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Digital skills are essential for engaging in employment, healthcare, education, and government services. However, the digital divide remains a social inequality, especially among marginalized populations. Through a community-engaged research approach, we conducted a digital skills learning intervention in a U.S. public housing community, where residents frequently face socioeconomic challenges and limited access to digital resources. Public housing is a community seldom explored in CSCW and HCI research and provides a unique context to study the ongoing digital skills gap. Through the lens of situated learning theory, we study how sociocultural factors impact the efficacy of a community-based computer skills learning intervention. Specifically, we examine how the public housing community organized various resources—online learning materials, instructors, peer social support, and on-the-job learning opportunities—for digital skills development. Notably, the training leveraged instructor critical care and peer support to develop a learning community between residents and leaders of the community NGO that continued beyond the formalized training program. We contribute to CSCW and HCI work on collective and assets-based approaches to enhancing digital capacity. Our work provides implications for building collective grassroots digital skills learning infrastructure that could create new digitally-engaged employment opportunities.

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

Additional Key Words and Phrases: public housing, sociocultural factors, digital skills, digital divide, digital training, digital engagement, community-based research

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1 INTRODUCTION

Digital skills are increasingly required to access employment, healthcare, education, and government services. Despite their importance in everyday life, the digital divide remains a barrier to accessing them [49, 83]. Even though access to digital devices (first-level digital divide [81]) has increased, the gap in the effective usage of digital devices (second-level digital divide [28]) continues to persist. These disparities disproportionately prevent under-resourced populations from fully leveraging technology for socio-economic advancement (third level digital divide [24, 80, 82]). To address the digital divide, it is essential to consider the multilayered social, economic, political, and cultural

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contexts where people are situated beyond mere access to digital devices and their connection to the Internet [57, 63, 71]. While more recent literature on the digital divide emphasizes the importance of fruitful engagement with digital technologies beyond just access, few have explored *how* third-level digital literacy can be facilitated, particularly in under-resourced contexts. This paper highlights the key importance of leveraging and addressing *sociocultural factors* in the efficacy of a community-based computer skills learning intervention for a U.S. public housing community.

U.S. public housing serves 2.3 million low-income people with its majority categorized as 'very low-income' [17]. Over half of the households consist of disabled and/or elderly residents, and 61 percent are nonwhite [17]. This population has demographic characteristics that overlap with those associated with lower rates of computer usage [8, 9, 71]. This overlap provides evidence of significant social disparities in using and learning computer skills among public housing adults.

Prior work on digital literacy and learning has also shown that even if adults with limited digital literacy are provided access to computers, the Internet, and online learning modules, they still face difficulties learning digital skills independently [7]. Notably, they may experience significant psychological barriers such as anxiety around using technology, self-doubt about digital skills competence, and lack of self-conception as a computer user [4, 59, 73, 74, 79]. Furthermore, those living in under-resourced communities face additional obstacles. They are likely to have limited access to digital literacy programs offered by local institutions (e.g., public libraries) due to inconvenient spatial/temporal accessibility [32] and unstable living conditions such as housing insecurity, family responsibilities and/or having more than one job.

To address the digital skills gap and overcome these challenges among the public housing population, we hypothesize that providing learning opportunities that engage sociocultural factors could facilitate digital skills development in a public housing community—a context rarely addressed in Computer-Supported Cooperative Work (CSCW) literature. We build on past CSCW and Human-computer Interaction (HCI) work that has described how informal learning of technology occurs through close relationships, such as family, friends and neighbors, within their social network [11, 12, 27, 42, 44, 62, 69, 89]. Community-based interventions fostering and emphasizing these social interactions have seen reasonable success in addressing the digital skills gap [25, 33, 88]. This success in digital skills learning can be explained through the lens of theories in learning sciences from a sociocultural perspective, which states that interaction with others, as well as various resources within a broader community of practice, is key to understanding and acquiring new knowledge and skills [26, 48, 84].

We ask, *What is the role and effect of the sociocultural context in learning digital skills in the context of a U.S. public housing community?* To answer this question, we conducted a digital skills learning intervention using a community-engaged research approach through a partnership with a community Non-Governmental Organization (NGO) in a public housing complex in Detroit, U.S. The digital skills training program, designed and led by the community NGO, took a grassroots approach centered on community relationships. Throughout the research project, the university research team employed participant observation and semi-structured interviews to understand trainees' learning experiences, social dynamics among the instructors and peers online and offline, and factors that made digital skills learning highly engaging during the training.

Using situated learning theory [48] as a framework, we describe how community members cultivated a learning community where people (instructors and peers) became essential sources of knowledge/skills and support for computer skills development that continued beyond the formalized training. Our findings highlight 1) trust and relationships with the community NGO, which made trainees feel comfortable to sign up for the training, 2) caring interactions among instructors and peers helped trainees to stay motivated to learn computer skills and overcome unexpected challenges, and 3) a collaborative learning community that expanded beyond the

formalized training program and continued in everyday lives of community members. As a result of the intervention, trainees overcame psychological barriers to learning computer skills. They became more independent learners, which is key in forming a new identity as computer users. Furthermore, some trainees were able to apply computer skills they learned in work settings, with some trainees envisioning new employment opportunities.

We contribute to the CSCW community by demonstrating how sociocultural factors shaped the efficacy of community-based computer skills learning intervention in a U.S. public housing. Our work also provides empirical insight and lived experiences of public housing residents, areas underexplored in CSCW and HCI research. Specifically, we enrich CSCW and HCI literature on collective digital skills learning [25, 33, 78, 88] by highlighting the importance of engaging sociocultural context, instructor critical care, and building trusting relationships between residents in a public housing context. This in-depth analysis adds nuances of a human element based on meaningful relationships to situated learning theory. Our intervention provides implications for building community digital capacity by activating social learning support in the community and digital reskilling for new employment opportunities, offering insight to mitigate the digital divide in underserved communities.

2 RELATED WORK

2.1 The Importance of relationships in digital skills learning

A rich body of work has established that support from personal social networks is a common route to learning technology in everyday life. People usually seek simple tech support (e.g., how to use devices and applications, troubleshooting, setting up devices) [44] from trusted social networks, such as family members (including children), friends, colleagues, and neighbors, [11, 12, 27, 42, 44, 62, 69, 89], rather than professional IT support or instruction manuals [19, 44, 58]. More recently, the role of 'tech caregiving' activities among a self-organized group of trusted people was fluid and reciprocal in sharing tech support regardless of age within the group members [44]. Furthermore, when security-related knowledge is shared among people with close connections, people were more willing to discuss, be accepting of, and access such knowledge [56], which seniors sometimes considered "expert" knowledge [56] but in reality is crucial for safe technology usage [53, 56]. Additionally, past work on digital literacy programs for older adults emphasized peer support as a key driver for engagement in training programs and learning [30, 51, 70]. These works show that mundane social interactions with close personal networks afford opportunities to learn basic digital skills, which lack thereof can be a cause of the digital skills gap [29, 36, 69]. In particular, marginalized and isolated populations tend to have fewer personal connections to provide tech support, which suggests the need for interventions to cultivate such informal networks and tech support from a broader community [36].

Beyond personal social networks, tech support and learning are available in structured learning contexts. At a community level, non-profit/local organizations, such as public libraries and community centers, have provided opportunities to learn basic computer skills, especially for underserved populations such as seniors, un(der-)employed people, and at-risk youth [39]. These local institutions provide access to computer devices and digital literacy programs that help community members with essential activities, such as job applications. Even with local community organizations, past work highlights that relationship-building is a centerpiece for learning digital skills. For example, relationships with library staff and instructors in digital literacy classes were a key motivation for learners to regularly attend the classes [39, 86]. Relatedly, past work also showed that seniors actively form relationships and negotiate with community institutions and staff/volunteers to gain needed tech support[50].

Despite the value that non-profit organizations bring to their communities, they face a number of challenges that affect their ability to sustain digital skills learning programs. For instance, public libraries in the U.S. often suffer from limited funding [14] and stable staffing (e.g., recruiting and maintaining quality instructors or training existing staff) to maintain digital literacy programs and tech support services for community members. They may also have difficulty meeting the needs of heterogeneous community members with different languages and cultures [39]. Another challenge is advertising digital literacy classes and accessibility due to geographic distances [14]. The target population often cannot allocate extra time and resources due to various life challenges, such as housing insecurity, family responsibilities, multiple jobs/shifts, and transportation [29, 39, 54]. To alleviate this gap, Wynia Baluk et al. [87] uncovered a physically accessible learning opportunity among public housing residents. Their interviews on digital literacy needs found that older adults living in Canadian affordable housing preferred learning digital skills through informal social networks within physically accessible locations as this approach accommodated various abilities and mobility [87]. From this work, we conjecture that to better reach underserved communities, organizing digital skills learning within these networks and making it part of the daily life in these communities can be a more effective and inclusive approach to addressing the digital skills gap.

2.2 Community-based interventions for digital skills learning

Past community-based CSCW and HCI research and ongoing digital inclusion programs highlight that social networks are important to activating digital skills capacity in under-resourced communities [15, 33]. Interventions that actively harnessed existing social networks embedded in the community showed the potential to invite community members to learn digital skills broadly via two approaches - intermediary and collective learning.

First, an important element in successful interventions is the availability of intermediaries. Past CSCW and HCI work noticed the role of intermediaries in everyday life, who are *"members with technology operation skills"* in social networks and *"enable technology use for persons whose technology access is affected by factors such as non-literacy, non-numeracy, lack of digital operation skills"* [68](p.1), as a collaborative way to gain support and use technology devices [18, 20, 60, 68]. This human-mediated support was crucial as only humans can effectively guide and bridge access to basic operational skills needed to use digital devices [7, 31, 35]. Human-mediated support coordinated at a community level is also crucial in expanding digital learning opportunities. HCI scholars showed that *"organizationally brokered ties"* [72] among low-income community members were able to provide digital resources and accompany digital skills learning opportunities. For instance, Hui et al. found that community organizations were vital for under-resourced entrepreneurs to access and connect resources needed to start employing digital marketing platforms. Outside academia, digital navigator programs deployed by community-based organizations (e.g., public libraries and community NGOs) that aim to increase access to digital resources have succeeded over the past few years [40, 59]. Digital navigators broadly refer to individuals who can provide tailored tech support on digital connectivity, devices, and skills in the community [1]. According to Kalmus et al., Black and Hispanic populations benefited more from digital navigators, but they still showed overall lower satisfaction due to logistical barriers, lack of trust in the organizations, and low confidence in learning. This highlights the key role of local community organizations working closely with and advocating for these populations in mediating digital skills learning.

Second, a collective approach based on familiarity among community members has proven to be effective, especially among underprivileged communities. HCI researchers employed a collective learning approach based on social networks embedded in the community to activate digital capacity to use technology for the benefit of community members' livelihoods. Through a participatory action research approach, Hui et al. showed that a group of local entrepreneurs in under-resourced

communities jointly initiated engagement with digital marketing tools through regular in-person meetings and low-tech tools (e.g., paper planning tools). HCI researchers have also implemented technology-based training projects that harness existing social relationships to engage community members with technology to disseminate knowledge across the broader community. For instance, Gandhi et al. co-created video content about agricultural practices to reduce poverty among marginalized Indian farmers and successfully shared the videos across the community, resulting in increased adoption of agricultural practices. Notably, to increase access and interest in video technology, they utilized the nature of homophily - commonalities shared among people - and local mediators with whom the farmers felt familiar. In other research, Yadav et al. scaled Community Health Workers (CHWs) training by introducing a mobile learning platform where CHWs across India could gather remotely. On this platform, they could meet with experts and peers to share and discuss healthcare knowledge/skills in real-time, which they had previously had to seek on their own. In addition, community-based digital literacy education enabled a group of Indonesian rural women in a tourist village to collaboratively explore digital marketing tools, leading to the continued adoption of the tools and empowerment of these women [78]. More similar to our context, Harris et al. noticed that affordable housing residents attended the digital literacy program not only to learn computer skills but also to socialize with neighbors[30]. It was also common that digital literacy programs facilitated new connections and a sense of belonging among older adults [61].

Behind the success of these collaborative efforts to activate the digital capacity of community members lies the close alignment of digital skills learning with people who share a similar culture and lifestyle. In other words, this collaborative learning approach involves community-driven processes where peers and more digitally advanced members actively support and engage with other community members. Our research expands on this research by identifying how such sociocultural values and interactions could be embedded in the design of a digital skills training program to foster greater engagement in the education of underprivileged computer learners in a public housing context. By applying the collective approach, we aid in organizing resources and learning basic computer skills in a U.S. public housing context. The residents here who often experience multiple demographic challenges —being mid-aged/older, low-income, disabled, and nonwhite— are particularly marginalized in their computer usage [8, 9, 71].

2.3 Situated learning theory

As a sociocultural theory of learning, situated learning, proposed by Lave and Wenger, views that learning occurs as people engage in social relations with others (i.e., peers, peers with more advanced skills, instructors), artifacts, activities, transparency of technology within a community of practice. With this perspective, situated learning shifts the analytical focus on learning from individual cognitive processes to broader ongoing social practices consisting of interactions of individuals and various actors, arguing that *"learning is an integral part of generative social practice in the lived-in world"* (p.35) [48]. Within the social world they belong to, people learn as they gain access and are exposed to various learning resources and opportunities accessible to them in everyday life through legitimate peripheral participation (learning curriculum). Notably, this learning process does not necessarily match deliberate instructions or pedagogy (teaching curriculum).

Thus, within a community of practice, the issue of facilitating access, conferring legitimacy (e.g., sponsorship, sense of belonging), and coordinating participation becomes crucial for learners to gain new knowledge and skills. In this sense, the social structure and sociocultural settings can hinder and promote individuals' learning opportunities. For instance, in a highly compartmentalized meat cutter's organization oriented toward profit maximization and efficiency, novice butchers who were assigned to perform only simple, repetitive tasks in a specific physical space (e.g.,

wrapping machine) had limited opportunities to observe others and learn how to cut meats and the entire process [48]. In another case, from a sociopolitical perspective, de Royston et al. argue that the underperformance of mathematics of African American students whose identities have been marginalized by education institutions can be explained by stereotyped power dynamics and its negative impact on their learning as mathematical practices and norms in the school system fail to accommodate diverse identities and sociocultural resources. On the other hand, recognizing the contributions of peripheral learners within a community of practice can foster motivation and engagement in learning. This process, where learners act upon the social world, enables them to better understand and acquire skills and knowledge. Crucially, as opposed to a narrow view of learning as a mere transmission of knowledge and skills, the social process of learning develops a membership in the community and thus transforms the identity of individual learners to become *"a different person with respect to the possibilities enabled by these systems or relations"* [48, p.53] as a result of learning. The perspective of situated learning was adopted to explore the process and ecology of various technology-based work communities. Through legitimate peripheral participation, Bryant et al. captured the evolving role and membership of Wikipedian editors [6]. To uncover diverse contributors in the data work community, Rothschild et al. shed light on civic data workers (full participants in their domains) as peripheral but crucial contributors to data contextualization, skills data scientists (full participants in the data work community) can learn. [66]. In our work, we apply situated learning theory as a framework to analyze *how* resources are organized for digital skills learning within a U.S. public housing community. To understand the effect and role of sociocultural context in the digital skills learning process led by the community, we focus on the social support and relational dynamics among community members with different computer skill levels to build a learning community that strengthens both individual and collective capabilities.

3 STUDY DESIGN/METHODOLOGY

3.1 Research background and objective

This work is part of a larger ongoing project aiming to bridge the digital divide by following prior CSCW work that employs an assets-based approach (e.g., [43]). In this ongoing project, public housing community residents were trained to provide digital skills support to other community members, particularly older adults who experienced social isolation and necessitated digital support. While the goal of the larger project was to implement the train-the-trainer model, this work focuses on the execution of the training program and the collective acquisition of digital skills among public housing community members. More specifically, this paper examines how sociocultural factors influence the effectiveness of digital skills training among community members in the implemented training program. To achieve this objective, we asked this research question: *What is the role and effect of the sociocultural context in learning digital skills in the context of a U.S. public housing community?*

Inspired by community-based participatory research approaches [37] that incorporate the expertise of community stakeholders in the research, we took a community-engaged research approach to design and implement a grassroots digital skills learning intervention. We tailored the intervention to the community's specific strengths and desires and examined the sociocultural factors in the collective learning process. For this, we partnered with a community organization to reach the public housing community in Detroit because such intermediaries often hold trusted relationships with community members. This academic-community partnership is supported by a growing body of literature that finds such partnerships mutually beneficial in digital literacy interventions, including works by Seo et al. [70] and Harris et al. [30], particularly for populations at high risk of digital

exclusion. Since February 2021, the research team has run ongoing bi-weekly meetings with the community NGO and external advisors. By January 2024, the community NGO had implemented two training sessions.

The university's Institutional Review Board (IRB) conducted a two-part review of our project. Initially, the IRB assessed the early stages of the project, which were primarily evaluative and observational and did not fit the definition of human subjects research requiring IRB approval. Given this, they determined it to be "not regulated." While the research results can be published, program evaluations, self-assessment of programs or business practices, and other quality improvement projects do not require IRB review because in these cases, the activities, rather than human subjects, are the objects of the study. Despite this classification, our research team adhered to best practices for handling data, ensuring confidentiality and privacy by anonymizing data, and limiting data access to team members on the IRB and who had appropriate IRB training. We were also open about the goals, methods, and anticipated outcomes for the project and, as stated earlier, regularly communicated with stakeholders and participants to build trust and accountability.

Subsequently, the IRB reviewed a more extensive pilot involving future training sessions. This expanded phase included interviews and surveys involving all trainees, including those from the first session. The IRB classified this phase as exempt because the research consisted of benign behavioral studies, which only involved collecting information from adult subjects through interviews and surveys. Furthermore, the methods employed did not expose the subjects to criminal or civil liability risk, nor did they have the potential to harm their financial standing, employability, educational advancement, or reputation.

3.2 Trainee Recruitment and Demographics

The community NGO advertised the training program, explained below, to the community through flyers, email newsletters, text messages, a face-to-face talk in the office, and at the promotion booth at community events (e.g., the annual health fair) before each training. Community members interested in learning about computers could enroll regardless of their knowledge of computer skills. However, due to staff shortage and increased instructor workload from other capacity-building projects within the community NGO, in the second training, the community partner decided to prioritize those with minimum computer skills who could use online learning materials. We recruited 11 community members for the first training (May to June 2021, 4 weeks), but 9 (7 women, 1 man, 1 who preferred not to disclose) completed the training. For the second training (Nov 2022 to April 2023, 6 months), 12 applied for the training. Ultimately, however, the community NGO conducted the training with 6 trainees (4 women, 2 men) because 2 were no longer interested, 1 left the community, and 3 were waitlisted for the next round of the training as they did not meet the minimum computer skills (and they were offered learning materials to build basic skills such as typing and using e-mail.)

The trainees' ages ranged from 30s to 60s. All participants identified as African-American; one was biracial African-American and White. All trainees had earned a high school diploma or some college education. All had access to at least one Internet-connected device (e.g., laptop, tablet, and/or Chromebook). While most trainees possessed basic computer skills such as turning on a computer and surfing the Internet, their confidence and prior knowledge varied based on their past experiences. For example, P2, who had been a machine operator and recently became an in-house staff member at the community NGO, brought relevant skills from her job. P3, who created YouTube videos as a hobby, also demonstrated higher confidence. However, most trainees had backgrounds in roles not requiring the basic computer skills covered in the training (e.g., cook (P4), door access control (P5), homemaking (P1, P11, P13), cashier (P9), and military service (P10)). These

participants typically had fewer professional opportunities to use computers and generally showed lower confidence in the training topics.

3.3 Training program

The first training was implemented as a 4-week pilot from May to June 2021. The second training was implemented from the beginning of November 2022 to the end of April 2023 for 6 months. The training programs mainly consisted of three learning activities: 1) self-paced online learning modules, 2) class huddles, and 3) teamwork activities to encourage social support and collaborative learning.

3.3.1 Self-paced online learning modules. Trainees were required to complete online learning modules before weekly class huddles and team meetings. These modules provided knowledge and materials on computer skills, along with opportunities to practice them through interactive exercises. These modules could be completed individually at their own pace or with the support of other trainees (team members).

In the first training (pilot), GetSetup (https://www.getsetup.io), a live peer-to-peer learning platform for older adults, and Bigger Brains (https://getbiggerbrains.com)[1], an on-demand eLearning video platform, were used as online learning materials. While synchronous interactivity with an instructor on GetSetup live sessions was preferred to Bigger Brains video lectures with quiz modules, trainees' feedback called for more time flexibility. With this feedback, Northstar Digital Literacy (https://www.digitalliteracyassessment.org)[1], asynchronous interactive practice modules with self-assessment tests on each topic, was used in the second training. This was suggested by the research team after an extensive review of training options and agreed upon by the second instructor.

The topics of online learning modules included basic computer skills (internet browsers, e-mail, Windows/Mac OS), essential software skills (e.g., Word, Excel, Powerpoint), technology for everyday life (Zoom, Google Calendar, social media, telehealth), technology support, and troubleshooting.

3.3.2 Class huddles. All trainees gathered in weekly class huddles led by instructors from the community NGO. The Executive Director, who owns a tech support business for small businesses, led the first training (Ins1). The second training was led by a staff member with extensive experience teaching basic computer skills (Ins2). This instructor, assigned to the site through a partnership with Literacy Minnesota and AmeriCorps, is also a board member of an NGO dedicated to mitigating the digital divide. The main purpose of the huddle was to check on the progress of online learning modules and assignments, in addition to the overall learning goals of the training program. During the class huddles, trainees shared their learning progress/experiences using self-paced online learning platforms and the challenges they encountered and asked questions in the large group. Following their learning progress, the pace and curriculum of the training program were adjusted as needed. For example, when more than half of the trainees in the second training had difficulty understanding Microsoft Excel, the instructor (Ins2) extended practice by a few more weeks. Due to the COVID-19 pandemic, the class huddles in the first training was entirely virtual on Zoom. Considering the limited visibility of trainees' learning activities, the first author conducted regular check-ins over the phone calls, via text messages, and emails to ensure they were on track and proactively identify any needed support. In the second training, the instructor (Ins2) added review activities, such as lectures and games, to reinforce what trainees learned in online learning modules. At this time, the class huddles were held mostly in person.

[1]The university research team purchased a membership license for Bigger Brains and Northstar Digital Literacy(GetSetup was free).

3.3.3 Teamwork. Trainees were divided into teams for both training programs: three teams of three to four trainees in the first program and two teams of three in the second program. Team formation was based on the trainees' self-reported confidence in computer skills from a survey used only in the first training, as well as the instructors' prior knowledge of the individual trainees. This strategy ensured that those needing additional assistance could receive it from other team members with more confidence and knowledge. Teams were encouraged to meet weekly and support each other in completing online learning materials and team assignments. In the first training, team meetings were held virtually on Zoom due to COVID-19 social distancing requirements, even though we observed that some team meetings occurred in person. In the second training, they were mostly in person.

Trainees received a $200 stipend in a lump sum at the end of the first training and a $25 stipend per week in the second training for completing the program's minimum requirements (e.g., 90% of class huddles and team meetings attendance, completion of all online courses). All trainees met these minimum requirements and received the stipend.

3.4 Data collection

3.4.1 Participant observation. The first author attended and observed nearly all class huddles and several team meetings online and offline throughout the two training programs (approximately 16 hours in the first training and 20 hours in the second training). In the first training, given the difficulties incurred due to the COVID-19 pandemic, the first author helped facilitate the class huddles and provided support as needed (e.g., access and login to online learning modules). To compensate for the limited visibility of trainees' learning activities, the first author conducted weekly check-ins using phone calls, text messages, and emails. The goal of the check-ins was to ensure that trainees were on track in their learning and to proactively identify any support needed. Detailed observation notes were taken directly on a laptop during online classes and on-site visits, with a focus on social dynamics among instructors and peers as they engaged in learning digital skills collectively.

3.4.2 Semi-structured interviews. Based on observations, the first author conducted post-training interviews with eight trainees in the first training and five from the second to gain in-depth insight into their learning experiences. Additionally, in the second training, the first author conducted mid-interviews with four trainees and two instructors to understand factors contributing to the high learning engagement the first author observed. All the interviews, ranging from 52 to 92 minutes, were attended by one or two research assistants or advisors who assisted with questions and note-taking.

The interview protocol covered personal backgrounds, computer usage experiences, challenges during training, and interactions with instructors and peers. All interviews were conducted via online videoconferencing, recorded with the participants' consent, and transcribed by a professional transcribed service. As interview compensation, a $15 Amazon gift card for the mid-interview and $20 cash for the post-training interview was provided.

3.5 Data analysis

We implemented several rigorous measures to mitigate potential subjectiveness and bias in our data analysis. First, we incorporated the lens of situated learning theory by Lave and Wenger [48] to guide the initial analysis. This theory emphasizes the development of a community of practice among trainees and instructors and helped to articulate how learning resources, such as the community NGO, instructors, peers, online materials, and on-the-job opportunities collectively

facilitated the emergence of a robust digital skills learning environment within the daily lives of public housing residents.

We also analyzed the data collaboratively, with the first author leading the data analysis using a mix of inductive and deductive coding [67]. Using situated learning theory [48] as an initial framework, the first author deductively coded data into themes such as the trainees' personal and common community background, social support from the instructor and peers, and opportunities for applying learning to everyday life. The analysis included inductive coding to allow new themes to emerge, such as interpersonal trust and collective motivation. The coding process involved iterative reading and summarizing observation notes and interview transcripts across the first and second training. These themes strongly informed our understanding of the role of trusting relationships and social interactions in the community as important sociocultural factors in digital skills learning in public housing contexts.

To uphold the principles of a community-engaged research approach and ensure the analysis was consistent with others, the first author followed a collaborative process throughout the data analysis process to supplement the single-author analysis. The first author presented the coded data for member checking in bi-weekly meetings with the community partner. The first author regularly discussed the themes and findings with the larger research team, incorporating their insights and feedback to refine the thematic framework. These discussions were important for validating the emerging themes and ensuring they accurately reflected the dynamics of the trainees' learning.

4 FINDINGS

The lens of situated learning views learning as individuals acting upon and becoming part of a community of practice through various relations with resources in the lived-in world. This paper shows how a public housing community organized resources—online learning materials, people (instructor and peers), the practices of social support, on-the-job learning opportunities—for digital skills development in the community (*learning curriculum*). Even though our intervention took the form of a formalized training program consisting of curated online learning modules and social learning activities (*teaching curriculum*), we observed that trainees learned most effectively through interactions with instructors and peers that continued in everyday life. This embodied the community's culture, which has an emphasis on social relationships and reciprocal support. Layers of social interactions with instructors and peers constituted a *"strong support system"* (P10) that helped trainees actively engage in the training and overcome challenges to continue learning. Overall, we describe how a learning community for digital skills development was cultivated where online learning materials, people (i.e., instructors and peers), and work/volunteer opportunities became sources of learning in the context of a public housing community.

4.1 Relationships around the community NGO in everyday life

Having lived, worked, and volunteered in the community and with the community NGO for years, trainees already held trusted relationships with each other, the community NGO, and instructors. Throughout the training, bonding among trainees built in the community over the past years facilitated meaningful interactions for learning digital skills in and outside the training program. Focusing on these relationships reflected the fundamental idea of situated learning, highlighting that learning occurs through interactions with people and various learning resources within a broader community of practice beyond the direct learning site.

4.1.1 Trust in the community NGO. The community NGO has advocated for the community over decades by seeking essential resources (e.g., food, healthcare, youth education programs) from external funders and representing the community in housing redevelopment meetings. Recently,

the community NGO has put efforts into building digital capacity to bridge the digital divide gap in the community. The NGO distributed lifeline government phones, tablets, and Chromebooks for community members to enhance access to digital devices (the first level of the digital divide [81]). In terms of digital skills (second level of digital divide [28]), the community NGO has offered curated online learning resources (e.g., YouTube videos and both paid and non-paid learning platforms) and also held basic computer classes for seniors. Some staff/volunteer members also provided basic tech support for using devices for community members who call or visit the community NGO. The Executive Director (Ins1), who has experience running a small tech support business, has led these efforts to enhance the digital capacity of the community. He was widely trusted by community members and played a main role in recruiting trainees in the initial stage of the training program; for instance, all trainees who participated in the training at least knew him, even though they might not necessarily have known other trainees.

Another instructor (Ins2), a staff member who recently joined the community NGO to work for community digital capacity building, was also highly committed to providing tech support to her colleagues and community members. She had extensive basic computer skills and teaching experience, working and being a board member at an NGO devoted to closing the digital divide. The relationships with this staff member influenced trainees' motivation to enroll in the training and learn computer skills. Some trainees (P3, P4, P5) explicitly mentioned that: *"one of the biggest reasons that I decided to join the training is the teacher"* (P3). Trainees trusted her commitment to helping colleagues acquire digital skills (from typing practice and hands-on demonstration of how to use office programs to recommendations of self-paced online learning modules) and appreciated her individualized, easy-to-understand explanations. The digital skills training started with a strong connection to community support and reciprocal trust between the instructors and trainees based on daily interactions.

4.1.2 Bonding among peer trainees. All except one trainee lived in the community for 5-12 years, and most had experience working/volunteering and interacting with one another around the community NGO in everyday life. Many were familiar with one another, shared common living environments, and lived close to one another before meeting in the training program. Some were parents of children in the same school and class (P1, P2), acquaintances or neighbors who saw each other on the way to the bus (P1, P3), or lived across the street from the community (P4, P9). P5, a retired senior and the only trainee from a nearby community, had come to the community NGO to work as a computer lab assistant. He soon became familiar with other office staff. When asked about socializing in the workplace, he highlighted that he shares the same historical hardships and discrimination in education, healthcare, and community development in the city as trainees from the community: *"I came from the same environment that surrounds [the community]. I grew up in that environment.... And just from years of survival, I understand what they're going through... so I don't have a problem blending in with them."*

When they gathered as a group for the training program, the friendships they built through living, working, and volunteering in the community became the foundation for their interactions and collaboration. These relationships provided a supportive environment for learning computer skills together. P2 described that this social support came *"naturally"*:

> *"We just asked each other and helped each other right away. This person may know this and that one. And we just all just helped each other automatically.... All I can say is that we just used to working together. So it's just natural."*

Based on the community NGO's ongoing commitment to digital capacity building and trusting relationships with instructors and peers, trainees started to engage in the digital skills training program organized by the community NGO. They leveraged the practice of social support in

the community to learn computer skills together in and outside the training program, as further described. This formed the foundation for cultivating a learning community for digital skills development, within which trainees became confident computer users while gaining computer knowledge and skills.

4.2 Learning with and from instructors and peers

> *"Senior planet (an online learning module) is similar. Yeah, some similarities in the AARP modules (another online learning module). But what the training does, it puts a teacher, a good teacher. It puts a team, which you get to interact. And .... you get to work with that team. You learn a lot more just by interacting."* (P5)

All trainees emphasized that interactions with the instructor and peers were the most enjoyable part of the training. As the quote above describes, despite the availability of self-paced online learning materials they could access at any time, they more effectively learned and practiced computer skills as they learned with and from others. Particularly, instructors and peers were important sources of learning and emotional support that helped them continuously engage with digital skills learning and the training program.

In addition, a collaborative learning environment and regular interactions, which were facilitated by the design of the training program, helped trainees push themselves to complete the training by giving them a sense of belonging and reciprocal accountability as a team and a cohort during the training. More digitally knowledgeable members helped other team members access online learning modules and practice computer skills. Emotional support trainees shared was crucial to keep other trainees on track when faced with challenges such as unexpected moves and family illness during training. This way, the training created a psychologically safe environment to practice new computer skills and enabled those who lacked confidence in using computers to overcome the learning challenges trainees faced.

4.2.1 Instructor's care about trainee's learning. The instructor's (Ins2) passion for teaching basic computer skills to address the digital divide manifested as caring for the trainee's learning in and outside the training program. Her commitment was important in increasing access to opportunities to learn computer skills, particularly among trainees with little confidence with computers. During the interview, the instructor shared that she firmly believed that all trainees could learn computer skills, and what was really needed was confidence in their capabilities.

Trainees described that they could *"talk," "relate to you [instructor]"* (P4), ask questions immediately and discuss anything about their learning. Some trainees (P3, P4, P5) recalled that she never treated them by their deficits or wondered why they did not know something. P4 reported that the instructor *"did not make me feel, because of who you are and what you do, that you are over my head, or because you have more education than me, as far as the technical side than I do.... she didn't make me feel bad about it."*

While using online learning resources, the instructor ensured that all trainees understood what they were learning, facilitating personal interactions with trainees. When most trainees had difficulty understanding the concept of Excel and formulas even after they completed online learning modules, the instructor reiterated the terminologies of Excel and the concept of coordinates and discussed how formulas work and when and how formulas can be or were used in trainees' everyday lives or for work (e.g., to tally the recipients, or items for a food program). Notably, the instructor's learning support for trainees exceeded the training hours. The teacher and trainees would stay after class to discuss whatever questions the trainees had about computers, even though these might not have been directly related to the lessons at hand. For example, in response to a trainee's question, the instructor explained how to label and organize emails after the class

huddle because everyone wanted to know. P4 believed that the learning support they received from the instructor exceeded what was typically expected. This was possible because of the strong relationships and personal interactions they shared:

> *"If I had a rapport with you, and we had been in a class before, we laugh, we joke, we talk. We laughed about what I thought, [what] I knew compared to what I don't know. I'm okay with that… But if it's like GetSetup (an online learning platform), sometimes you didn't have that. It was like we done with it, within this hour of time, whereas there's times [in person class with the instructor] where we went over our time. We know we were past our time in class… we were still there two hours later, asking questions trying to do things better.… try to get an understanding of it."*

The instructor's caring in offering learning support encouraged trainees to ask questions even when they had difficulties articulating them actively. They believed the instructor would catch what they were trying to ask and provide an answer that would clarify their questions and learning. This way, the instructor's care for the trainee's learning created a psychologically *"safe"* (P4) environment where trainees were not afraid to talk through, felt *"comfortable"* (P4) to ask questions about what they did not know. P4 described:

> *"I was comfortable. I could ask whatever I want or attempt to ask whatever I want. And it was okay no matter how crazy.... And because I'm not that computer savvy… I can kinda get it out and [the instructor] was able to be, 'oh, you mean this,' and I'm like, 'yeah, that kind of thing', … It was just real… and I'm comfortable in the atmosphere. I felt safe. I felt safe to be me, and just to say I don't get it, I don't know, or laugh at myself about it, 'Oh, it was right there,' that kind of thing when I say that."*

The instructor facilitated class huddles where trainees could be active learners, not considering them as mere objects needing training. This is an important philosophy of situated learning to form an organic learning community conducive to sharing knowledge and skills where people, as capable learners with different levels of knowledge and skills participate in and collaborate to learn together [48].

4.2.2 Learning support from more digitally knowledgeable peers. Trainees who were relatively more confident with computers (P1, P2, P3, P5) described how they relied on Google and YouTube to learn some computer skills and how this involved trial and error. However, not all trainees felt comfortable using this solitary learning approach, especially those with little computer experience. When learning office (e.g., Excel, PowerPoint) and online communication (e.g., Zoom, Gmail) programs, trainees often felt *"scared"* (P2) to *"mess up"* (P2), make an error or lose what they had on the screen if they clicked a wrong button (P2, P4, P9, P10). For example, P4, a first-time computer learner whose previous job was cooking/serving, remembered that she became nervous when her granddaughter, who was helping her with Google Slides, left. At that moment, she did not want to touch anything on the screen. Furthermore, she mentioned that *"sink or swim"* learning approach was an uncomfortable environment to learn to use the computer, *"Here, go the material. Here you go; you have to have this done by a certain time.' I have never done this before. What am I supposed to have done?" And she continued to say, "If I'm at that frustration level, I need immediately help."*

Immediate and direct help was available through team-based learning with peers of varied levels of computer skills for such trainees. In our observations of the teams, we noted that more digitally knowledgeable trainees (P1, P2) took it upon themselves to lead the team and provide necessary learning support. When P9, a senior computer learner using a tablet granted by the community NGO, first tried to access online learning platforms to take online courses and get on Zoom for the class huddle, she did not know how to open a browser and log in to the learning platform websites.

She also occasionally felt stuck when the screen was frozen and did not know how to manage it. In such situations, she would ask her teammate (P2) for help, and then her teammate would go to the house of P9, who was wearing an oxygen concentrator and living without family members, to walk her through how to use the tablet and log in to the online learning platforms. Furthermore, this digitally knowledgeable team member (P2) would also invite her teammates to her place and demonstrate the skills they were learning in front of the team. During virtual class huddles, P9 showed appreciation for this help, saying that her teammates (P2)'s help was *"instrumental"* for her to continue the training. In another case, the digitally knowledgeable trainees (P1, P2) also helped their teammates book synchronous online courses, for example, by sharing Google Calendar invites with the team as they were booking their own. One of the team members appreciated this support, saying: *"She's busy, but she always finds the time .... she took the lead because ..... she had some technical background already, and so she encouraged us to just jump into the pool....and we'll be okay."* (P10)

This way, peers served as crucial sources for learning digital skills, especially for those who had difficulty accessing them. In the final presentation at the first training, one trainee talked about team support through which they gave and received help:

> *"We pick up where one leaves off... There were times when we wanted to give up because of what we didn't know, but we encouraged each other not to... We learned you don't have to be naturally gifted at computers when taking this training."*

4.2.3 Emotional support. Regular class huddles also created a sense of belonging and emotional support. These were particularly important during the pandemic when all class huddles were virtual and in-person interaction was significantly inhibited, adding challenges for those who had not used Zoom or email before. Apparently, some trainees felt that learning digital skills in entirely virtual settings was not *"personal"* (P2, P4). Many trainees, however, mentioned that the introduction (or icebreaking) part of every virtual class huddle was their favorite part of the entire training. During this time, all trainees gathered on Zoom, 'met' with other trainees, and took turns talking to everyone for a few minutes. The instructor (Ins1) and research team encouraged trainees to share what they learned, their challenges, and what support they needed. Trainees remembered that even simply seeing the faces of other trainees over the computer screen (P13) or just saying *"hello, my name is ...."* (P4) to others they already knew well *"made my day"* (P11). Furthermore, P2 referred to this warm, friendly interaction as *"a confidence builder for everybody"* that made them *"feel more comfortable"* to share their struggles openly. Sharing common challenges with other trainees made them feel that they were *"not the only one(s)"* (P4) who was experiencing a tough time and could relieve stress caused by navigating self-paced online learning modules alone. Similarly, regular team meetings were outlets to share and *"vent"* (P10) their struggles and emotions (P2, P4, P11) as well. P4 described these moments of emotional connectedness to get through challenges and stress:

> *"Just to say and kind of have the same sentiment, how you feel like you're not the only one who's having a rough time trying to get it or trying to schedule the class and you can't find the class and you try to get stuff done before the time's up for you to get it done. So that was a lot in there ... It was great."*

Emotional peer support was particularly crucial for trainees experiencing unexpected personal life disruptions that significantly limited their time and attention to the training. For example, two trainees (P10, P12) had to move housing (un)expectedly in the middle of the training. One trainee received a 24-hour notice to move out. These moves constrained their training time and Internet access. One trainee (P10) used the computer lab in the non-profit building to maintain digital access during this time, while the other trainee (P12) used her mobile phone to take online classes. This,

however, was not as suitable for learning computer skills. P12 also had to care for her ill sister and left in the middle of the final presentation after receiving a call from the emergency room. She described, *"I couldn't put in the effort that I wanted to on everything because I was going through so much.... It took me almost two weeks to move, and during the move, my sister got sick."* One of the team members in her team (P1) would communicate with her throughout her situations over the phone and via email. Her teammates informed them about the training (e.g., links to the online learning modules, class materials, and assignments) each week and had regular check-ins. During the interview, P12 thanked her team member, who always kept her in the training loop by calling and showing concern for her. She stated that she would have dropped out of the program without team support.

4.3 A new work family—building a learning community during and outside the training

The second training was led by a professional digital literacy instructor (Ins2). Most of these in-person class huddles were full of laughter and spiced with friendly everyday conversations about life. Trainees were invigorated by the opportunity to interact with each other and learn together. One trainee, P5, expressed *"It's more fun to learn if you like it, and you have a good time; it makes learning a lot easier."* He elaborated that building relationships with other trainees was the key to effective learning: *"when you get along, you like the people and learning like we're always back and forth..... that's how we're learning. We're just picking up things."* This friendship, rooted in everyday community life, greatly facilitated the development of a learning community focused on digital skills acquisition within and outside formal training sessions. This sense of camaraderie, rooted in community, facilitated the development of a learning environment for learning digital skills. It extended beyond the training, with team competitions during training sessions and ongoing technical support at work serving as examples of how the learning community for digital skills flourished as trainees engaged with the program. The *learning curriculum* evolved organically—trainees acquired computer skills through self-paced online learning materials, interactions with peers and instructors, and real-world work experiences within the NGO.

4.3.1 Team competition. During in-person class huddles, the instructor (Ins2) often employed games. These were team competitions with quizzes requiring trainees to demonstrate computer skills they learned in front of the class. The game afforded friendly competition for trial and error of computer skills in a psychologically safe, fun environment backed by learning and emotional support from the instructor and peers. Before the class huddle, the instructor (Ins2) examined assessment test results on the online learning platforms and checked what questions the trainees struggled with. She prepared incorrectly answered test questions for the quiz games so trainees could review difficult parts through game activities together. During class huddles, trainees answered quiz questions by quickly pressing a computer button, demonstrating features to earn points. During the interview, the instructor (Ins2) explained that she intentionally gave more opportunities to students who had not performed as well on the tests and showed less confidence in computer skills. This approach ensured they received encouragement and validation from the class. This inclusive facilitation again shows her willingness to help trainees learn computer skills so that *"no one falls behind"* (Ins2).

The competitions based on support from instructors and peers brought joy and laughter to computer skills learning. During the team competition, we observed that trainees were excited to buzz in, answer, and proudly *"show off"* (Ins2) what they knew in front of the class. They cheered for their team members and shouted out hints when their team members struggled to answer. Interestingly, by the middle of the game, trainees started to cheer and encourage anyone who tried to answer the quiz, regardless of their designated teams. The blurred team division was also

evident when the teacher explained the game's competition rules and showed the winning team the prize. One trainee (P4) violated the rule, shouting out *"There are no losers. We are all winners!"* This collective learning spirit was reaffirmed by trainees' remarks in the interviews. Trainees recalled these moments as P1 said,

> *"If you didn't know the question, even though the other team wasn't supposed to help you … everybody still try to work together." P4 also remembered, "We still help each other. Our goal is for everyone. … Everyone wants to be successful. Whatever we do, there's no failure unless you want to fail."*

Amid this excitement and friendly team competition, trainees could review and reinforce essential computer skills they learned in the online learning modules. Trainees explained that the game made them *"think"* (P1, P2) hard within a short amount of time for the quiz, and support from the instructor and peers was very *"encouraging"* (P1). Importantly, this created an environment where they could try and safely make mistakes as a natural part of the learning process, knowing they had support from the instructor and peers.

This collaborative learning environment based on caring and supportive relationships with instructors and peers empowered trainees to become more active and confident learners. P11 was initially too shy to turn on the microphone and camera and speak out in front of others during the virtual class huddle. But with support from instructors and peers that *"made her feel at home"* (P11) and felt like *"a new work family"* (P11), she was able to push herself through to *"get over a shy mode."* She shared it during the interview:

> *"Working with you [teammate, instructor, research team] all, and you're giving us the more support that you gave us. It made me a lot more confident, … if I don't understand something, ask questions and speak out. My voice can be heard, instead of just being shy all the time, and if I didn't understand something … before the end of the class… I do have that; their understanding. So that's why I made my work with people to become a family, because you made me feel like a family and It made me get out my comfort zone"*

4.3.2 Applying and continued learning at work. Half of the trainees (P1-6) ended up working or volunteering at the community NGO, which allowed them to continue learning and apply what they learned on the job. When they did not know how to use computer skills to complete tasks at hand, they had to ask their colleagues from the training (including instructors and peers) or search online by themselves—skills many of them developed through the program.

Particularly, trainees reported that the instructor (Ins2), who was also a colleague at the community NGO, was approachable whenever they needed help with using computers any time through any communication channels (e.g., email, call, text messages, face-to-face). Even after the training was officially completed, P3, working as a computer lab assistant and helping with senior computer classes at the community NGO, said he learned more from her office tasks (e.g., changing the browser settings and setting up a Facebook portal). Similarly, P5 mentioned that the proximity to instructors and peers in the community helped him with his role as a Community Health Worker (a role where he aided community members in accessing healthcare resources). Furthermore, P5 started to envision getting a remote work job in the future as a retiree, combining his newly gained computer skills with his decades of past trade experience in access control. This shows that learning and support continued through training relationships with instructors or peers or in a broader community context of work and everyday life beyond the training program.

While most trainees indicated during the interviews that they increased self-efficacy to learn computer skills and increased confidence with computers after the training (e.g., P10, who before the training felt that he would *"fall on my face"* because he felt that he *"didn't have any solid*

foundation" reported that the computer is *"not a threat"* anymore after the training), we notice increased self-efficacy as becoming more confident, independent digital skills learners. After two rounds of training, P4 described learning new computer skills using YouTube and her determination to accomplish a task:

> *"He [her boss] wanted me to do something on there, and I think it was just a test to aggravate me. But I was determined, I was gonna get it. And I knew where to go. I said, 'Okay, well, I need to find how to do this, because I'm not going to be defeated today, I'm going to get this done. And so I went to YouTube. I found one that was simple to the point and wouldn't confuse me, and I was able to do it… Desktop and my Chromebook that greatly helps. That's something that really, really, really helps you because you see it, and while you seeing it as fresh and you do it. So if you mess up, you can back up the recording and be like, 'okay, let me look at this again. Let me get understanding and pause it and then do it.' You know you got it, or you could just keep practicing until you get it."*

Her past jobs were cooking and serving, and she recently shifted to an in-office job at the community NGO because of physical limitations from aging and restaurant closures during the pandemic. For this transition, the training and learning opportunities were crucial for her to handle office work that required computer skills: *"I wanted to learn more about [computers] … because I was gonna be on the computers. Never thought I'll even be that person, honestly never thought that."* During her internship as a community organizer at the community NGO she started after the training, she additionally applied for an in-house office job in another NGO. Unfortunately, it didn't work out, but a new employment opportunity became available for her: *"I was going to venture somewhere else… Yeah, it was cool. It's something I haven't done in a long time."*

5 DISCUSSION

To address the digital divide within an underexplored community in CSCW, our research examined the role and effect of sociocultural factors in digital skills learning in the context of a U.S. public housing community. Our results confirm prior CSCW and HCI work on digital literacy interventions, suggesting that embedding computer skills learning in the social context of everyday life increases the accessibility of learning to underresourced populations [64]. At the same time, our work addresses a significant research gap by deeply integrating sociocultural context into community-based digital literacy models, which currently lack this comprehensive approach [14].

In this section, we provide key sociocultural factors rooted in the everyday realities of U.S. public housing residents. These factors created a safe and meaningful learning environment and cultivated a new learning community through the training program. We discuss the unique sociocultural context of a public housing complex, calling attention to how instructors foster critical care, trusting relationships, and the development of a vibrant learning community. Our findings expand situated learning theory by adding nuances of a human element based on meaningful relationships, thus enriching our understanding of community-driven education processes. We then provide broader implications for community digital capacity building by activating informal social support and digital reskilling for new work opportunities. Our empirical insights into the lived experiences of public housing residents and digital skills learning offer practical implications for designing community-sensitive digital training programs to bridge the digital divide.

5.1 The importance of sociocultural factors in digital skills learning interventions

5.1.1 Collective learning in a public housing complex. Geographical proximity among housing facilitates social meeting and collaborative learning [22, 30, 87]. Beyond the convenience of social interactions among residents, we revealed the unique sociocultural contexts in U.S. public housing

that motivated community members to participate in collective learning. Most trainees reported that they worked and volunteered together in the community NGO to support the community by sharing resources for healthcare, food, and digital connection. The shared history of living nearby and in the same neighborhood, which provided social support to overcome hardships together, created strong bonds that became the basis of social learning support. Against this backdrop, collective digital skills learning encouraged a group of community members to collaborate in learning computer skills, embodying the community's culture of social support. This finding echoes past CSCW research uncovering village-based models in similar settings [16], and emphasizes that the approach was crucial for public housing residents to collectively overcome psychological difficulties in learning about computers and to stay motivated throughout the training.

Additionally, as public housing community members, our trainees faced unique life challenges, such as unexpected moves and family emergencies that limited their time for learning (P10) and nearly led some of them to give up their training (P12). Only the support from team members prevented this. By showing the role of sociocultural backgrounds in facilitating learning outcomes in the public housing complex, we enrich the past literature on collective approaches to digital skills learning for underserved populations [25, 33, 78, 88].

Implications for Future Interventions: Taken together, the significant role of sociocultural context in enhancing collective digital skills learning suggests the need for interventions to be deeply integrated into the fabric of local community spaces. Specifically, learning opportunities and interventions should be deployed within local spaces, such as community centers/workplaces and regular gatherings for resource distribution and culturally significant activities. In other words, learning opportunities should exist where everyday interactions occur among community members, building on the existing social cohesion within shared sociocultural contexts.

5.1.2 Instructor and critical care. Our work confirms the importance of instructor qualities to foster inclusivity and motivation among adult digital literacy learners in community settings [39, 70, 86]. We further show that instructors demonstrated critical care [85] by being aware of and attending to sociopolitical disadvantages that had long excluded trainees from quality education in Detroit. Critical care involves acknowledging social and political realities that shape students' identity and learning environment [2, 85]. In addition to compassion and empathy, teachers who enact critical care are consciously aware of students' marginalized sociocultural backgrounds and advocate for students faced with structurally unjust environments [2, 85]. As suggested by interviews with P4 and P5, trainees were aware of limited educational opportunities given the historical social disparities they face. We observed that the caring instructor (Ins2) was passionate about tackling the digital divide and holistically considered the marginalized sociopolitical positions of the trainees in and outside the training program, which was crucial in motivating trainees to learn digital skills. The instructor created a psychologically safe environment by staying after class for hours to explain confusing concepts, regularly affirming that trainees were capable, and making herself accessible for tech support and questions through any communication channels outside the training. Past CSCW research similarly described teachers who embody critical care and create a secure learning space for children vulnerable to social discrimination, such as gender bias, amid technology-based learning [41] and intercultural conflicts in computer classes [3]. We demonstrate that the instructors effectively broadened access to digital skills learning resources by creating a learning space for historically marginalized adult learners. While the instructors in our training had a sociocultural background similar to that of the trainees, instructors who do not necessarily have the same background as the learners can also build rapport by understanding students' sociocultural backgrounds and caring for students' learning holistically [46].

Implications for Future Interventions: To foster critical care to expand digital skills learning opportunities for marginalized adult learners, future work in CSCW can engage with the Education field to apply best practices and professional training (e.g., culturally relevant pedagogy [45]). This would help to develop instructors or staff/volunteers leading digital literacy interventions who critically consider sociocultural contexts of learners.

5.1.3 Trusting relationships and an emerging learning community. Our findings confirm previous work that emphasizes the benefit of peer support in digital literacy programs and interventions for marginalized populations [30, 51, 70]. Our work, however, specifically captured how peer support that started from a formalized training program extended to an informal learning environment in everyday life. Using situated learning theory, we revealed that even though the training had a structured format for social interactions (i.e., regular class huddles and team meetings), ultimately, it was the relationships among instructors and peers built around living, working, or volunteering in the community (NGO) over many years that facilitated interactions for collaborative digital skills learning. Team members' support in and outside the program enabled public housing residents to participate in digital skills learning and mitigate challenges, for example, caused by spatial constraints and health conditions. One senior trainee wearing an oxygen concentrator and living without family members (P9) gained continuous learning support from one of her teammates, who would visit her place throughout the training. Even after the training, these relationships enabled trainees (P3, P4, P5) to continue to receive support from the instructor and fellow trainees at work in the community NGO office.

Given the trusting relationships, the blurred boundaries between the formalized training and everyday life ultimately cultivated a learning community where community members acted as learning resources and scaffolding to access and understand online learning materials, practice digital skills, and share emotional support with one another. This is consistent with Rogoff, who found that learning in a community happens through collaborative and meaningful participation in sociocultural activities, where both mature and less mature members contribute to ongoing community activities and practices [65]. From this sociocultural perspective of learning, our community-based learning intervention afforded social support for less digitally knowledgeable members by bringing together community members to participate in collaborative digital skills learning, thus building a learning community that trainees described as *"a new work family"* (P11). This emerging learning community provides empirical evidence of how a formalized training intervention can foster informal social support for underresourced community members [36, 87].

We employed situated learning theory as a new analytical approach in CSCW to understanding effective community-based digital engagement and sociocultural contexts among marginalized adult learners. The focus on the process of organizing resources and building a learning community based on deep analysis of trainees' social worlds and backgrounds shed light on the meaning of collective computer skills learning. Furthermore, by focusing on the quality of social relations among actors, our in-depth qualitative investigation of learning in the public housing community contributes to situated learning theory. Situated learning theory concerns 'authentic' learning in everyday life through interactions among different actors as distributed sources of knowledge and skills in a social 'system' [48]. As we showed, trusting relationships with instructors and peers who shared similar life experiences in the public housing area strongly motivated trainees to participate in collaborative learning (affording access to learning resources) and build a learning community, thus supporting trainees' transformation into more confident computer users. In other words, utilization (or even access) to online learning modules and continued computer skills learning would not have been possible for many trainees without their intentional efforts and dedication to helping one another in and outside the training program. Thus, our intervention, where social

learning support straddled formalized and informal learning, adds nuances of human elements to situated learning theory.

Implications for Future Interventions: A learning environment where social interactions and peer support occur within the context of a community is crucial to fostering a learning environment that lasts beyond formal training. When designing a training program, team members with different computer skills and confidence levels can ensure peer support for those who need additional help. Considering the key role of trusting relationships, ensuring time and common activities where community members can mingle in (e.g., ice breaking in class huddles) and outside (e.g., volunteering, gathering for a meal, community events) a training program can transfer existing bonding to collaborative digital skills learning. Communities whose members do not share existing bonding may need additional upfront effort to build new bonding.

5.2 Toward community digital capacity building

5.2.1 Activation of social learning support in the community. Our findings offer insights into developing a grassroots digital skills learning infrastructure in the community. By leveraging existing social networks and bonding in public housing as community assets, we provide empirical evidence to past CSCW work on the efficacy of community-based interventions aimed to enhance digital capacity [43]. As digital skills learning happens through trusting relationships and interactions among community members, nurturing a community for learning digital skills as part of community life can enhance the digital capacity of the entire community. Kropczynski et al. [44] found that both community members who provide and who receive 'techcare' support perceived similar levels of community collective efficacy. This suggests that fostering a learning community where community members of different computer skills levels actively share learning support can strengthen collective digital capacity in the community. Implying from the fact that most trainees did not have jobs that required professional computer skills before joining the training, many community members might have few personal social networks from which they can observe or learn computer skills (in)directly. Communities with strong digital capacity based on active social support in everyday life can, in turn, greatly benefit individual community members to learn digital skills through other community members. Thus, the activation of social learning support through the formalized training we showed has the potential to mitigate the ongoing digital skills gap in the broader community.

Implications for Future Interventions: To validate this hypothesis and potential benefit, future intervention can track learning support spread across the community through digital skills learning intervention and trainees who gained new computer skills. Future work can also examine individual and collective community digital capacity through a longitudinal intervention study and measure changes before and after developing community-based computer skills learning.

5.2.2 Digital reskilling for new employment opportunities. In adopting a holistic approach to digital skills training, our intervention connected resources and mobilized social networks, providing more than traditional classes and materials. This approach facilitated practical work opportunities offered by the community NGO [2], which became on-the-job training opportunities to practice new computer skills. In this work, trainees could apply the computer skills they learned and continue learning with colleagues' support. Trainees also could see themselves becoming more independent computer skills learners at the workplace, for example, by searching YouTube videos by themselves to complete tasks at hand. Furthermore, some trainees envisioned new employment opportunities

[2]In our study, the community NGO sourced the financial resources for these jobs through other programs and external grants.

outside the community, such as remote inventory management (P5) and an office staff job at another NGO (P4).

Digital skills training that incorporates community-based on-the-job training has implications for digital reskilling, an area of burgeoning research [23, 38, 47, 75, 76]. Digital reskilling aims to help workers in lower-paying or declining jobs to transition to higher-paying jobs with more stability [21]. This is calling for broader and more accessible training for underserved populations as it is predicted that manual, low-income workers (e.g., in food services, customer service, office support, production work), women, and people of color are more likely to be impacted and displaced [21, 23]. While collective digital engagement among underresourced work groups has been widely studied in CSCW and HCI, there is less research studying how to enable digital reskilling for new employment among community members (e.g., those without jobs requiring computer skills) [66]. As an exception, Lu et al. uncovered that during COVID, working-class job seekers did not use digital resources but tended to rely on familiar resources (i.e., asking advice from family/friends) for job reskilling [52]. They called for more community-based work to support individuals' skills development as well as community capacity. Our work demonstrated one way in which community-based work can afford tangible practice for job reskilling for employment.

Implications for Future Interventions: On-the-job training based on community work can be a pathway for digital reskilling to access and explore more stable jobs where trainees can use computer skills. Additionally, working in a community where trainees feel comfortable and have social support, as part of the training that considers sociocultural factors, can motivate them to engage in such opportunities and develop additional job skills, such as communication with clients. This can also help them shape their work identity as computer users. Furthermore, this can be extended to the reciprocally sustainable growth of the community and its members, for example, where community members can develop digital skills while providing tech support to underserved local small businesses [34]. Our intervention, which involved work opportunities within the community, hints at an effective digital skills learning strategy that can create a real-world impact on the lives of the public housing community members. Future work can empirically examine the transitional process from digital reskilling to actual employment in and outside the community, such as types of jobs that digital reskilling can offer, challenges of navigating the transition (e.g., challenges of transitioning to be an online freelancer [5]), additional requirements, skills, and support for different stakeholders.

6 LIMITATIONS AND FUTURE WORK

Our qualitative community-engaged research study investigated the effect of sociocultural factors on digital skills learning among residents of a predominately African American public housing complex in Detroit. While our findings highlight the significance of these factors, whether they are relevant to communities with different demographic or cultural backgrounds remains unknown. Given that social interactions are fundamental to learning [48], we expect that the importance of sociocultural factors would hold the same weight in other contexts. However, further research is needed to confirm this across different contexts. In addition, the success of our study was largely due to our partnership with the community NGO and the specific resources available for digital skills training and the deep connections among community members. Community NGOs lacking similar conditions might face challenges replicating our results, especially if resources are limited or instructors have different capabilities.

To address these limitations, future research should include longitudinal and larger-scale studies involving more trainees and continued training sessions to further validate our intervention's effectiveness. Extending the study to include a variety of demographic groups and community settings would also enhance the generalizability of our findings and confirm or deny the adaptability

of the training model. In the future, community organizations can build networks to share resources and best practices. Furthermore, government agencies can facilitate such networks to channel necessary resources to inform public policy [55, 77].

7 CONCLUSION

The current landscape of literature on digital literacy training tends to focus on individual outcomes [10]. Using a community-engaged research approach, we implemented and studied a digital skills training program led by an NGO in a U.S. public housing community. Our analysis undertaken through the lens of situated learning theory revealed how a public housing community organized learning resources for digital skills learning and facilitated social learning support based on trusting relationships. Our work contributes to the growing attention to sociocultural contexts of digital skills learning and community-assets-based approaches that promote more sustainable learning in the everyday life of community members. Our findings provide insight into building grassroots digital skills learning infrastructure and addressing the ongoing digital divide issue in marginalized communities.

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REFERENCES

[1] National Digital Inclusion Alliance. n.d.. *The Digital Navigator Model.* Retrieved January 16, 2024 from https://www.digitalinclusion.org/digital-navigator-model

[2] Rene Antrop-González and Anthony De Jesús. 2006. Toward a theory of critical care in urban small school reform: Examining structures and pedagogies of caring in two Latino community-based schools. *International Journal of Qualitative Studies in Education* 19, 4 (2006), 409–433.

[3] Ian Arawjo, Ariam Mogos, Steven J Jackson, Tapan Parikh, and Kentaro Toyama. 2019. Computing education for intercultural learning: Lessons from the Nairobi play project. *Proceedings of the ACM on Human-Computer Interaction* 3, CSCW (2019), 1–24.

[4] Priyankar Bhattacharjee, Steven Baker, and Jenny Waycott. 2020. Older adults and their acquisition of digital skills: A review of current research evidence. In *Proceedings of the 32nd Australian Conference on Human-Computer Interaction.* 437–443.

[5] Allie Blaising and Laura Dabbish. 2022. Managing the transition to online freelance platforms: Self-directed socialization. *Proceedings of the ACM on Human-Computer Interaction* 6, CSCW2 (2022), 1–26.

[6] Susan L Bryant, Andrea Forte, and Amy Bruckman. 2005. Becoming Wikipedian: transformation of participation in a collaborative online encyclopedia. In *Proceedings of the 2005 ACM international conference on supporting group work.* 1–10.

[7] Kathleen Carson, Stacey Wedlake, Matthew Houghton, Anisa Khoshbakhtian, David Keyes, and Yvette Iribe Ramirez. 2021. *Digital bridge: Providing digital access to low-income job seekers during the COVID-19 pandemic.* Technical Report. Seattle Jobs Initiative.

[8] Sumit Chandra, Hannah Hill, Tejus Kothari, Lane McBride, and Nithya Vaduganathan. 2021. Closing the Digital Divide in US Education—for Good. *Boston Consulting Group* (2021).

[9] Namkee G Choi and Diana M DiNitto. 2013. The digital divide among low-income homebound older adults: Internet use patterns, eHealth literacy, and attitudes toward computer/Internet use. *Journal of medical Internet research* 15, 5 (2013), e93.

[10] Heena Choudhary and Nidhi Bansal. 2022. Addressing Digital Divide through Digital Literacy Training Programs: A Systematic Literature Review. *Digital Education Review* 41 (2022), 224–248.

[11] Chhaya Chouhan, Christy M LaPerriere, Zaina Aljallad, Jess Kropczynski, Heather Lipford, and Pamela J Wisniewski. 2019. Co-designing for community oversight: Helping people make privacy and security decisions together. *Proceedings of the ACM on Human-Computer Interaction* 3, CSCW (2019), 1–31.

[12] Teresa Correa, Joseph D Straubhaar, Wenhong Chen, and Jeremiah Spence. 2015. Brokering new technologies: The role of children in their parents' usage of the internet. *New Media & Society* 17, 4 (2015), 483–500.

[13] Maxine McKinney de Royston et al. 2013. Power, identity, and mathematical practices outside and inside school. *Journal for Research in Mathematics Education* 44, 1 (2013), 264–287.

[14] Brian Detlor, Heidi Julien, Tara La Rose, and Alexander Serenko. 2022. Community-led digital literacy training: Toward a conceptual framework. *Journal of the Association for Information Science and Technology* 73, 10 (2022), 1387–1400. https://doi.org/10.1002/asi.24639

[15] 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*. 1–14.

[16] Tawanna R Dillahunt, Alex Jiahong Lu, Aarti Israni, Ruchita Lodha, Savana Brewer, Tiera S Robinson, Angela Brown Wilson, and Earnest Wheeler. 2022. The Village: Infrastructuring Community-based Mentoring to Support Adults Experiencing Poverty. In *Proceedings of the 2022 CHI Conference on Human Factors in Computing Systems*. 1–17.

[17] Benny Docter and Martha Galvez. 2020. The Future of public housing: public housing Fact Sheet. *Washington, DC: Urban Institute* (2020).

[18] Lynn Dombrowski, Amy Voida, Gillian R Hayes, and Melissa Mazmanian. 2012. The labor practices of service mediation: a study of the work practices of food assistance outreach. In *Proceedings of the SIGCHI conference on human factors in computing systems*. 1977–1986.

[19] Paul Dourish, Rebecca E Grinter, Jessica Delgado De La Flor, and Melissa Joseph. 2004. Security in the wild: user strategies for managing security as an everyday, practical problem. *Personal and Ubiquitous Computing* 8 (2004), 391–401.

[20] Michaelanne Dye. 2019. *Vamos a resolver: Collaboratively configuring the Internet in Havana.* Ph. D. Dissertation. Ph. D. Dissertation. Georgia Institute of Technology.

[21] Kweilin Ellingrud, Saurabh Sanghvi, Anu Madgavkar, Gurneet Singh Dandona, Michael Chui, Olivia White, and Paige Hasebe. 2023. Generative AI and the future of work in America. (2023).

[22] Alejandra Ellison-Barnes, Alyssa Moran, Sabriya Linton, Manotri Chaubal, Michelle Missler, and Craig Evan Pollack. 2021. Limited technology access among residents of affordable senior housing during the COVID-19 pandemic. *Journal of Applied Gerontology* 40, 9 (2021), 958–962.

[23] Marcela Escobari, Ian Seyal, and Michael Meaney. 2019. Realism about Reskilling: Upgrading the Career Prospects of America's Low-Wage Workers. Workforce of the Future Initiative. *Center for Universal Education at The Brookings Institution* (2019).

[24] Carolina Feijao, Isabel Flanagan, Christian Van Stolk, and Salil Gunashekar. 2021. *The global digital skills gap: Current trends and future directions.* RAND.

[25] Rikin Gandhi, Rajesh Veeraraghavan, Kentaro Toyama, and Vanaja Ramprasad. 2007. Digital green: Participatory video for agricultural extension. In *2007 International conference on information and communication technologies and development*. IEEE, 1–10.

[26] G. James Greeno. 2005. *Learning in Activity.* Cambridge University Press, 79–96. https://doi.org/10.1017/CBO9780511816833.007

[27] Rebecca E Grinter, W Keith Edwards, Mark W Newman, and Nicolas Ducheneaut. 2005. The work to make a home network work. In *ECSCW 2005: Proceedings of the Ninth European Conference on Computer-Supported Cooperative Work, 18–22 September 2005, Paris, France*. Springer, 469–488.

[28] Eszter Hargittai. 2001. Second-level digital divide: Mapping differences in people's online skills. *arXiv preprint cs/0109068* (2001).

[29] Eszter Hargittai. 2003. The digital divide and what to do about it. *New economy handbook* 2003 (2003), 821–839.

[30] Kathy Harris, Naila Judge, and Chris Burger. 2022. Learning from Each Other: A Partnership between an Affordable Housing Organization and a Digital Literacy Research Organization. *Adult Literacy Education* 4, 3 (2022), 27–33.

[31] Ian Hecker and Pamela Loprest. 2019. Foundational Digital Skills for Career Progress. *Urban Institute* (2019).

[32] Ke Huang-Isherwood Hernan Galperin. 2023. *Digital Inclusion in Public Housing: The case of HACLA.* Retrieved January 16, 2024 from https://arnicusc.org/wp-content/uploads/2022/11/MEDIA-Case-Study-%5EN2-HACLArevised-2.15.2023.pdf

[33] 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*. 1–15.

[34] Julie Hui, Kristin Seefeldt, Lutalo Sanifu, Christie Baer, Jeanette Szomstein, and Tawanna R Dillahunt. 2024. "I was able to give her the confidence": Reciprocal Capacity Building in a Community-based Program for Digital Engagement. In *Proceedings of the CHI Conference on Human Factors in Computing Systems*. 1–13.

[35] Julie Hui, Kentaro Toyama, Joyojeet Pal, and Tawanna Dillahunt. 2018. Making a living my way: Necessity-driven entrepreneurship in resource-constrained communities. *Proceedings of the ACM on Human-Computer Interaction* 2, CSCW (2018), 1–24.

[36] Amanda Hunsaker, Minh Hao Nguyen, Jaelle Fuchs, Teodora Djukaric, Larissa Hugentobler, and Eszter Hargittai. 2019. "He explained it to me and I also did it myself": How older adults get support with their technology uses. *Socius* 5 (2019), 2378023119887866.

[37] Barbara A Israel, Amy J Schulz, Chris M Coombe, Edith A Parker, Angela G Reyes, Zachary Rowe, and Richard L Lichtenstein. 2019. Community-based participatory research. *Urban health* 272, 2 (2019), 272–282.

[38] Jason Jabbari, Haotian Zheng, Stephen Roll, Daniel Auguste, and Oren Heller. 2023. How did reskilling during the COVID-19 pandemic relate to entrepreneurship and optimism? Barriers, opportunities, and implications for equity. *Journal of Family and Economic Issues* (2023), 1–20.

[39] Heidi Julien, David Gerstle, Brian Detlor, Tara La Rose, and Alexander Serenko. 2021. Digital Literacy Training for Canadians, Part 1:"It's… Just Core Public Works". *The Library Quarterly* 91, 4 (2021), 437–456.

[40] Matt Kalmus, Hannah Hill, Jean Lee, Chris Goodchild, and David Webb. 2022. *A Human Approach to Closing the Digital Divide.* Retrieved January 16, 2024 from https://www.bcg.com/publications/2022/how-to-close-digital-divide-with-human-approach

[41] Naveena Karusala, Aditya Vishwanath, Arkadeep Kumar, Aman Mangal, and Neha Kumar. 2017. Care as a resource in underserved learning environments. *Proceedings of the ACM on Human-Computer Interaction* 1, CSCW (2017), 1–22.

[42] Sara Kiesler, Bozena Zdaniuk, Vicki Lundmark, and Robert Kraut. 2000. Troubles with the Internet: The dynamics of help at home. *Human-computer interaction* 15, 4 (2000), 323–351.

[43] Yasmine Kotturi, Julie Hui, TJ Johnson, Lutalo Sanifu, and Tawanna R. Dillahunt. 2024. Sustaining Community-Based Research in Computing: Lessons from Two Tech Capacity Building Initiatives for Local Businesses. *Proc. ACM Hum.-Comput. Interact.* 8, CSCW1, Article 178 (apr 2024), 31 pages. https://doi.org/10.1145/3641017

[44] Jess Kropczynski, Reza Ghaiumy Anaraky, Mamtaj Akter, Amy J Godfrey, Heather Lipford, and Pamela J Wisniewski. 2021. Examining collaborative support for privacy and security in the broader context of tech caregiving. *Proceedings of the ACM on Human-Computer Interaction* 5, CSCW2 (2021), 1–23.

[45] Gloria Ladson-Billings. 1995. Toward a theory of culturally relevant pedagogy. *American educational research journal* 32, 3 (1995), 465–491.

[46] Gloria Ladson-Billings. 2005. Culturally relevant teaching: The key to making multicultural education work. *Research and multicultural education: From the margins to the mainstream* (2005), 102–118.

[47] Guido Lang and Tamilla Triantoro. 2022. Upskilling and reskilling for the future of work: A typology of digital skills initiatives. *Information Systems Education Journal* 20, 4 (2022), 97–106.

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

[49] Thai V Le, Hernan Galperin, and Dorian Traube. 2023. The impact of digital competence on telehealth utilization. *Health Policy and Technology* 12, 1 (2023), 100724.

[50] Noah Lenstra. 2017. The community-based information infrastructure of older adult digital learning: A study of public libraries and senior centers in a medium-sized city in the USA. *Nordicom Review* 38, s1 (2017), 65–77.

[51] David Lindeman. 2021. Lessons from lighthouse: operationalizing technology to support older adults in affordable housing communities. *Innovation in Aging* 5, Suppl 1 (2021), 465.

[52] Alex Jiahong Lu, Anna Gilhool, Joey Chiao-Yin Hsiao, and Tawanna R Dillahunt. 2022. Emotional labor in everyday resilience: Class-based experiences of navigating unemployment amid the COVID-19 pandemic in the US. *Proceedings of the ACM on Human-Computer Interaction* 6, CSCW2 (2022), 1–27.

[53] Tamir Mendel and Eran Toch. 2023. Social Support for Mobile Security: Comparing Close Connections and Community Volunteers in a Field Experiment. In *Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems*. 1–18.

[54] Catherine Middleton. 2021. Digital infrastructure for the post-pandemic world. Public Policy Forum Toronto, ON, Canada.

[55] Prema P Nedungadi, Rajani Menon, Georg Gutjahr, Lynnea Erickson, and Raghu Raman. 2018. Towards an inclusive digital literacy framework for digital India. *Education+ Training* 60, 6 (2018), 516–528.

[56] James Nicholson, Ben Morrison, Matt Dixon, Jack Holt, Lynne Coventry, and Jill McGlasson. 2021. Training and Embedding Cybersecurity Guardians in Older Communities.. In *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems*. 1–15.

[57] Office of Policy Development and Research. 2016. *Digital Inequality and Low-Income Households*. Retrieved January 16, 2024 from https://www.huduser.gov/portal/periodicals/em/fall16/highlight2.html
[58] Carolyn Pang, Zhiqin Collin Wang, Joanna McGrenere, Rock Leung, Jiamin Dai, and Karyn Moffatt. 2021. Technology adoption and learning preferences for older adults: evolving perceptions, ongoing challenges, and emerging design opportunities. In *Proceedings of the 2021 CHI conference on human factors in computing systems*. 1–13.
[59] Hyewon Park, Sabrina Tam, and Patricia Jew. 2023. Comprehensive Understandings of Factors Impacting Seniors' Digital Literacy Training Outcomes. *Available at SSRN 4528708* (2023).
[60] Lucy Pei and Roderic Crooks. 2020. Attenuated access: Accounting for startup, maintenance, and affective costs in resource-constrained communities. In *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems*. 1–15.
[61] Kaisa Pihlainen, Kristiina Korjonen-Kuusipuro, and Eija Kärnä. 2021. Perceived benefits from non-formal digital training sessions in later life: views of older adult learners, peer tutors, and teachers. *International journal of lifelong education* 40, 2 (2021), 155–169.
[62] Erika Shehan Poole, Marshini Chetty, Tom Morgan, Rebecca E Grinter, and W Keith Edwards. 2009. Computer help at home: methods and motivations for informal technical support. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. 739–748.
[63] Massimo Ragnedda. 2019. Conceptualising the digital divide. *Mapping digital divide in Africa: A mediated analysis* (2019), 27–44.
[64] Aishwarya Lakshmi Ratan, Sambit Satpathy, Lilian Zia, Kentaro Toyama, Sean Blagsvedt, Udai Singh Pawar, and Thanuja Subramaniam. 2009. Kelsa+: Digital literacy for low-income office workers. In *2009 International Conference on Information and Communication Technologies and Development (ICTD)*. IEEE, 150–162.
[65] Barbara Rogoff. 1994. Developing understanding of the idea of communities of learners. *Mind, culture, and activity* 1, 4 (1994), 209–229.
[66] Annabel Rothschild, Amanda Meng, Carl DiSalvo, Britney Johnson, Ben Rydal Shapiro, and Betsy DiSalvo. 2022. Interrogating data work as a community of practice. *Proceedings of the ACM on Human-Computer Interaction* 6, CSCW2 (2022), 1–28.
[67] Johnny Saldaña. 2021. The coding manual for qualitative researchers. (2021).
[68] Nithya Sambasivan, Ed Cutrell, Kentaro Toyama, and Bonnie Nardi. 2010. Intermediated technology use in developing communities. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. 2583–2592.
[69] Neil Selwyn. 2004. Reconsidering political and popular understandings of the digital divide. *New media & society* 6, 3 (2004), 341–362.
[70] Hyunjin Seo, Joseph Erba, Darcey Altschwager, and Mugur Geana. 2019. Evidence-based digital literacy class for older, low-income African-American adults. *Journal of Applied Communication Research* 47, 2 (2019), 130–152.
[71] Gopal K Singh, Mehrete Girmay, Michelle Allender, and Ramey T Christine. 2020. Digital divide: marked disparities in computer and broadband internet use and associated health inequalities in the United States. *International Journal of Translational Medical Research and Public Health* 4, 1 (2020), 64–79.
[72] Mario L Small and Leah E Gose. 2020. How do low-income people form survival networks? Routine organizations as brokers. *The ANNALS of the American Academy of Political and Social Science* 689, 1 (2020), 89–109.
[73] Laura D Stanley. 2003. Beyond access: Psychosocial barriers to computer literacy special issue: ICTs and community networking. *The Information Society* 19, 5 (2003), 407–416.
[74] Kelly Steelman and Charles Wallace. 2017. Breaking barriers, building understanding: A multigenerational approach to digital literacy instruction for older adults. *ACM SIGACCESS Accessibility and Computing* 118 (2017), 9–15.
[75] Fabian Stephany. 2021. One size does not fit all: Constructing complementary digital reskilling strategies using online labour market data. *Big Data & Society* 8, 1 (2021), 20539517211003120.
[76] Sarah Haroon Sualehi. 2023. (Some) adults left behind: Digital literacy and the working learner. *New Directions for Adult and Continuing Education* 2023, 179 (2023), 67–77.
[77] Roksolana Suchowerska and Anthony McCosker. 2022. Governance networks that strengthen older adults' digital inclusion: The challenges of metagovernance. *Government Information Quarterly* 39, 1 (2022), 101649.
[78] Sujarwo Sujarwo, Tristanti Tristanti, and Erma Kusumawardani. 2022. Digital Literacy Model to Empower Women Using Community-Based Education Approach. *World Journal on Educational Technology: Current Issues* 14, 1 (2022), 175–188.
[79] Łukasz Tomczyk, Maria Lidia Mascia, Dorota Gierszewski, and Christopher Walker. 2023. Barriers to digital inclusion among older people: a intergenerational reflection on the need to develop digital competences for the group with the highest level of digital exclusion. *Innoeduca. International Journal of Technology and Educational Innovation* 9, 1 (2023), 5–26.
[80] Alexander JAM Van Deursen and Ellen J Helsper. 2015. The third-level digital divide: Who benefits most from being online? In *Communication and information technologies annual*. Emerald Group Publishing Limited, 29–52.

[81] Alexander JAM Van Deursen and Jan AGM Van Dijk. 2019. The first-level digital divide shifts from inequalities in physical access to inequalities in material access. *New media & society* 21, 2 (2019), 354–375.
[82] Jan AGM Van Dijk. 2006. Digital divide research, achievements and shortcomings. *Poetics* 34, 4-5 (2006), 221–235.
[83] Emily Vogels and A. 2021. Digital divide persists even as Americans with lower incomes make gains in tech adoption. *Pew Research Center* (June 2021). https://www.pewresearch.org/fact-tank/2021/06/22/digital-divide-persists-even-as-americans-with-lower-incomes-make-gains-in-tech-adoption/
[84] Lev Semenovich Vygotsky and Michael Cole. 1978. *Mind in society: Development of higher psychological processes*. Harvard university press.
[85] Camille M Wilson. 2016. Enacting critical care and transformative leadership in schools highly impacted by poverty: An African-American principal's counter narrative. *International Journal of Leadership in Education* 19, 5 (2016), 557–577.
[86] Elizabeth Withers, Gloria Jacobs, Drew Pizzolato, Jill Castek, Kimberly D Pendell, and Stephen Reder. 2015. Job seeking learners: digital literacy acquisition case study. (2015).
[87] Kaitlin Wynia Baluk, Brian Detlor, Tara La Rose, and Carmela Alfaro-Laganse. 2023. Exploring the digital literacy needs and training preferences of older adults living in affordable housing. *Journal of Technology in Human Services* 41, 3 (2023), 203–229.
[88] Deepika Yadav, Pushpendra Singh, Kyle Montague, Vijay Kumar, Deepak Sood, Madeline Balaam, Drishti Sharma, Mona Duggal, Tom Bartindale, Delvin Varghese, et al. 2017. Sangoshthi: Empowering community health workers through peer learning in rural india. In *Proceedings of the 26th International Conference on World Wide Web*. 499–508.
[89] Jason C Yip, Carmen Gonzalez, and Vikki Katz. 2016. The learning experiences of youth online information brokers. Singapore: International Society of the Learning Sciences.

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