

Lessons Learned from Supporting Low-income Older Adults to Use a Tablet PC in the Age of Digital Divide

Xiaotong Du
Rutgers University
New Brunswick, NJ, USA
xd103@rutgers.edu

Willow Yao
Rutgers University
New Brunswick, NJ, USA
wsy4@scarletmail.rutgers.edu

Sunyoung Kim
Rutgers University
New Brunswick, NJ, USA
Sunyoung.kim@rutgers.edu

ABSTRACT

Low-income older adults are more likely to face a digital divide due to the limited internet access and digital skills, especially during the COVID-19 pandemic. While many studies in HCI have identified obstacles older adults encountered in technology use, little is known about the digital inequity that older adults experienced in adopting and using the tablet PC for the first time. In this study, we provided 28 low-income older adults with instruction sessions to help them set up and use tablet PCs. From these sessions, we found that while social connection as the most requested feature provides a positive experience, creating or managing a login account and being unfamiliar with common interaction techniques were challenging for older adults to use a tablet PC for the first time. We conclude with design implications for senior-friendly technology.

CCS CONCEPTS

• **Human-centered computing** → **Human computer interaction (HCI)**; *Empirical studies in interaction design*.

KEYWORDS

Older Adults; Tablet PC; Low-income; Digital Divide; Digital Inequity; Technology Adoption.

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1 INTRODUCTION

Older adults want to remain active and independent. Nearly 27% of adults over the age of 60 in the United States live alone as of 2018 [3]. Information and Communication Technologies (ICTs) have the potential to support independence, socialization, and aging in place [8]. The social distancing and sheltering-in-place orders had made using ICTs among older adults more important than ever before since they were excluded not only physically from their friends

and family members but also socially from their local communities during the COVID-19 pandemic.

However, the digital divide still exists among older adults. While the technology adoption rate of older adults has been increasing, 25% of older adults are still non-internet users [2]. Especially, older adults of color and lower socioeconomic status are more likely to have limited internet access [10]. A digital divide refers to not only the physical access to technology but also the skills of using the technology [19]. While the adoption of ICTs among older adults has been increasing, only 26% of older internet users are confident of performing tasks on digital devices, and 73% of older adults said they needed others to help them use new devices [1]. The good news is that older adults are eager to learn [4]. The motivation has recently been growing among older adults since social distancing and shelter-in-place orders have made technology an exclusive tool to connect with the world during the pandemic. Currently, many local communities and non-profit organizations seek to provide services and resources needed for the underserved populations to cope with the COVID-19 pandemic, one of which is to offer low-income older adults access to technology and training for its use. This is an opportunity for low-income older adults to get more comfortable using technology and connecting to online communities even after social distancing orders are lifted.

As part of the nationwide effort to keep older adults healthy and safe in their homes during COVID-19, we collaborated with a local low-income senior housing organization in the greater New York area. We offered instructions on using a tablet PC that the organization distributed to their residents for free. This paper reports the insights we learned from these instruction sessions about the needs and challenges older adults had in their initial interactions with a tablet PC. This study further expands our understanding of the digital divide from lacking internet access and digital skills to the digital inequity created by ICTs for first-time tablet PC users among older adults. Based on the findings, we discuss implications to consider in designing senior-friendly technology for novice users.

2 BACKGROUND

Research has shown that technology use can improve older adults' quality of life and social well-being. For instance, social media use and online information-seeking increase older adults' social satisfaction and reduce their feeling of loneliness [6]. Others focus on positive aging and view older adults as contributors to the online communities, such as using online platforms to share content and build relationships with each other [20]. However, technology adoption and use are influenced by demographic and socioeconomic status, and older populations are not the exception. Older adults, especially racial minorities, with lower levels of education and lower

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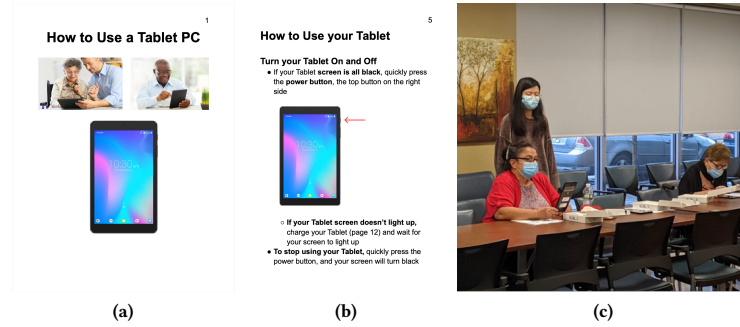


Figure 1: Instruction manual cover (a), One page of the manual (b), and A tablet PC instruction session (c)

incomes have lower rates of using the internet and higher rates of discontinuing internet use due to cost and disability, albeit their interest in using the internet and computer [10].

Supporting older adults to use technology could increase their comfort in using technology and reduce the risk of loneliness and social isolation [17]. Many research in HCI have investigated the technology acceptance behaviors among older adults based on theoretical models such as the technology acceptance model (TAM) [9] and the Unified Theory of Acceptance and Use of Technology (UTAUT) [18]. For instance, Kim et al. have combined those two models and shown that peer support is an effective way to help older adults adopt and use new technology [15]. Magsamen-Conrad et al. have used UTAUT to investigate the tablet device use across generations and found consistent differences between younger and older generations [16]. Gonzalez et al. have found that direct contact with digital devices provides older adults with positive experiences and increases self-confidence [11]. Therefore, as part of these efforts, our work aims to offer community-based support for technology adoption among low-income older adults and explore the challenges older adults had in their initial interactions with technology.

3 METHODS

3.1 Participants

This study is part of a larger outreach event organized by a local, non-profit organization for an affordable housing community in the greater New York Area. This organization raised funds to distribute free tablet PCs to their residents to support low-income older adults' access to information online during COVID-19. The first and the second authors attended the event for distributing a tablet PC and offered in-person instruction on how to use a tablet PC for those who wanted. Among those who received a free tablet PC in this event, 28 people aged 65 years and over (6 males and 22 females) signed up to attend the instruction session. In terms of general technology use, all participants owned a mobile phone, most of which were touchscreen-based smartphones, and three were physical keypad phones. Most participants said they had used touchscreen-based devices before but did not own a tablet PC except one participant.

3.2 A Tablet PC and Instruction Materials

Affordable, 8-inch, 4G LTE-enabled tablet PCs were purchased by the organization for free distribution to their residents. As supplementary material to instruct the use of this tablet PC, we created a printable instruction manual in English and made its Spanish version (Figure 1a). The manual was designed based on previous research [5]: (1) hardware operations section to provide basic instructions of how to operate the device, such as turning on and off the device, adjusting volume, and basic interaction gestures (e.g., touch, scroll, swipe), and (2) software operations to provide instructions of how to use various mobile applications on a tablet PC, including social media (e.g., Facebook), virtual conferencing software (e.g., Zoom, Skype), general information search (e.g., Google, public library websites), online shopping (e.g., Amazon), and leisure and entertainment (e.g., YouTube). In each step of the instruction, we included large images of a screen in which an arrow points to the content of instruction to help participants follow along easily (Figure 1b). Throughout the manual, we were careful in avoiding technical jargon and instead used informal and straightforward language. For instance, we labeled the section for social connection as keep in touch with loved ones and information-seeking as keep up with local news or events. In addition, we included instructions on how to download and install mobile applications to a tablet PC. This instruction manual served not only as supplementary material for participants during the instruction session but also as a handout for participants to use at home.

3.3 Study Procedure

The instruction sessions were held in a community meeting room of the housing organization. To abide by the CDC's safety protocol under COVID-19, we limited four participants per instruction session. Since 28 participants signed up for the instruction sessions, we divided them into 10 sessions with 2 to 4 participants in each session. During the session, participants were asked to sit apart to maintain a safe distance (See Figure 1c). In addition, all participants sanitized their hands before entering the room and wore a protective facial covering throughout the session. Because participants include half English speakers and half Spanish speakers, we had one Spanish interpreter in each instruction session. Two researchers and one interpreter attended each session. It lasted about one hour,

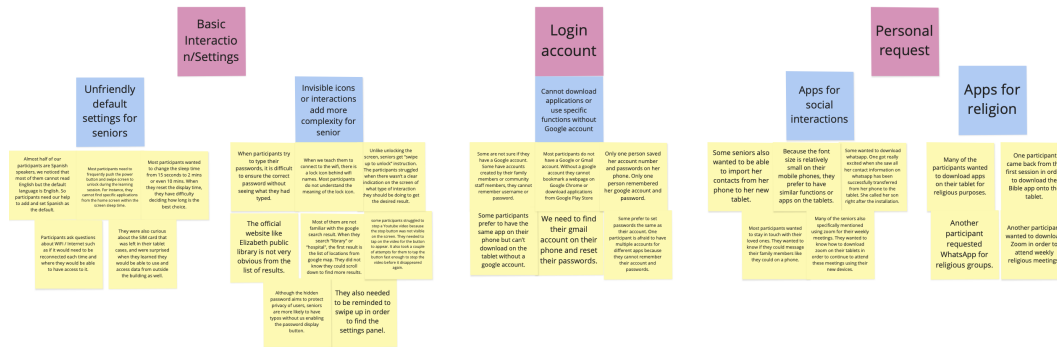


Figure 2: Example of the affinity diagramming

aiming to help participants with an initial setup of a tablet PC and teaching them the basic hardware and software operations.

Upon arrival, each participant received a tablet PC and a print-out of instruction material. After providing an overview and the purpose of the session, we obtained verbal informed consent to audio-record each session. We then asked participants' general experience with technology, including a digital device they own and prior experiences with personal computing technologies (e.g., internet use, touchscreen), and their language preference. Then, we split participants into subgroups consisting of one researcher and one or two participants to meet the participants' needs by different experiences with technology and spoke languages. Following the order of instruction material, we explained and demonstrated how to use a tablet PC from its hardware operation to the software. Throughout the session, participants were encouraged to operate the device themselves and to ask any questions. Once there was no more question from participants and participants expressed confidence in using a tablet PC themselves, we adjourned the session. Participants left the room with a tablet PC and a copy of an instruction manual. We offered a follow-up session in the following week for those who expressed that they were still not confident using the devices after the first instruction session. Five participants signed up for the follow-up session and were divided into 3 groups. During the follow-up session, we answered any questions and helped solve issues that participants had using a tablet PC, such as creating an online account and downloading applications.

While we audio-recorded the first few sessions upon participants' consent, it turned out to be difficult to discern the conversations from the audio because multiple people were speaking in different languages simultaneously throughout the session. Thus, we stopped audio-recording and instead made notes of participants' questions and responses at the end of each instruction session. Two researchers who offered participants the instruction sessions took field notes independently to capture participants' reactions, experiences, and challenges while using a tablet PC. Notes were later discussed and combined for data analysis. No monetary compensation was provided since all participants were offered a tablet PC to possess.

3.4 Data analysis

The data were analyzed using affinity diagramming. Affinity diagramming, developed from the KJ model [14], is a technique to synthesize unstructured and qualitative data from fieldwork and observations [12]. We used affinity diagramming to derive insights from observations and field notes. It helps us to understand older adults' experiences and challenges of adopting tablet PCs. Two authors combined raw data from observations and field notes into one document. We typed each data point on the yellow sticky notes that contain reactions, observations, reflections, or thoughts related to older adults' tablet PC use. We then cluster notes into generalized topics (e.g., unfriendly default settings, invisible icons or interactions) based on their meaning and similarity on the blue sticky notes. Finally, we grouped similar topics into emerging themes (e.g., basic interaction, login account, and personal request) (See Figure 2).

4 FINDINGS

Overall, most participants were satisfied with various features or applications a tablet PC offers, such as connecting with their friends and family members, shopping online, playing games, and listening to music. Among those features, participants requested to learn and use applications for social connection the most. In using these applications, however, most participants encountered recurrent challenges associated with basic login account setups and unfamiliarity with common practices.

4.1 Positive reactions to capabilities that a tablet PC offers: social connection

Participants were content with staying connected with family, friends, and community, specifically their grandchildren and religious groups, via a tablet PC. We found that video-based communication applications were not the only way participants stayed connected with their grandchildren. For instance, after learning how to shop online on Amazon, one participant searched a child mask to buy for her grandchild. After learning to search for information online, another participant found a tutorial about how to knit a hat on Google. She expressed her excitement by laughing and said that she would knit a hat for her grandchild. One participant asked for installing a game to play with her grandchild. Another

participant sent her cat photo to her grandchild after learning how to send an image via a messaging application. In addition, there were many questions and requests relating to connecting with their religions, such as installing and using video conferencing software (e.g., Zoom) or instant messaging applications (e.g., WhatsApp) to join virtual religious services or bible study groups.

4.2 Challenges for the first-time tablet PC users

4.2.1 A login account. We initially planned to teach participants a wide range of mobile applications. However, we had to focus on using the pre-installed applications on the tablet PC (e.g., Google, YouTube) because participants encountered a recurring problem with login accounts. Some participants failed to log in either because they forgot if they had an account or forgot login credentials. For those who remembered they had an account, most of them cannot recall their login passwords because their accounts were created by somebody else, such as family members or a local community. Only two participants remembered their account username and password either by memory or by checking the recorded username and password on the phone.

Participants who did not have an account encountered a different problem. While they were willing and even attempted to create a new account, their efforts were often in vain because most usernames they wanted to use were taken. While the system recommended alternative usernames when the entered username already existed, the suggested usernames were complicated and difficult to remember. One participant tried more than three times to create a username because all usernames that she created already existed. She did not choose system-recommended usernames since they are difficult for her to remember. When she finally created a username successfully and the system proceeded to the next step, she already forgot the username she just created and said, "No, No, I don't remember it. How can I go back?" Therefore, on top of the already demanding and aging-related difficulties that older adults have to overcome, they suffer from additional digital inequity because they started to use digital services late and available usernames and secure passwords are difficult to remember.

4.2.2 Unfamiliarity with common practices in technology use. Because older adults grew up before the era of digital technology, digital interaction techniques that are well-acknowledged and taken for granted by young people might not be perceived as the same by older adults. There are many interaction techniques that mobile applications offer without direct instruction. For instance, we observed that some participants struggled to stop a YouTube video because the stop button was invisible on the screen while the video was playing. They needed to be told to tap the screen to see the hidden buttons. Also, most participants did not know that they could swipe up or down on the home screen of a tablet PC to open soft panels for device setup or quick access to more applications. We also observed that some participants viewed information only on the first page of search results because they did not know there is a pagination bar at the bottom to indicate a series of related content exists across multiple pages. Such unfamiliarity with common digital interaction practices made it very difficult for first-time users to perform intended and desired actions with a tablet PC.

5 DISCUSSION

While participants appreciated the instruction sessions and learned how to use a tablet PC at the end of the session, we identified two main challenges for older adults to adopt and use a tablet PC. First, creating and managing a login account was challenging because available usernames and secure passwords were difficult to remember for older adults. Second, participants were unaware of many digital interaction techniques that are prevalent in mobile applications. Reflecting on these findings, we propose the following implications to consider for the design of senior-friendly technology.

5.1 Inclusive online account systems

During the instruction session, the most time-consuming part was to sign up for or log in to a mobile application because participants either did not have online accounts or forgot the existing username and password. For those without an online account, creating a new one was a big burden. This finding has important implications for developing an inclusive and senior-friendly online account system that allows older adults to create a new account with easy-to-remember usernames and passwords. Lack of internet access and low technology literacy are two primary reasons for the digital divide [19]. We argue that the difficulty with login accounts would further widen the gap as easy-to-remember online accounts were taken by current users, and easy-to-remember passwords did not meet the system requirement for security reasons. Older adults already lag behind in terms of internet and technology adoption compared with their younger counterparts. Creating an online account or setting a password, which is the fundamental step in using mobile applications, played an extra obstacle for older adults. Unlike parking lots that offer particular lots for disabilities or special grocery shopping hours reserved for older adults during the pandemic, older adults do not have any privilege in a digital world. Instead, older adults are left with usernames and passwords that are longer, more complicated, and difficult to remember.

We suggest some potential design implications for more inclusive online account systems. For instance, new software or applications should reserve easy-to-remember account usernames for older adults because some usernames had already existed when participants tried to create their accounts. Since what is easy to remember would be varied by different people, it would be worth exploring the ideas for allowing older adults to obtain easy-to-remember usernames as what we do in a physical world during the pandemic (e.g., special shopping hours for high-risk population). For existing online software or applications, the algorithm could recommend alternative usernames based on older adults' personal information such as their first and last name with simple numbers (e.g., firstnamelastname01) or with special signage (e.g., username_senior, username_silver, etc.), rather than suggesting a username with combinations of random letters and numbers. In terms of designing senior-friendly passwords, researchers have proposed how cultural-based graphical passwords (e.g., selecting images of personal habits such as going to the concert) could improve users' memorability and reduce time to create or recall passwords [7]. In addition, passwordless authentication based on notifications from users' personal devices or on external devices would be another possible solution

for older adults. However, future research is still needed to evaluate such alternative systems for authenticating older adult users.

5.2 Clear instructions or indicators of available actions for novice users

The unfamiliarity with commonly used digital interaction techniques made it difficult for older adults to use mobile applications on a tablet PC. We identified these techniques as tacit knowledge in technology use. Tacit knowledge was first defined by Howells as non-codified, know-how knowledge that requires one's experience to acquire [13]. Tacit knowledge in technology needs older adults to spend considerable time interacting with digital devices to learn, which increases the level of difficulty for first-time tablet PC users. Young adults usually do not need instructions when they first launch an application, especially for the most widely used applications (e.g., YouTube). However, some older adults who use these applications would be unfamiliar with prevalent interaction techniques for the first time. We suggest that the application could ask users if it is their first time using the application or the level of familiarity to decide if they need to display instructional overlays. Applications should provide novice users with detailed instructions, whether or not the application is prevalent. Clear indicators for the system use and navigation may also increase the accessibility to available actions. For instance, text labels such as "swipe to unlock the screen," "tap the screen to display hidden buttons", or "scroll down to view more results" could increase the clarity of invisible interaction and reduce the confusion for first-time tablet PC users.

6 CONCLUSION AND FUTURE RESEARCH

We provided instruction sessions for low-income older adults about using a tablet PC that they received for free from their housing organization. In the instruction session, we helped with a device setup and the hardware and software operations. The most used and wanted features were applications related to social connection. At the same time, we identified barriers caused by the digital inequity in current ICTs: have difficulty creating and managing a login account or password and unfamiliarity with tacit knowledge in technology. Based on these findings, we discussed the design implications for senior-friendly technology, including inclusive online account systems and clear user interface indicators to inform actions. Our next step is to conduct a longitudinal study with older adults to better understand how older adults use a tablet PC and other mobile applications over time in their daily lives.

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