Older adults and Digital Technology: A Study of User Perception and Usage Behavior

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Abstract. Nowadays, with aging society, there are an increasing number of older adults, who are current or potential users of digital technologies. However, how older adults perceive and use digital technologies does not receive sufficient research attentions. This study investigated older adults' user perception and usage behavior of digital technologies in Hong Kong. A semi-structured interview was designed to understand their feelings and experience of daily digital technology use. The results found that older adults presented positive attitudes to the digital technology use but less self-efficacy of their own capabilities of learning these technologies. The majority of participants reported difficulties when using and learning digital technologies, especially navigation problems. Additionally, there is a tendency of using mobile computing devices instead of computers among older adults. By considering older adults' special needs and limitations in future digital technology design, a better user experience could be assured.

Keywords: Digital Technology · Older Adults · User Perception · Usage Behavior

1 Introduction

Nowadays, with aging society, there are an increasing number of older adults, who are current or potential users of digital technologies. However, the digital technology is still not widely adopted in the population of older adults compared with young people [1]. The study from Hong Kong Census and Statistics Department reported that more than 99.6% of local residents aged at 10-34 years old had the computer knowledge, whereas only 30.1% of older adults aged above 65 years old reported knowing how to use computers in 2015 [2]. This problem will probably be magnified while new technologies emerge with diverse interfaces and interaction styles evolving. The reasons may lie in many aspects. First, it is reported that older adults have fewer interests [3], and high level of anxiety when using technologies [4]. They also tend to show less confidence in their own knowledge, capabilities and skills of learning and using technologies [5]. Moreover, the aging process has started to bring significant changes to

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older adults' physical and mental abilities as early as mid-fifties [6], such as the visual perception, audition ability, movement control, and cognition. All of these declines may influence the way how older adults perceive and use the digital technologies. Therefore, it is essential to help the designers and practitioners to better understand the possible facilitators and barriers of learning and using technologies for older adults, especially when advanced technologies continue to emerge in their daily lives.

Research examining the relationships between the technology acceptance and attitudinal variables has proposed some important impact factors such as computer anxiety and self-efficacy [7] [8] [9]. In addition, individual's perception of technologies is reported to have some effects on user behavior, such as perceived usefulness and perceived ease of use [10]. The purpose of this study is to explore the user perception and usage behavior of digital technologies among older adults, and to investigate how their demographic factors, perception attributes, and usage behavior influence with each other. Specifically, older adults' perceptions of technology use and perception of their own self-efficacy in technology learning were investigated since these are major problems in technology acceptance. Older adults' usage behavior was analyzed by questions like how older adults adopt the technologies, and what problems they may encounter while using technologies. As there is a trend towards the use of mobile computing devices and touch-screen displays rather than computers and desktops, the digital technologies investigated in this study focused on both of the traditional computers and mobile computing devices with touch-screen displays, such as smart phones, tablets, and iPad.

2 Methods

The main method used in this study was a semi-structured interview, which was conducted in a local senior citizen center in Hong Kong. The semi-structured interview was chosen because it allows for planning interview questions and scheduling interview process in advance, and can be hosted in flexible locations based on older adults' daily activity place. Furthermore, as the older adults sometimes can't easily understand the questions, using interview also allows researchers to further explain to them in details. In this way, interviews can help older adults to better understand what we are attempting to ask. Considering of older adults' physical limitations, the whole section was controlled in 30 minutes for each participant.

2.1 Participants

Fifteen older adults participated in this study, including 5 males and 10 females. The participants were recruited from the local senior citizen center in Hong Kong. All participants reported being in good physical conditions and having the basic recognition capability of Chinese characters. In this study, the average age of participants is 77.9 ranged from 61 to 90 years old, with a standard deviation of 7.9 years old. Additionally, education backgrounds were also investigated. The majority of participants were at the education level below primary school (53.3%), followed by those at the level of primary school (13.3%), secondary school (20.0%), and above the level of college and university (13.4%).

2.2 Interview Design

Based on the literature review, this study is particularly interested in the following aspects of user perception: general attitude, perceived usefulness, self-efficacy to learn new digital technologies or applications. Participants' usage behaviors and using experience were detailed investigated, including different types of digital technologies they used, the average time they usually spent on, and their most frequently used functions and applications. Furthermore, participants were asked about their perceived ease of use and ease of learning about these digital technologies. Then they were required to rank the 11 possible difficulties and problems in terms of usability and learnability of digital technology use.

Three questions were designed to measure the old adults' user perception about digital technologies. Firstly, older adults' general attitudes were asked: *do you like the idea of using digital technology?* Then, a second question was used to investigate whether the digital technology could enhance their performance and bring convenience to their daily life. The questions were designed as: *do you think using the digital technology would bring some conveniences to your life?* Additionally, a third question was asked about their self-efficacy of learning new things: *do you feel confident to learn a new kind of digital technology or related application?* These three questions all used a format of 5 Likert scale to ask the participants to choose verbally. All related comments were recorded for further analysis.

For those who had the experience of using the digital technology, including computers, smart phones, tablets or iPad, smart watches and the other related technologies, three questions about their usage habits were asked. Participants were firstly asked to choose the most frequently used digital technology and indicate their using frequency. Then, participants were asked about their most frequently used functions or applications. Questions were like: *How often do you use digital technologies, including computer, smart phone, iPad or tablet, smart watch, or others? What is your most frequently used product? What are your most frequently used functions or applications?* In addition, participants were also asked to evaluate the ease of use and ease of learning about these technologies. Particularly, 11 common difficulties and problems were summarized from the study of [11], including target design, graphics design, icon design, content and layout design, color design, and navigation problem. Participants were instructed to choose these possible difficulties based on their real experience, or indicate other relevant problems they encountered. In the end, to better learn how older adults gain supports from others and in which way they prefer to learn digital technologies, the question was asked: *When you learning a new digital technology or relevant application, in which way do you prefer to learn?*

3 Results

3.1 User Perception of Digital Technology

The majority of participants showed positive feelings to digital technologies (73.3%). For example, 3 participants indicated that they appreciated the new things showing in their life, and they liked playing games using smart phones. However, there were still

3 participants reporting that they were bored with digital technologies because sometimes the technology was very complex and easily broken.

Regardless of whether the participants used digital technologies or not, 86.7% of them showed positive attitudes towards the convenience that digital technologies could bring to them.

When the participants were instructed to verbally evaluate how confident they feel if they were asked to learn a new digital technology or application, most of them chose a positive answer (73.3%). However, half of these participants actually showed little confidence considering of the whole interview. For instance, 2 of them demonstrated that they were too old to learn new things. 5 participants complained that they had bad memories and less patience to learn new technologies. 4 people reported that they had the confidence to learn new technology only when the technology was simple enough. Thus, based on the real situations, there were only about 33.3% participants showing clear and strong confidence to learn new technologies.

For further analyzing, the spearman correlation analysis was used to examine the relationship between participants' demographic factors, perception attributes and usage behavior. As the results indicated, participants' perceived ease of use was positively correlated with participants' overall attitude ($p=0.010$) and perceived usefulness of technologies ($p=0.049$), as shown in Table 1.

Table 1. Correlation coefficient between perceived ease of use and perception attributes.

	Attitude	Perceived usefulness	Self-efficacy
Correlation Coefficient	0.735**	0.604*	0.595
p	0.010	0.049	0.054

3.2 Usage Behavior of Digital Technology

Totally, there were 11 participants having digital technology experience in this study. Among them, 4 participants (26.7%) reported a low level of digital technology experience with 2-5 hours per week. 6 participants (40%) indicated a medium level of experience with an average time ranged from 0.5 to 3 hours per day. Only one participant reported a high level of experience with 4 hours per day. Additionally, many of the participants reported they used or owned at least two kinds of digital technologies. The majority of them indicated that they used the smart phones (81.8%), followed by those who used the computers (63.6%), and tablets or iPad (36.3%). While they were asked their most frequently used digital technology, 5 participants chose smart phones (45.5%), followed by 4 participants chose computers (36.3%) and 4 participants chose tablets or iPad (36.3%). The frequency of the most frequently used functions or applications reported by older adults is displayed in Fig. 1. As shown, besides the basic functions, the four most frequently chosen functions or applications were hobbies and entertainments (81.8%), information, learning and education (54.5%), health and wellness care (54.5%), and social interaction (45.5%). For older adults, supports from others are quite important for them to use and learn the digital technology. 11 older adults preferred to learn to use technologies with their children or husband, and only 2

older adults preferred to learn by themselves. Moreover, 9 older adults (60%) indicated clear intention to learn more digital technologies in the future.

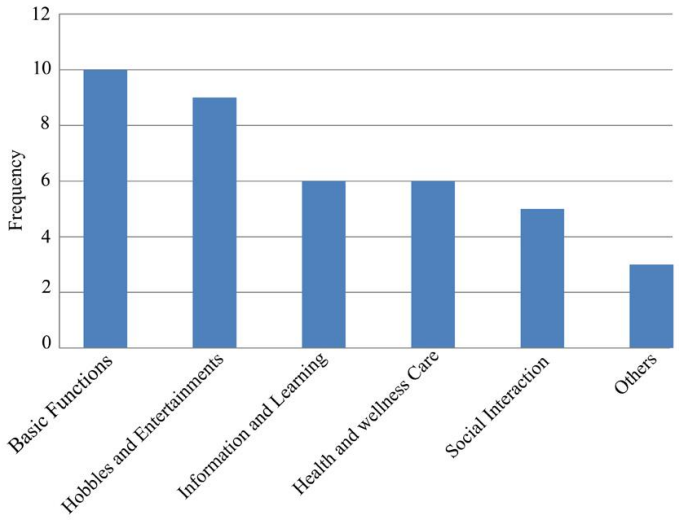

Fig. 1. Frequency of most frequently used functions among older adults (n=11).

For those 11 participants who has digital technology experience, the general ratings of their perceived ease of use and ease of learning towards digital technologies were as follows: 8 participants found it difficult to use or learn the digital technologies (72.7%); 2 participants found it not quite difficult to use or learn digital technologies and only 1 participant found it easy to use or learn digital technologies. When the participants were asked about their user experience or difficulties when using digital technologies, they tend to describe the digital technologies as complex, complicated and constantly changing. The frequency of difficulties and problems reported by older adults is demonstrated in Fig. 2. The common difficulties they encountered mainly focus on navigation problems, including the problems of pull down menus, navigating between different functions, and finding the way back to the previous interface. Additionally, the problems of content and layout design, and target design were also frequently reported by many participants.

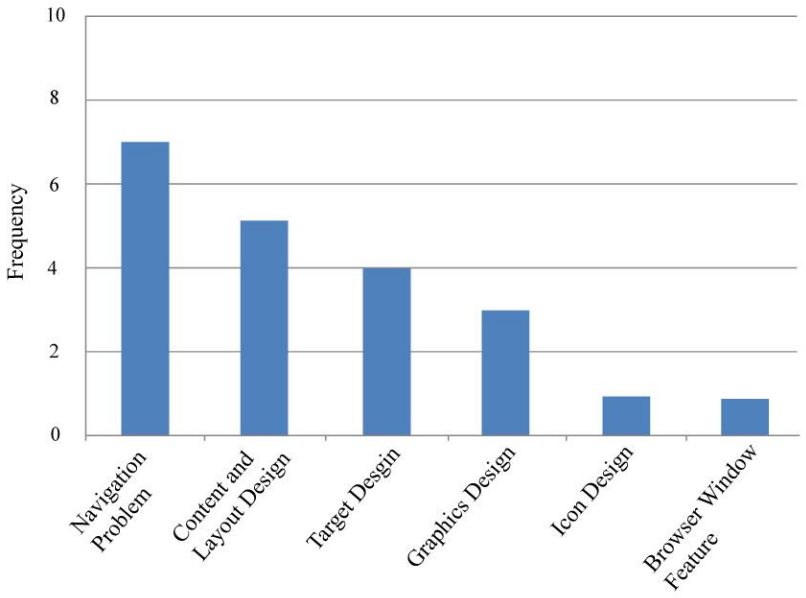

Fig. 2. Frequency of difficulties and problems related to digital technology using and learning (n=11).

4 Discussion

In this study, we explored the current situation of older adults' user perception and usage behavior of digital technologies in Hong Kong through a semi-structured interview.

Overall, the findings from this study indicated that the older adults' attitudes toward digital technology were quite positive, which are consistent with some other investigations which focused on desktops and computers [12] [13]. Not surprisingly, most of the older adults thought the digital technologies would bring conveniences to their daily lives. Nevertheless, regarding to older adults' perception of their own abilities to learn technologies, they showed a quite complicated attitude in this study. On the one hand, most of the participants firstly reported they were confident to learn new things. On the other hand, the majority of them reported negative attitudes to some extent during the whole interview process. The possible reason may lie on that older adults desire to contribute to the society [14] and tend to express their positive feelings of experience [15]. In this way, we suggest that using interview method is quite useful to dig out their real perspectives and feelings. By using different ways to ask each question and employing different approaches to comprehending each answer, the validity and trustworthiness of the research can be enhanced in the future study [16].

Contrary to some previous studies [10] [17], the findings from this research indicated that there is no correlation between demographic factors and perception attrib-

utes. That is to say, regardless of the age, gender and educational background, older adults generally hold positive attitudes to the digital technology and less confidence about their abilities and skills to learn or use these technologies. The differences may be caused by the wide use of digital technologies in older adults' daily lives in Hong Kong during recent years. An increasing number of older adults are convinced of the usefulness of digital technologies by their families and friends. In addition, the results from this study demonstrated that older adults' perceived ease of use was positively correlated with participants' overall attitude and perceived usefulness of digital technologies.

Surprisingly, the use of digital technologies is quite common among the older adults in Hong Kong. It is worth noting that, there is a tendency of using mobile computing devices and touch screen displays such as smart phones or iPad among these older adults, instead of desktops or computers. Especially, besides the basic functions, older adults showed the intention to use applications for hobbies and entertainment, information searching, and health-care related purposes. However, the majority of older adults in this study reported difficulties and problems to a different extent when using and learning digital technologies, which implies that current technologies are not successfully inclusive. The digital technology seems quite complicated, complex and changeable to them. Especially, the most frequently reported difficulties are related to the navigation problems. The possible reason is that older adults' usage of digital technology was still restricted in simply tasks which mainly required simple navigations. In addition, supports from others are quite important for older adults. Many participants prefer to learn new technologies with their children firstly and then practice by themselves. More importantly, the older adults showed some expectations for the future digital technologies design. For instance, some participants demonstrated that: "I wish the digital technology could be designed simpler and easier for us to use; otherwise, it is totally useless and meaningless for us".

5 Conclusion

This study investigated the older adults' user perception and usage behavior of digital technologies in Hong Kong, which will assist the designers and practitioners to better understand older adults' special needs and limitations while using digital technologies. These understandings can help with designing digital technologies to facilitate the diverse user capabilities for all potential users including older adults, in order to ensure users' ease of use and ease of learning, and a better user experience. The semi-structured interview in this study suggested that older adults tend to show positive attitudes towards technology use but less self-efficacy of their capabilities to learn technologies, which emphasizes the importance for researchers to continue focusing on this research area.

Overall, the majority of older adults perceived and experienced various difficulties when using technologies, which implies that current technologies are not successfully inclusive and the user experience should be improved. This finding also appeal the designers to consider older adults' unique capabilities and special needs when designing digital technologies, and make some allowances in design to facilitate their cognitive, visual and even emotional needs. For instance, the most frequently reported dif-

ficulties and problems from older adults were related to the navigation problems, which should be further emphasized in technology design. Further research is necessary to explore the relationships between different cognitive capabilities and usability problems. Also, research needs to be undertaken to investigate how to develop or design the digital technology based on older adults' unique cognitive and visual characteristics.

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