HOSTED BY unisel UNIVERSITI SELANGOR

Selangor Science &Technology Review
Special Issue: Science and Technology for Society
Vol 5 No 5 (2021)

Towards User Experience Evaluation of Digital Health Technology for Elderly

Nur Farhanum Abdul Aziz[1], Azaliza Zainal[2], Nahdatul Akma Ahmad[3]
[1,2] Faculty of Communication, Visual Arts, and Computing, Universiti Selangor, Bestari Jaya Campus, Selangor
[3]Faculty of Computer and Mathematical Sciences, Universiti Teknologi MARA, Perak Branch, Tapah Campus, Perak
E-mail: [1]farhanum.aziz@gmail.com
[2] azaliza@unisel.edu.my
[3]nahdatulakma@gmail.com

Abstract – The elderly is portrayed as having difficulty using digital health technology and are not competent enough in using the technology. Digital health technologies, such as mHealth, eHealth, and wearable technology, are significant enablers for elderly to live freely at home for a more extended period, close to physical and economic support. However, digital health technology diffusion is still in its early stage in Malaysia, and there is a slow rate of adoption among elderly. Little is known about the perspectives and requirements of elderly when it comes to digital health technologies. More work is needed to assess elderly user experience of using digital health technology for a better-quality digital solution in promoting elderly wellness in Malaysia. This study aims first to identify elements of elderly user experience evaluation in digital health technology from previous work and next is to propose research design strategy for this study. Therefore, this study employs reviewing method of previous scholars articles gathered from two prominent databases, Scopus and WOS. The result of this article will be the research design process and strategies to execute the project in the next phase. These research design process and strategies hope to provide a useful reference for the developers, gerontechnologist and researchers to produce digital health technologies that are useable and tailored to the elderly user's needs.

Keywords: User experience elements; digital health technology; elderly; wellness

1. INTRODUCTION

Broadly defined, digital health technology refers to collecting, sharing, and analyzing health data using digital information, data, and communication technologies to improve patient health and health care delivery [1]–[3]. It uses computing platforms, connectivity, software, and sensors. For instance, mobile health (mHealth) apps, web-based healthcare (eHealth), wearable devices, sensors, health information technology (HIT), digital therapeutics, personalized healthcare (PHC) and telehealth [3]. These technologies span a wide range of uses, from general wellness applications to medical devices, especially for the elderly. Digital health technologies are significant enablers for elderly to live freely at home for a more extended period, close to physical and economic support [4]–[6]. However, digital health technology diffusion is still in its early stage in Malaysia, and there is a slow rate of adoption among elderly. When it comes to digital health technologies, little is known about the perspectives and needs of the elderly. More work is needed to assess elderly user experience of using digital health technology for a better-quality digital solution in promoting elderly wellness in Malaysia.

The elderly in Malaysia is identified as those who are 60 years old and above [7]. Like many other countries worldwide, Malaysia is also experiencing the rapid growth of elderly due to declining fertility and longer life expectancy [8]. However, elderly are portrayed as having trouble grasping and adopting the use of digital health technology [9]. A solution to this issue has emerged to evaluate user experience elements of digital health technologies. Policies supporting digital health technology have been adopted in recent years [10]. According to [11], user experience (UX) has been identified as a key component of good practice in digital health technology development. User experience (UX) becomes a vital factor in adopting these digital health technologies, as the people who need to use them may have problems when using any digital health technology for their health conditions, particularly the elderly. The term "user experience" was created by [12], which describes the importance of user-centered designs in which design concepts are solely based on user needs and desires. On the other hand, user experience is defined as an extension of usability (efficiency, effectiveness, satisfaction) by adding affect and emotions [13]. User experience and usability elements are considered important because of their role in helping design and evaluate interfaces and technical systems for digital health technologies that are suitable and tailored to the elderly user needs [14].

2. RELATED WORK

According to several established papers, there are a lot of studies about digital health technology [1]–[6]. Digital health technology has been advocated as a solution for improving health care quality, cost, and safety [3]. A comprehensive systematic literature review (SLR) was conducted throughout this research. Scopus and Web of Science (WoS) are selected as the databases. [15], [16] stated that Scopus and Web of Science (WoS) are two of the most often leading databases for systematic literature reviews. After all the SLR steps have been carried out, 29 articles related to user experience and usability of digital health technology were eligible for review. All 29 eligible articles were analyzed using thematic analysis. As a result, four elements that prominent emerged from the articles that were chosen. The elements are efficiency, effectiveness, satisfaction, and learnability. Firstly is efficiency. For any digital health technology to be acceptable by elderly, they had to be efficient and flexible with elderly needs [17]. For example, flexible scheduling allows elderly users to personalize the app and

offers to change medication dosage that helps suit their needs, such as a medication reminder app [18]. Besides that, digital health technology user interface (UI) features are the most crucial issues discussed by the researchers. Any application interfaces should be designed tailored to elderly user preferences, such as using more oversized buttons and text, consistent layout, simple font and icon and high contrast colors [18]–[20]. The choice of text is also vital to ensure that the text type is not confusing and that elderly can understand it.

Secondly is effectiveness. All digital health applications should avoid displaying unwanted information that could overload the screen [21] and be effective and made more simpleness for the elderly use. Several papers emphasize the importance of designing digital health technology focusing on simplicity, as this could meet the needs of elderly users [20]. For example, a healthcare website should have a consistent and straightforward home page [22], predictable, and easy to navigate [23]. Also, if there's a login process, it should be made as simple as possible, like do not hide the password and be clear about what username is required [24]. The third element is satisfaction. Good quality content, accessibility, and accurate information will increase elderly interest and satisfaction in using the system [25]. For example, in serious motion-based exercise games, a study from [26] proves that the elderly reduction of pain decreases and may lead to positive effects. Also, elderly can experience sympathetic responses and social satisfaction while playing the games with another person [26]. The last element is learnability. Learnability refers to the ability of systems, programs, and interfaces to quickly become familiar to users, even if they have no prior familiarity with them [27]. Any digital health technology should allow elderly users to control their application successfully through shorts and simple steps in a way that they can learn by themselves [21]. All these four elements are the review from previous work related to elderly user experience elements of digital health technology. These elements may be the guidance to execute project in the next phase.

3. PROPOSED RESEARCH STRATEGY

3.1 Target Participants

There will be approximately 40 elderly participants that will attend the small online workshop. Participants in the elderly category, defined as those aged 60 to 74 years old, will be eligible to participate. The gender of the participants is not highlighted and considered, as this study does not focus on the gender itself. The participants can include both males and females as well as elderly that have no severe cognitive impairments. Also, the participants chosen will be those who have a smartphone and have essential experience in operating a smartphone.

3.2 Research Design Process

This study will comprise of four phases, as depicted in Figure 1. The process contains research planning, user experience evaluation, data analysis and interpretation, and discussion and conclusion. Detailed explanations for each phase are discussed further in the following section.

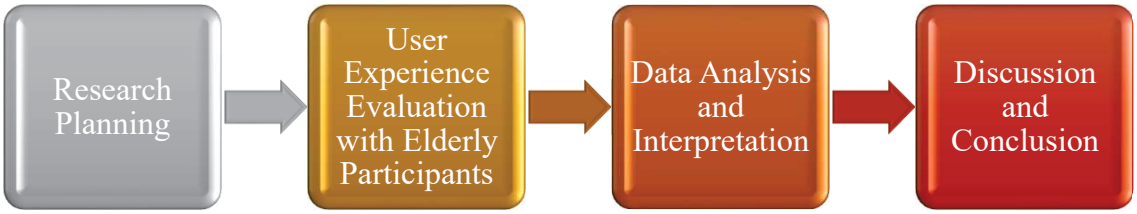

Figure 1: Research Design

1) Research planning: Systematic literature review (SLR) will be conducted to study elderly user experience using digital health technology. This method will be conducted by searching for relevant journals and articles through two established databases, Scopus and Web of Science. First, the researcher identifies relevant articles through databases and screening the title and abstracts of the identified articles that fit the current study. Then, the selected papers were analyzed to determine eligibility. Next, experts will confirm that the eligible selected article was of high quality and finally look for eligible elements of user experience evaluation that may be incorporated into this current study.

2) *User experience evaluation with elderly participants:* In this phase, a case study method will be used for implementing user experience evaluation with the elderly users. A small online workshop will be conducted using a focus group approach to demonstrate the use of digital health technology to elderly. Next, the elderly users will be interviewed using semi-structured interview to obtain elderly user experience in using digital health technologies. There will be about eight small online workshop which consists of four to five members. The small online workshop will be run through an online platform. Snowball sampling and purposive sampling will be used throughout this study to ensure a sufficient number of participants.

3) Data analysis and interpretation: The third phase will be focusing on analyzing the data collected during the previous phase. The triangulation of qualitative data collection through focus group and semi-structured interview will be analyzed verbatimly using thematic analysis to produce the themes. Following thematic analysis, the expert review will also be conducted in this phase. The experts will review the user experience evaluation elements that are proposed in this study. This study will employ experts from the following categories; elderly users, gerontechnologist, and clinicians. Experts are essential in deciding which elements of user experience is advisable for the elderly.

4) *Discussion and conclusion:* Finally, the development of user experience evaluation elements for digital health technology will be the result of this study. These user experience evaluation elements are expected to provide useful resources for the developers, gerontechnologists, and researchers to produce digital health technologies that are usable and adapted to the needs of elderly users. Results obtained for this study will be presented and reported.

CONCLUSION

User experience has been identified as a key component of good practice in developing digital health technology. It becomes a vital factor in adopting digital health technology, particularly for elderly users. The result of this article is expected to propose planning for the research design strategies to execute the project in the next phase. The result offers several significant contributions for practical purposes and to the body of knowledge. A comprehensive systematic literature review was presented throughout this study period. Several studies from previous work identify elements of elderly user experience for digital health technology. However, more study into the elements of user experience evaluation in digital health technology is highly intriguing to investigate further. These elements of user experience may be helpful for the developers, gerontechnologist and researchers that can be considered in developing digital health technology for older adult users. In conclusion, it is hoped that the result of this article could contribute significantly to the body of knowledge and can act as a sound basis for further research in user experience elements evaluation of digital health technology among elderly. Finally, the researcher also hopes that this research design strategy will lead to the development of elderly user experience elements in digital health technologies that are usable and adaptable to the needs of elderly users in future.

ACKNOWLEDGEMENT

This work is supported by the Fundamental Research Grant Scheme (FRGS) FRGS/1/2020/ICT01/UNISEL/03/1

REFERENCES

[1] A. Sharma *et al.*, "Using Digital Health Technology to Better Generate Evidence and Deliver Evidence-Based Care," *J. Am. Coll. Cardiol.*, vol. 71, no. 23, pp. 2680–2690, 2018, doi: 10.1016/j.jacc.2018.03.523.

[2] M. P. Turakhia, S. A. Desai, and R. A. Harrington, "The outlook of digital health for cardiovascular medicine: Challenges but also extraordinary opportunities," *JAMA Cardiol.*, vol. 1, no. 7, pp. 743–744, 2016, doi: 10.1001/jamacardio.2016.2661.

[3] D. M. Levine, S. R. Lipsitz, and J. A. Linder, "Trends in seniors' use of digital health technology in the United States, 2011-2014," *JAMA - J. Am. Med. Assoc.*, vol. 316, no. 5, pp. 538–540, 2016, doi: 10.1001/jama.2016.9124.

[4] E. M. Agree, "The potential for technology to enhance independence for those aging with a disability," *Disabil. Health J.*, vol. 7, no. 1 SUPPL, pp. S33–S39, 2014, doi: 10.1016/j.dhjo.2013.09.004.

[5] H. Y. Kao, C. W. Wei, M. C. Yu, T. Y. Liang, W. H. Wu, and Y. J. Wu, "Integrating a mobile health applications for self-management to enhance Telecare system," *Telemat. Informatics*, vol. 35, no. 4, pp. 815–825, 2018, doi: 10.1016/j.tele.2017.12.011.

[6] B. Reeder, E. Meyer, A. Lazar, S. Chaudhuri, H. J. Thompson, and G. Demiris, "Framing the evidence for health smart homes and home-based consumer health technologies as a public health intervention for independent aging: A systematic review," *Int. J. Med. Inform.*, vol. 82, no. 7, pp. 565–579, 2013, doi: 10.1016/j.ijmedinf.2013.03.007.

[7] "Department of Statistics Malaysia Official Portal," 2020. https://www.statistics.gov.my/index.php?r=column/cone&menu_id=dDM2enNvM09oTGtQemZPVzRTWENmZz09 (accessed Mar. 23, 2021).

[8] A. E. Roberts, T. A. Davenport, T. Wong, H. W. Moon, I. B. Hickie, and H. M. LaMonica, "Evaluating the quality and safety of health-related apps and e-tools: Adapting the Mobile App Rating Scale and developing a quality assurance protocol," *Internet Interv.*, vol. 24, 2021, doi: 10.1016/j.invent.2021.100379.

[9] L. Knox *et al.*, "Using the Technology Acceptance Model to conceptualize experiences of the usability and acceptability of a self-management app (COPD.Pal®) for Chronic Obstructive Pulmonary Disease," *Health Technol. (Berl).*, vol. 11, no. 1, pp. 111–117, 2021, doi: 10.1007/s12553-020-00494-7.

[10] X. Sun *et al.*, "Internet use and need for digital health technology among the elderly: A cross-sectional survey in China," *BMC Public Health*, vol. 20, no. 1, pp. 1–8, 2020, doi: 10.1186/s12889-020-09448-0.

[11] B. C. Zapata, J. L. Fernández-Alemán, A. Idri, and A. Toval, "Empirical Studies on Usability of mHealth Apps: A Systematic Literature Review," *J. Med. Syst.*, vol. 39, no. 2, pp. 1–19, 2015, doi: 10.1007/s10916-014-0182-2.

[12] D. Norman, *The Design of Everyday Things*. 2016.

[13] L. M. Contreras-Somoza *et al.*, "Usability and User Experience of Cognitive Intervention Technologies for Elderly People With MCI or Dementia: A Systematic Review," *Front. Psychol.*, vol. 12, no. April, pp. 1–15, 2021, doi: 10.3389/fpsyg.2021.636116.

[14] V. P. Cornet *et al.*, "Untold stories in user-centered design of mobile health: Practical challenges and strategies learned from the design and evaluation of an app for older adults with heart failure," *JMIR mHealth uHealth*, vol. 8, no. 7, pp. 1–14, 2020, doi: 10.2196/17703.

[15] M. Gusenbauer and N. R. Haddaway, "Which academic search systems are suitable for systematic reviews or meta-analyses? Evaluating retrieval qualities of Google Scholar, PubMed, and 26 other resources," *Res. Synth. Methods*, vol. 11, no. 2, pp. 181–217, 2020, doi: 10.1002/jrsm.1378.

[16] A. Martín-Martín, E. Orduna-Malea, M. Thelwall, and E. Delgado López-Cózar, "Google Scholar, Web of Science, and Scopus: A systematic comparison of citations in 252 subject categories," *J. Informetr.*, vol. 12, no. 4, pp. 1160–1177, 2018, doi: 10.1016/j.joi.2018.09.002.

[17] H. Hawley-Hague *et al.*, "Smartphone apps to support falls rehabilitation exercise: App development and usability and acceptability study," *JMIR mHealth uHealth*, vol. 8, no. 9, 2020, doi: 10.2196/15460.

[18] S. Chew, P. S. M. Lai, and C. J. Ng, "Usability and utility of a mobile app to improve medication adherence among ambulatory care patients in Malaysia: Qualitative study," *JMIR mHealth uHealth*, vol. 8, no. 1, 2020, doi: 10.2196/15146.

[19] E. Brox, S. T. Konstantinidis, and G. Evertsen, "User-centered design of serious games for older adults following 3 years of experience with exergames for seniors: A study design," *JMIR Serious Games*, vol. 5, no. 1, pp. 1–14, 2017, doi: 10.2196/games.6254.

[20] Y. C. Liu *et al.*, "Design and usability evaluation of mobile voice-added food reporting for elderly people: Randomized controlled trial," *JMIR mHealth uHealth*, vol. 8, no. 9, 2020, doi: 10.2196/20317.

[21] H. M. Salman, W. F. Wan Ahmad, and S. Sulaiman, "Usability Evaluation of the Smartphone User Interface in Supporting Elderly Users from Experts' Perspective," *IEEE Access*, vol. 6, no. c, pp. 22578–22591, 2018, doi: 10.1109/ACCESS.2018.2827358.

[22] J. L. Yeong, P. Thomas, J. Buller, and M. Moosajee, "A Newly Developed Web-Based Resource on Genetic Eye Disorders for Users with Visual Impairment (Gene.Vision): Usability Study," *J. Med. Internet Res.*, vol. 23, no. 1, pp. 1–17, 2021, doi: 10.2196/19151.

[23] P. Elers, I. Hunter, D. Whiddett, C. Lockhart, H. Guesgen, and A. Singh, "User requirements for technology to assist aging in place: Qualitative study of older people and their informal support networks," *JMIR mHealth uHealth*, vol. 6, no. 6, pp. 1–7, 2018, doi: 10.2196/10741.

[24] R. Harte *et al.*, "Human-centered design study: Enhancing the usability of a mobile phone app in an integrated falls risk detection system for use by older adult users," *JMIR mHealth*

uHealth, vol. 5, no. 5, 2017, doi: 10.2196/mhealth.7046.

[25] D. Castilla *et al.*, "Process of design and usability evaluation of a telepsychology web and virtual reality system for the elderly: Butler," *Int. J. Hum. Comput. Stud.*, vol. 71, no. 3, pp. 350–362, 2013, doi: 10.1016/j.ijhcs.2012.10.017.

[26] P. Brauner and M. Ziefle, "Serious motion-based exercise games for older adults: Evaluation of usability, performance, and pain mitigation," *JMIR Serious Games*, vol. 8, no. 2, 2020, doi: 10.2196/14182.

[27] M. K. Moon and S. C. Kim, "Usability evaluation of movement support service robot for elderly," *Adv. Intell. Syst. Comput.*, vol. 486, pp. 517–526, 2017, doi: 10.1007/978-3-319-41685-4_46.