-formal intermediary settings and were from a

racial group often underrepresented in research with varying educational backgrounds and ages. However, as intermediary interactions were within a single resource-constrained community, the experiences offered by the participants may not be fully transferrable to other contexts. In addition, participants were connected to community non-profit organizations, thus this study may not have reached the full range of intermediation from informal settings or connected with people who are socially isolated, and thus have even fewer access to resources. To address these limitations people were asked about their intermediary experiences both within and outside these semi-formal organizational settings. In addition, to understand the scope of strategies and tactics we mapped them across multiple disciplines and learning theories during analysis. We recognize that we may have overlooked studies from other fields. Nevertheless, mapping of the strategies and tactics to existing literature and theory facilitated generalization beyond the study data.

6 | CONCLUSION

This study surfaces a range of community intermediary strategies and tactics that support basic access to technology, ongoing use of technology and long-term access for people in resource-constrained communities. The study found that intermediary tactics are commonly focused on immediate need. However, addressing technological disparities necessitates the development of intermediary strategies to guide those being helped through the iterative cycles of learning new skills and knowledge. Furthermore, the delivery of some tactics could be strengthened through systematic application of learning theory. This consolidation of intermediary strategies and tactics for facilitating long-term access to and use of technology for resource-constrained communities is the first step towards developing models of human intermediation that treat it as an essential community infrastructure. Future research that assesses and builds upon these intermediary strategies and tactics is welcomed.

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DATA AVAILABILITY STATEMENT

The data gathered during this study is not publicly available and cannot be shared due to confidentiality. Participants are potentially identifiable from the information contained in the qualitative data. Furthermore, ethical restrictions from the consent process used with participants prevent data sharing and data requests. Any questions about this can be directed to the corresponding author.

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