Evaluating the feasibility and perceptions of a senior-friendly tablet among older adults in Singapore: A mixed-methods study

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Abstract

Background: Digital technologies are becoming increasingly pervasive and integrated into our everyday life. This presents innovative opportunities to enhance older adults' independent living and mental well-being. However, many older adults still lag behind in technological use. To enhance older adults' mental well-being, a senior-friendly tablet known as SilverPad has been developed that is localised and multilingual to suit Singaporean older adults and designed to be inclusive for those who are less tech-savvy. SilverPad contains a suite of cognitive games and digital contents specially designed to be engaging and mentally stimulating for the older adults. Hence, this study was motivated to explore older adults' attitudes and acceptance towards the use of digital technologies specifically SilverPad.
Objective: To explore the feasibility, acceptability, and perceptions of a senior-friendly tablet from older adult users in Singapore who are not tech-savvy.
Method: A single-group, mixed-methods, pre–post-study design was employed to assess the feasibility, acceptability, and perceptions towards SilverPad from target older adult users in Singapore. Fourteen healthy older adults, above 60 years of age, completed the study.
Results: Following a 2-week exposure to SilverPad, there was a significant improvement in participants' comfort level with tablet use and mental well-being. Their interest level increased slightly but was marginally significant. However, there was no significant difference in participants' sense of efficacy. Participants' qualitative feedback provided further insights notably on the themes of perceived ease of use, satisfaction, perceived benefits, positive impacts experienced, and motivation to use the tablet, with some individual differences recognized.
Conclusion: The current study has shown that most participants found the experience of using the SilverPad tablet to be satisfying and positive with demonstrable effects on their level of comfort and well-being. The study has also uncovered further insights on the usability and acceptability of using SilverPad that supports its feasibility to benefit older adults.

Keywords: digital technologies, senior-friendly tablet, SilverPad, mental well-being, older adults

INTRODUCTION

In a super-ageing society that is projected to see an unprecedented emergence in the ageing population, its impacts are multi-dimensional. Much of the research efforts have been directed at the prevention goal to delay the onset of symptoms resulting from cognitive declines, such as cognitive training and stimulation to enhance cognitive and social functioning (eg., Hall et al., 2009, Kawashima, 2013). To that end, cognitive stimulation from games, puzzles, reading, reminiscence, and the like have been shown to be potentially beneficial. In line with this trend, SilverActivities has been involved in developing and promoting innovative and senior-friendly tablet-based solutions to engage older adults, the most popular being SilverPad (https://silveractivities.com/silverpad).

To empower seniors to stay well, SilverPad has been developed as an easy-to-use tablet-based application for older adults to improve and maintain their mental well-being. The development of SilverPad has been guided by experts and professionals from the ageing sector taking into consideration the local context and evidence-based approaches. Notably, as a senior-friendly tablet, SilverPad has been well-received by senior care centres and general users.

SilverPad has three main unique features that distinguish it from other tablets. Firstly, the senior-friendly design is embedded in its user interface. As shown in *Figure 1*, the seniors will always see the main screen as the first screen with an easy interface after turning it off and on. The inter-

Figure 1. SilverPad main screen

face is designed to be simple for the older adult to operate the tablet independently. Big icons and text are presented. The date and time are always shown on the top in big letters for convenience. SilverPad also has volume buttons on the top to make it easy to increase/decrease the volume without looking for physical buttons. It also contains a big icon showing the battery status. Uniquely, SilverPad is multilingual and supports all four local languages i.e. English, Chinese, Malay, or Tamil making it easy for the elderly to switch to their preferred language (*Figure 1*). Sil-

verPad also has a virtual home button (*Figure 1*) that helps the elderly to come back to the main screen. For example, if the elderly open the games in full-screen mode, they can return to the main screen by clicking this floating home button.

One of the biggest challenges that the elderly face while using a tablet is to find the apps they want to open. SilverPad makes this easy as all apps and content like games, and videos, are neatly organized into categories and folders on SilverPad (*Figure 2*). Each box seen on the main

Figure 2. SilverPad layout and organization

screen is a category. By clicking on a category, for example Digital Activities, it opens another screen with folders on the left. By clicking on each folder, they can easily find games/apps that they want to open.

Secondly, SilverPad contains a good selection of localized content with more than a hundred senior-friendly activities and games. One of the most popular is the Cognitive Games (*Figure 3*). One of the main categories within Cognitive Games is Brain Exercise. The games under this category are inspired by and adapted from research studies by incorporating the relevant training principles e.g., adaptable difficulty levels, targeted cognitive functions (e.g., memory, speed, attention, etc), reminiscence elements with localized context and stimuli (e.g., use of Singapore currency for the Cashier game, old vintage objects/landmarks based on local cultures, etc). Apart from cognitive games, *"Casual games"* contains other fast-paced games. There are other trivia-based games, bingo, and world tour (including local landmarks with reminiscence elements). Similarly, all of the games are multilingual with voice-over instructions in all four languages.

Thirdly, SilverPad has been developed into an open platform that allows new apps and content to be added by users and not limited to fixed apps. Any family member can access the content management system on the laptop/desktop and add content which will be reflected in SilverPad in real-time. Its content management system also appeals to senior care centres in the potential use of SilverPad to monitor the cognitive health of older clients by keeping track of their performance over time.

Digital-based well-being approaches are gaining traction with growing empirical support. These technologies are cost-effective, highly accessible (that the user carries around), and customizable with useful functionalities. For instance, digital-based cognitive training has been shown to be efficacious and feasible including for populations at high risk of cognitive decline (Coyle et al., 2014). Relevantly, previous studies have reported that older adults found learning to use tablet computers to be a positive experience including their confidence level, social connection, enjoyment, learning, and mental well-being (Chen et al., 2021; Vaportzis et al., 2018).

Although SilverPad has been well-received and gaining popularity, there is still a significant proportion of target older adults who could be potential users to benefit from its use but who generally fall behind in the use of technology. This observation is consistent with the research findings on the digital divide especially for those from the oldest age group, with low educational levels, and low income (Hong & Cho, 2017). Due to the considerable variability in the educational levels among the older populations in Singapore which could also reflect the barrier in their technological adoptions, a senior-friendly tablet-based solution such as SilverPad has been designed to bridge this gap.

According to the Technology Acceptance Model (TAM), the key factors identified that influence an individual's acceptance and intention to use technology include perceived ease of use and perceived usefulness (Venkatesh et al., 2003). In essence, perceived ease of use refers to the extent to which a person believes a particular technology to be easy to use without requiring substantial effort. In contrast, perceived usefulness relates to the extent to which a person believes how technological use could bring about certain benefits. Further, perceived ease of use and perceived usefulness are postulated to shape a person's attitude towards technology adoption leading to the behavioural intention to use. In parallel, perceived usefulness has been posited to have a strong link with the behavioral inten-
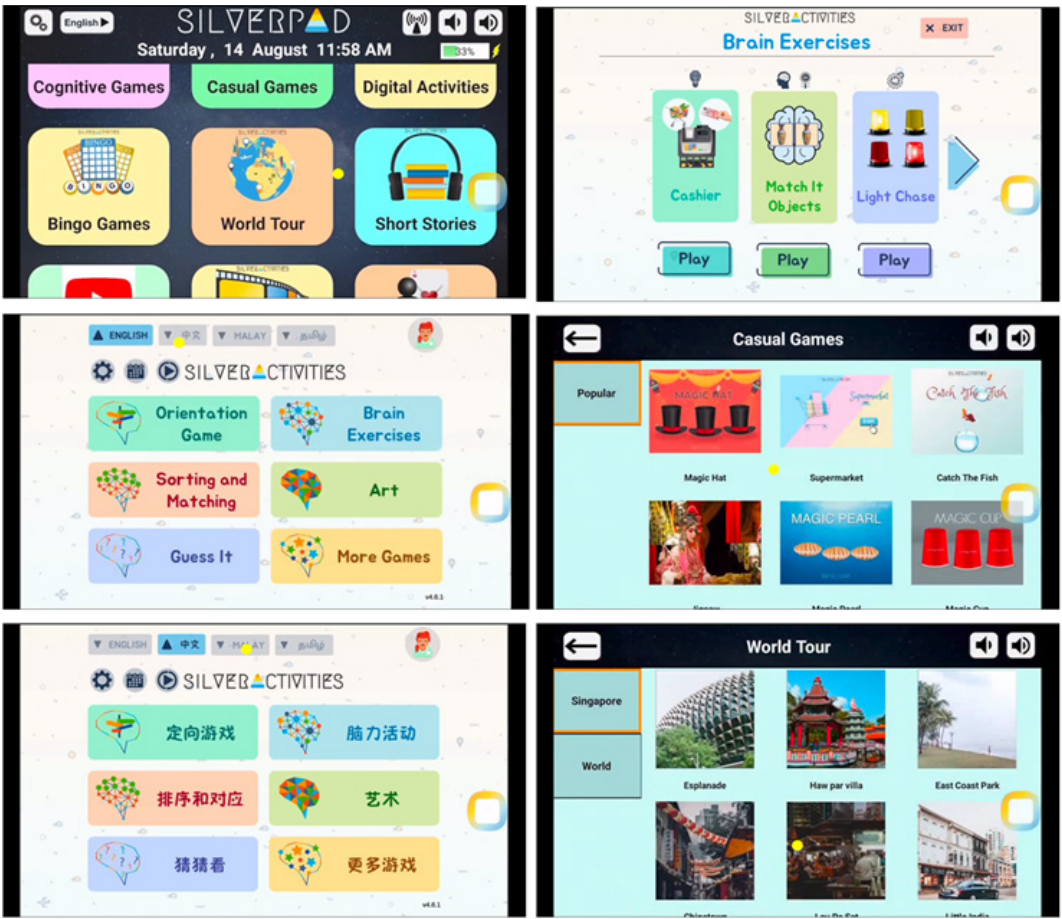
Figure 3. SilverPad content examples

tion to use (Holzinger et al., 2011).

Beyond TAM, newer models have been proposed that expanded on TAM and addressed some of its inadequacies (Chen et al., 2021; Chen & Chan, 2014a; Venkatesh et al., 2003). Pertinently, the Senior Technology Acceptance Model (STAM) developed by Chen and Chan (2014a; 2014b) incorporated other influential factors taking into account the older users' characteristics. Intriguingly, Chen and Chan's study (2014a) with Hong Kong Chinese older adults found that individual characteristics (age, gender, education, health), technological self-efficacy and anxiety, physical and cognitive abilities, as well as facilitating conditions (basic knowledge, available help, financial resources, accessibility and social influences) to be stronger predictors. These factors affect older adults' technological acceptance more strongly to a great extent.

In the local context, there is a dearth of research that examine older adults' attitudes and acceptance towards the use of digital technologies specifically tablet usage. Hence, in this study, we aimed to explore the feasibility, acceptability, and perceptions towards tablet-based training such as SilverPad from the target potential older adult users in Singapore who are not tech-savvy. In alignment with the technology acceptance models, the relevant constructs had been infused into our inquiry on areas such as ease of use, usefulness, efficacy, affect, and motivational factors.

Research questions
a. Will there be significant changes in technological attitudes (comfort, efficacy/confidence, interest) and mental well-being following the 2-week exposure using SilverPad?
b. What would be the magnitude of change in technological attitudes and mental well-being following the 2-week exposure to using SilverPad?
c. What are the participants' perceptions (usability and acceptability) towards the use of SilverPad?

Based on the relevant past research, we hypothesized that there would be positive effects on participants' technological attitudes and mental well-being post-training.

Table 1. Summary of participant's demographics and tablet usage

Participant ID	Age (years)	Gender	Ethnicity	Language	Education (years)	Occupational status	Marital status	Visuomotor Issues	Live alone	Tablet usage (over 2 weeks)	(average time)
P01	79	Female	Chinese	Mandarin	0	Retired	Married	None	No	6-7 days weekly	>1 hour per use
P02	84	Male	Chinese	Mandarin	0	Retired	Married	Trembling hands	No	6-7 days weekly	>1 hour per use
P03	78	Female	Chinese	Mandarin	0	Retired	Single	None	Yes	3-5 days weekly	30-60 min per use
P05	74	Female	Chinese	English	10	Working part-time	Widowed	Cataract surgery	Yes	3-5 days weekly	>1 hour per use
P06	74	Female	Chinese	English	10	Retired	Married	None	No	1-2 days weekly	30-60 min per use
P07	68	Female	Chinese	Mandarin	6	Retired	Married	Presbyopia	No	6-7 days weekly	>1 hour per use
P08	78	Male	Chinese	Mandarin	2	Retired	Married	None	No	6-7 days weekly	>1 hour per use
P10	74	Female	Chinese	English	10	Retired	Married	Cataract surgery	No	6-7 days weekly	20-30 min per use
P11	83	Male	Chinese	Mandarin	12	Retired	Married	Cataract	No	3-5 days weekly	30-60 min per use
P12	80	Female	Chinese	Mandarin	9	Retired	Married	Cataract	No	6-7 days weekly	20-30 min per use
P13	74	Female	Chinese	English	10	Retired	Married	None	No	6-7 days weekly	>1 hour per use
P14	74	Female	Chinese	English	10	Working part-time Others	Divorced	None	No	3-5 days weekly	20-30 min per use
P15	62	Female	Malay	English	9	Married	Married	Myopia	No	3-5 days weekly	30-60 min per use
P16	72	Male	Chinese	English	10	Retired	Married	Myopia	No	6-7 days weekly	>1 hour per use

Note. Data from P04 and P09 were excluded due to attrition and non-usage of tablet respectively.

METHODS
Study design
A single-group, mixed-methods, pre–post study design was employed to assess the feasibility, acceptability, and perceptions towards SilverPad from target older adult users in Singapore. The choice of the 2-week tablet exposure was justified due to the focus of the study towards feasibility and receptivity (rather than cognitive intervention purpose), which corresponds to some other feasibility studies that adopted brief training exposure (e.g., one demo session in Beer et al., 2017; 2-week training reported in Jay & Willis, 1992) although there exists wide variation in the duration.

Participant recruitment and sample size
A total of 16 community-dwelling target older adults were recruited who fulfilled the criteria of (1) aged 60 and above residents in Singapore, (2) cognitively healthy, (3) having little or no familiarity with tablets/ computers (eg. not using game apps). Participant recruitment was done through convenience and snowball sampling from collaboration with a senior care centre and by word of mouth. The sample size was also deemed to be acceptable for qualitative research purposes based on the conventionally recommended number of 12 to reach thematic saturation (Boddy, 2016).

Procedures
If the participant was agreeable to take part in the study, the research team would arrange for a session to go through a briefing with the participant as well as informed-consent taking, before commencing the interview session. The participants would be informed that the interview session would be recorded for the purpose of transcription and analysis.

At the pre-test, the research team would go through the survey instruments and semi-structured interviews with the participant on his/her perceptions towards tablet use. After which, participants would be provided with SilverPad tablet (on loan from SilverActivities) and recommended to engage in playing the games/activities on SilverPad daily (20-25 mins/day) for 2 weeks. The researcher would demo to the participants how to use SilverPad.

At the conclusion of 2 weeks, post-study surveys and interviews would be carried out on participants' perception towards SilverPad, including feasibility and acceptability. At the completion of the study, participants would be given a $20 gift voucher as a token of appreciation and the tablet would also be collected back.

Measures
a. Interview protocol and questions

b. Survey instrument 1: Attitudes toward Tablets (Adapted from Attitudes toward Computers Questionnaire with "computer" being replaced with "tablet" and inclusion of 3 of the relevant components for the purpose of this study i.e., Comfort, Efficacy, and Interest; Jay & Willis, 1992)
c. Survey instrument 2: WHO Well-Being Index (Topp et al., 2015)

Data analysis
The transcripts of the qualitative interviews were analysed using the Dedoose software (https://www.dedoose.com/) for thematic coding. The emerging themes were extracted into Excel and further reorganized and refined. The quantitative analyses for the survey instruments were performed using paired-sample t-test considered to be robust for a small sample (De Winter, 2013).

RESULTS
Usability
Usability was evaluated in regard to whether SilverPad was easy to use, easy to remember use, and easy to learn to use (*Table 1*).

Ease of use
Most of the participants (12 out of 14) thought that SilverPad had been easy to use to a greater extent. Participants commented that SilverPad was *"very straightforward"*, *"quite simplified and easy to learn"*, and *"nice to use"*. Nine participants further mentioned that it was not hard to remember how to use SilverPad. A majority of the participants (10 out of 14) reported that it did not require a lot of effort to learn how to use SilverPad. Example quotes:
"It's actually a simplified tablet already, considered for elderly, because most of the things are easy to manage ah [sic]." (P06)
"Sometimes I forget, but I roughly know from here." (P05)
"I think quite minimum effort ah [sic]… As long as you know the basic and then you just explain some of the things should be fine." (P14)

Within the minority, a few mentioned that it was more effortful for them depending on the types of games/contents. One depended on a volunteer's support to engage her in using SilverPad during home visits, while one occasionally forgot how to navigate on her own. This reflects some individual variation in participants' capability among a few who might need more individualized support. Example quote:
"If there are no teachers, then games like bingo are a lot easier to understand. The other games are a lot harder…My memory just not good so I required a lot of effort." (P11)

Senior-friendly user interface

Table 2. Outcome measures before and after 2-week tablet use (n = 14)

Measures	Before	After	t	p (one-tailed)	df	Effect size (Cohen's d)
Attitudes toward Tablets						
Comfort	16.29 ± 3.95	19.43 ± 4.40	-2.65	**0.01****	13	0.71
Efficacy	19.14 ± 3.23	19.79 ± 3.68	-0.50	0.31	13	0.13
Interest	20.21 ± 2.64	21.29 ± 3.22	-1.77	0.05	13	0.47
WHO-5 Well-being Index	15.43 ± 7.29	18.71 ±5.25	-1.93	**0.04***	13	0.52

Date presented as mean ± standard deviation
Note. *p < .05, **p < .01

In the same vein, some participants elaborated that the user interface of SilverPad was senior-friendly. The participants appreciated the game variety, big display and font, intuitive user interface, and relative ease to navigate within Silver-Pad. Example quote:
"The user interface is also very simple. It's not complicated…Unlike phones that is more complicated." (P08)

Contrastingly, a few of the participants revealed that they learned through trial and error in exploring the games/contents on SilverPad. Example quote:
"You know ah, some are quite easy, some just trial and error lor [sic], so I begin to find out how to do it ah." (P14)

Acceptability
Acceptability was evaluated in regard to how SilverPad was received by the users in terms of satisfaction, perceived benefits, effectiveness, and motivation to use.

Enjoyed and satisfied with SilverPad
Most of the participants (12 out of 14) expressed that they had enjoyed using SilverPad. Some clarified that the mental challenge, learning new things, and positive feelings experienced when getting it right as the reasons behind their sense of satisfaction. Example quotes:
"I like to play the game because the game situation is always different (numbers generated are different)… Very fun, it made me happy." (P07)
"Yeah that game very fun… ah quite satisfied, quite a lot new to me, mm [sic]" (P05)

Some of the participants mentioned that the games met their expectations while a few reported not having any expectations, to begin with. Example quote:
"I didn't expect anything, I just take out, open up, eh not bad ah [sic], then you know… it's a recall of your memory and also depend on how the person look at it ah, it can be knowledge also." (P13)

Perceived benefits / usefulness
Most of the participants (13 out of 14) thought that SilverPad could be beneficial in various ways, as summarized in the following sub-themes.

Participants expressed that SilverPad could be useful to help pass the time to stay engaged instead of an inactive lifestyle. Example quotes:
"Otherwise, there's nothing to do. Other you are done with your housework, there is nothing else to do… Tablets are similar to a companion in that sense." (P07)
"It helps to fill my time and make it so I don't think that much." (P03)

Further, participants perceived that SilverPad affords the opportunity to learn new things and train the mind. Participants viewed that Silver-Pad could benefit brain health by keeping the mind active, training the ability to concentrate and remember and staying mentally alert. Example quotes:
"…it works your mind, and then you don't feel like you have dementia or things like that because your mind will start working and you're concentrating on what is there on the tablet so you will think that it's quite interesting and you won't just daze off ah, shall I say." (P06)
"…activate your mind." (P03)

Among other perceived benefits, one participant further stated that SilverPad could be beneficial to help monitor mental performance. Another mentioned that SilverPad could be used as a tool for shared social activities such as learning together with friends. Some highlighted that SilverPad provides a source of enjoyment. Example quotes:
"… I want to know how good my brain, that's an opportunity to know… one thing you can test whether you still alert or not." (P05)
"If you have friends then it can be a social activity for them…learn how to use together also" (P11)
"You feel like you have the enjoyment, and then you have something to look forward when you can enjoy your days playing around." (P06)

Effectiveness
Almost all participants (13 out of 14) acknowledged that SilverPad had been effective in bringing some positive impacts. Similarly, participants' personal experiences of using SilverPad coincided with the themes of perceived benefits. Participants mentioned that it's easier to pass the time, being kept companied and mentally active with SilverPad. Anecdotally, other participants felt that SilverPad helped to enhance their mental

abilities. Example quotes:

"Whenever I'm free I can play so it's good. I'm free almost every day so I can fill these times with the SilverPad." (P12)

"…doesn't have to sleep and can keep playing the tablet, it's better than sleeping for prolonged period." (P02)

"…It's true because I beat the calculator when I'm outside. Although my brain is gradually deteriorating, that's why I like to play this cognitive game…" (P07)

Some participants related that they experienced positive emotions such as feeling *"happy"*, *"entertained"*, *"relaxed"*, and *"cheerful"* from using SilverPad. Example quotes:

"Yeah I very happy [sic]. I so lucky got COVID then I had the tablet… I'm trying to use it…" (P10)

"…makes me feel like you know when you do something right you feel happy, cheerful." (P15)

Other sub-themes mentioned include gaining new knowledge and developing new interests from using SilverPad. Interestingly, a pair of spousal participants even stated improved relationships from being occupied with SilverPad and thus relieved them from spousal frictions.

Motivation

Most participants (13 out of 14) indicated their intention to continue to use SilverPad. Participants stated that they're willing to continue to use SilverPad. Some other participants mentioned their willingness to recommend SilverPad to others. Example quotes:

"I would like to have one also ah [sic]. If I have one also good." (P10)

"Yes I will recommend this to my friends. So they will make use of their time on something that is useful you see…" (P06)

However, participants highlighted some considerations in recommending SilverPad to others. A few thought that cost and individual preference/abilities are important considerations. Example quotes:

"…I will try because most of my friends not quite educated." (P16)

"Everyone has different interests…" (P11)

"…I mean old people no income you know…" (P05)

Opportunities for improvement

Some participants suggested various opportunities for improvements in the use of SilverPad. Hardware-related aspects are beyond the scope (eg. tablet weight, tablet stand, internet access) and hence not presented here. A few participants felt that more training support and instructional guidance could be provided to some users relating to individual capabilities. Example quote:

"I think for now the games must have more instruction I think that's it ah [sic]." (P15)

One participant suggested having all games displayed on one screen. Another mentioned prepping users to deal with auto-update, popups, or adverts from some externally streamed programs, as well as customizable streamed programs for some apps.

On the other hand, some did not see the need for further improvements. Example quote:

"This is very good enough already." (P16)

DISCUSSION

This study set out to explore the feasibility, acceptability, and perceptions towards tablet use specifically SilverPad as a senior-friendly tablet for older adults who are less tech-savvy. The findings add to the understanding of older adults' technological attitudes, mental well-being, and perceptions toward tablet use following brief exposure to SilverPad, as discussed below.

After a 2-week exposure to SilverPad, there was a significant improvement in participants' comfort level with tablet use with a medium effect size (*Table 2*) based on Cohen's conventions (Grice, 2018). This shows that the participants felt much more comfortable with the tablet and their use. It is also noteworthy that participants' interest levels increased slightly but were marginally significant. The interest dimension measures the extent to which the participants are interested in learning about and using tablets. The smaller effect shown for the interest dimension could be attributable to the initially high level of interest at the starting point from the fact that the participants were interested to take part in the tablet study, to begin with. On the other hand, there was no significant difference in participants' sense of efficacy, which taps into their feelings of competence with the tablet in the post-test. Participants' qualitative feedback would provide further insights into this.

Another notable finding was the significant positive effects on participants' mental well-being after the brief exposure to SilverPad, with a medium effect obtained (*Table 2*). This can be further corroborated by the qualitative findings on the positive impacts experienced.

Based on the qualitative findings, the majority of participants appraised SilverPad positively. SilverPad was perceived to have a good level of usability including ease of use with a senior-friendly user interface and easy navigation. Participants also reported that it is easy to remember how to use it as well as to learn how to use SilverPad. Perceived ease of use translates to a low barrier to entry (Charness & Boot, 2016). The senior-friendly tablet would make it easier for older adults to push through the barrier of technological discomfort.

While the majority found SilverPad to be easy to use, to a lesser extent, individual differences exist in their learning strategies and capabilities. This needs to be considered in the approach to reach more widely and effectively older adults who are not tech-savvy. Pertinently, those from the oldest cohort, with low education and low income might need additional support (Hong & Cho, 2017).

Participants overall enjoyed and were satisfied with SilverPad which indicates a high level of acceptability. Many participants viewed the tablet use as beneficial including being a good way to pass time, enabling older adults to learn new things and train their minds, self-monitoring on mental performance, a tool for shared social activity, and a source of enjoyment. In addition to the perceived benefits, the participants recounted the positive impacts experienced including passing time, keeping the mind active, enhancing mental abilities, feeling positive emotions, gaining new knowledge, expanding new interests, as well as improving the relationship.

Correspondingly, a majority of the participants were willing to continue to use the SilverPad tablet. This finding is consistent with the postulation of the Technological Acceptance Model that a person's intention to use new technology is determined by the perceived ease of use and perceived usefulness (Charness & Boot, 2016; Holzinger et al., 2011). Acceptance is also a major factor that determines the participants' willingness to learn something new (Holzinger et al., 2011). Hence, participants' positive perception towards the tablet including ease of use and benefits would relate to their willingness to adopt it consequently.

On the other hand, opportunities for further improvement based on individual differences are also noted. Some users would deem more training support, instructional guidance, further simplified display (eg. showing everything on one page), pre-empting certain tablet behaviors (eg. popups), and more customizable streamed programs to be useful enhancements.

The present findings are preliminary but suggestive of the feasibility and promise of SilverPad that would merit further investigation. The next step could involve an intervention study based on a randomized controlled trial with reasonably larger sample size and standard training protocol (e.g., intervention and control group assignment, longer training period) to evaluate the efficacy of Silver-Pad on cognition. Other outcome measures to establish transfer effects might also be of interest.

Conclusion

Many older adults tend to lag behind in the use of digital technologies but are eager to learn. Providing the opportunity for older adults to try and be exposed to digital technologies could help them overcome their antipathy or apprehension towards the use of technology designed to suit their interests, abilities, and needs.

The current study has shown that most participants found the experience of using SilverPad tablet to be satisfying and positive with demonstrable effects on their level of comfort and well-being. The study has also uncovered further insights on the usability and acceptability of using SilverPad that supports its feasibility to benefit older adults. While there is no perfect technology, SilverPad can serve as a useful case study for other gerontechnologists to consider its design factors in terms of user interface, contents, and content management system as discussed.

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