

Evaluation Method of Mobile Health Apps for the Elderly

Nur Ani

Faculty of Computer Science, Universitas Mercu Buana, Jakarta Barat, Indonesia

nur.ani@mercubuana.ac.id

ABSTRACT

Article Info

Volume 6, Issue 4

Page Number : 388-394

Publication Issue :

July-August-2020

Article History

Accepted : 02 Aug 2020

Published : 07 Aug 2020

Mobile health apps usually have a user interface that is difficult for elderly users to understand. With the increase in the number of elder users using applications on mobile phone, research on this area is important to do. This research aim is to present comprehensive review of mobile application evaluation for the elderly. The research methodology adapted PRISMA method to find and review relevance research articles in order to reach research goal. Based on literature study, we found three methods or models that have been applied for elderly user usability evaluation, including usability heuristics, system usability scale and technology acceptance model.

Keywords: User Interface Design, Mobile Application, Elderly People

I. INTRODUCTION

The development of information and communication technology (ICT) has begun since the end of 1990. This phenomenon is supported by developments in the field of telecommunications, especially wireless technology. The existence of ICTs has an impact on all sectors because ICTs have the benefit of increasing efficiency and effectiveness. In addition, ICTs encourage innovation and change the working paradigm [1]–[3].

Telephone technology is one of innovation of wireless technology which is advancing with new hardware and software features. By using a cellphone, we can access many complete application services to support our daily activities [4]–[6].

The combination of telephone equipment and internet technology has led to the development of the smartphone era. Each smartphone offers the latest applications to provide a new experience for its users.

However, the use of mobile devices for elderly people is very limited. They usually use cellphones only to make phone calls and send short messages. This happens because the interface of the device is not adjusted to the needs and ability of the elderly to use and explore more about the services in the device [2], [7].

With the increase in the number of elder users using smartphone applications, research related to the user interface is important. Every application that is designed for elderly users' needs special adjustments

so that it can be easily and conveniently operated by elderly users [8]–[10].

Based on background above, this research proposed a survey of methodology or technique that is used for user interface usability evaluation to design mobile application for elderly people. It can help to mobile apps evaluation for senior citizens.

II. LITERATURE REVIEW

Many research has been done in research area of mobile apps for the elderly. In this research we attempted to focus on area mobile application evaluation for elderly people that is defined below.

A. Mobile Application Evaluation

However, when compared to desktop computers, mobile devices have disadvantages such as limitations in the screen, input-output mechanism, battery and so on. Therefore, to get effective and efficient use of mobile devices, special evaluations for mobile devices are needed [11].

Aside from the physical aspects of mobile devices, mobile users also need to be evaluated. Evaluation can be in the form of how users respond to the use of mobile devices when operating an application or other purpose. This feedback is useful for improving and increasing comfort in using mobile applications [11]–[13].

B. Elderly People

Elderly people or senior citizens is similar terminology for expressing older people. While the context of the definition of the term "older people or elderly people" differs between several countries or regions. For example, there are differences in the age range for elderly people between regions in Africa and Europa. Some regions or countries in developing countries define senior citizens as people who have 65-year age or more. Meanwhile, according to the agreement made by the UN or United Nations, the

age range for senior citizens is a person who has age 60 and above [2], [14], [15].

Age changes affect sensory abilities, but the most influential aspect is the ability of audition and vision (including contrast sensitivity, visual acuity and colour sensitivity. Other research studies suggest that the ability to remember and reason information for elderly people also decreases [16]–[18].

III. METHODOLOGY

This section will discuss detail of research phases including the method and its explanation.

In this research, we have four research phase to reach research aim, including identification, screening, eligibility and inclusion criteria. These phases are adapted from the systematic review method known as Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA).

The PRISMA is a method introduced by Moher et al. in 2005 which is used to review scientific articles in the medical field [19]–[21].

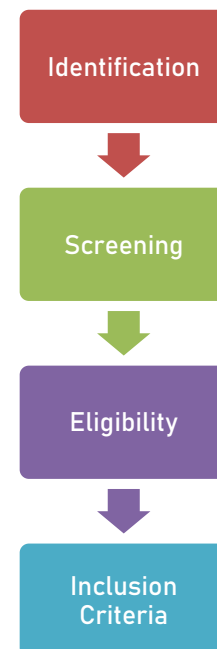


Figure 1. Research phase

Based on Figure above, the explanation of every phases is elaborated below [19]–[21]:

1. The phase "identification" is the stage to determine the possibility of the main keywords used to search for scientific articles in the database of scientific research relating to our study in general.
2. Phase namely "screening" is the stage to determine scientific articles that fit the scope of the study by considering search criteria and research questions.
3. The "eligibility" phase is the stage to examine the article content fairly deeply by paying attention to all components in the article including the title, abstract, method, research results, conclusion.
4. The last phase called "inclusion criteria" is the stage to determine which articles will be used in a systematic review or not.

IV. RESEARCH RESULT

Based on literature study, we found several methods that is used to user interface usability evaluation for elderly. We observed research study from 2011 until 2020 from reputable research database.

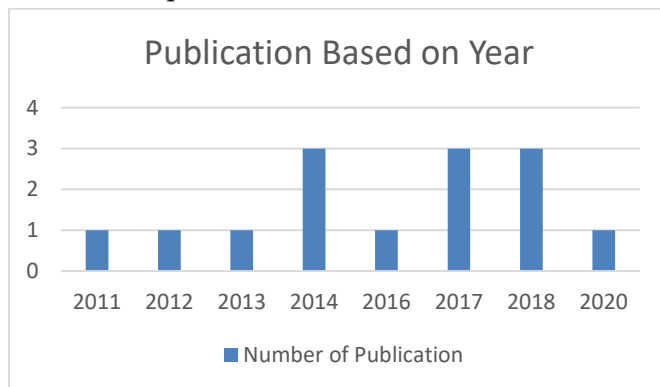


Figure 2. Research distribution based on year

In this research, we found fifteen related-articles which is classified into method used namely Heuristic Approach, System Usability Scale and Technology Acceptance Model. We depicted statistical data of publication based method used in graph below.

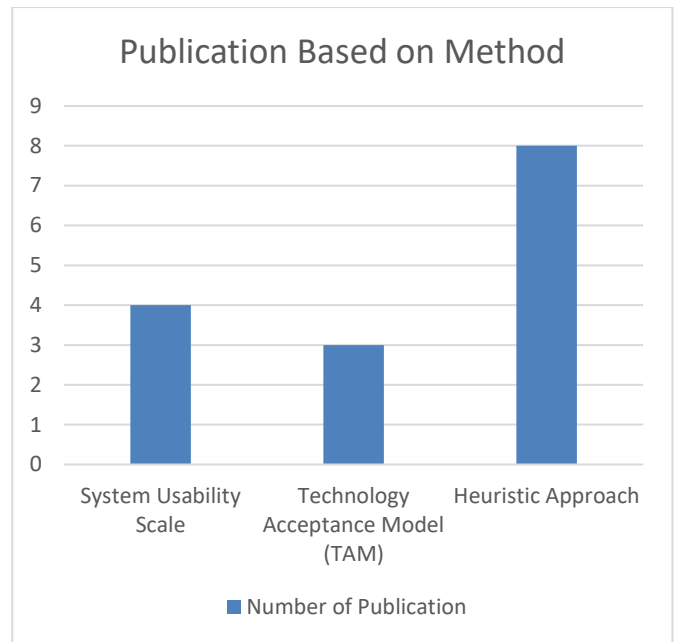


Figure 3. Research distribution based on method

To answer what is method used for mobile application evaluation of elderly people, we attempted to summarize result in Table below. The title of "what tool or approach" on the table means what is approach, tool or method applied in previous research to evaluate mobile application, for example Heuristic Approach, System Usability Scale and Technology Acceptance Model.

TABLE I. DATA OF RESEARCH PAPER

Authors	Ref.	Year	What tools/ approach?
(Isaković et al. 2016)	[18]	2016	System Usability Scale
(Jia et al. 2013)	[22]	2013	System Usability Scale
(MacIs et al. 2020)	[8]	2020	System Usability Scale
(Pyae et al. 2017)	[23]	2017	System Usability Scale
(ALsswey, Bin	[24]	2018	Technology

Authors	Ref.	Year	What tools/ approach?
Umar, and Bervell 2018)			Acceptance Model (TAM)
(Wen, Cheng, and Chang 2017)	[7]	2017	Technology Acceptance Model (TAM)
(Ling et al. 2017)	[9]	2017	Technology Acceptance Model (TAM)
(Marin et al. 2011)	[25]	2011	Heuristic Approach
(Al-Razgan, Al- Khalifa, and Al- Shahrani 2014)	[26]	2014	Heuristic Approach
(Salman, Wan Ahmad, and Sulaiman 2018)	[10]	2018	Heuristic Approach
(Salman, Ahmad, and Sulaiman 2018)	[27]	2018	Heuristic Approach
(Hermawati and Lawson 2016)	[28]	2016	Heuristic Approach
(Watkins et al. 2014)	[29]	2014	Heuristic Approach
(Silva, Holden, and Nii 2014)	[30]	2014	Heuristic Approach
(Inostroza et al. 2012)	[31]	2012	Heuristic Approach

To present review of every method used, we attempted to elaborate it respectively as below.

A. System Usability Scale

System usability scale is one of method to evaluate mobile apps usability based on feedback from users [32]. This method contained 10 (ten) simple statements of questionnaire to usability quickly with limited respondents [33]. The item of questionnaire is listed below.

No.	Original Item
1	I think that I would like to use this system.
2	I found the system unnecessarily complex.
3	I thought the system was easy to use.
4	I think that I would need the support of a technical person to be able to use this system.
5	I found the various functions in the system were well integrated.
6	I thought there was too much inconsistency in this system.
7	I would imagine that most people would learn to use this system very quickly.
8	I found the system very cumbersome to use.
9	I felt very confident using the system.
10	I needed to learn a lot of things before I could get going with this system.

Figure 4. The questionnaire item of SUS [32]

Example of the used System Usability Scale (SUS) for evaluation mobile apps of elderly people is proposed by Isaković at al (2016). The reason of System Usability Scale (SUS) selection for research because this method has been used in many research articles and industry purposes [18]. The example result of SUS measurement is depicted below.

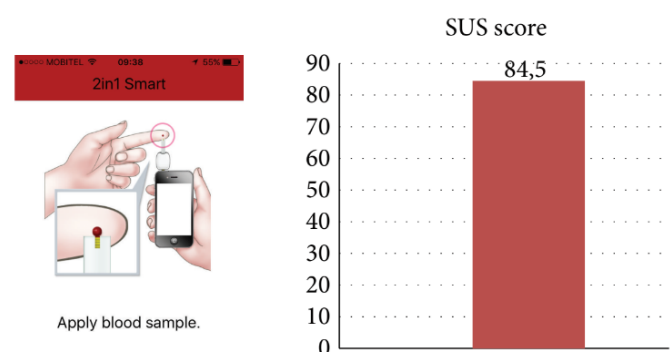


Figure 5. Example of SUS score result

B. Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM) is employed to evaluate intention to use of application. It contained 21 items with the following 4 main subjects: perceived usefulness of the technology, attitude toward using the technology, perceived ease of use and intention to use the technology. For rating feedback result, we can used 7-point Likert scale from -3 (strongly disagree) to 3 (strongly agree) [9]. Example research to evaluate mobile apps is conducted by Wen et al. (2017). This research

describes the mobile smartphones application usability evaluation by utilizing Technology Acceptance Model (TAM). TAM itself contained four main dimension including cognitive usability, willingness to use, cognitive ease of use and attitude. The participant of this research is 41 elderly people [7], [34].

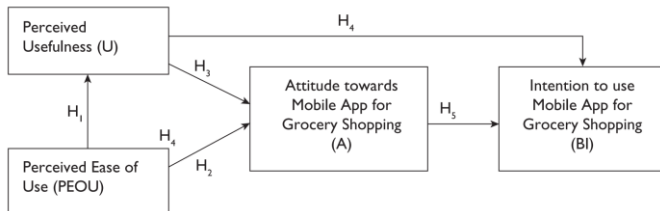


Figure 6. Example of technology acceptance towards grocery shopping using mobile applications [35]

C. Heuristic Approach

The usability heuristic evaluation technique in case of elderly adults can relate to the identified usability issues that would be found by elderly people when using user interface of smartphone's application [10]. Many studies have been completed in usability heuristic evaluation for elderly user of mobile phone [25], [26], [10], [27], [28], [29], [30] and [31]. Overall, every research study presents usability issues of elderly people when using mobile application.

One of heuristic approach referred for many research is SMASH or **SM**Artphone's **uS**ability **H**euristics for mobile applications. This method is developed based on Touchscreen-based Mobile Devices (TMD). SMASH consisted of 12 heuristics that are depicted in Figure below [10].

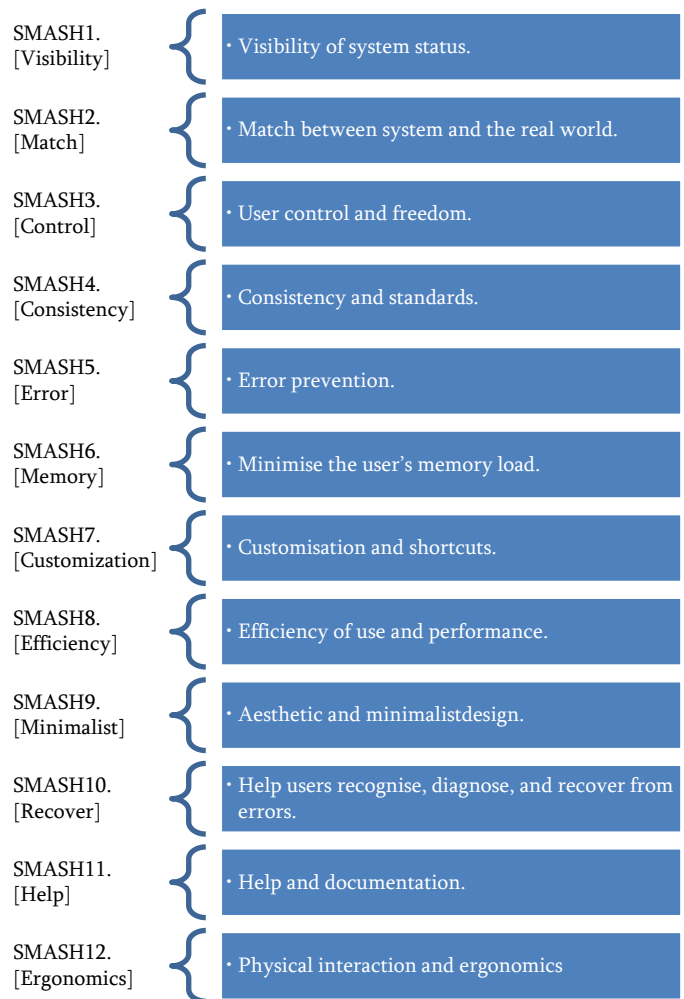


Figure 7. Twelve heuristics in SMASH [10]

V. CONCLUSION

This research aim is to conduct systematic review of mobile application evaluation method for the elderly research articles. This is important to support of application improvement in order to simplify elderly users in using mobile application. The research methodology adapted PRISMA method. As many fifteen relevant articles was identified for systematic literature review. In conclusion, we found three methods or models that have been applied for elderly user usability evaluation, including usability heuristics, system usability scale and technology acceptance model.

VI. REFERENCES

- [1] D. Fitriyah, A. N. Hidayanto, R. A. Zen, and A. M. Arymurthy, "APDATI: E-Fishing Logbook for Integrated Tuna Fishing Data Management," *J. Theor. Appl. Inf. Technol.*, vol. 75, no. 2, 2015.
- [2] F. J. García-Peñalvo, M. Á. Conde, and V. Matellán-Olivera, "Mobile apps for older users - The development of a mobile apps repository for older people," *Lect. Notes Comput. Sci. (including Subser. Lect. Notes Artif. Intell. Lect. Notes Bioinformatics)*, vol. 8524 LNCS, no. PART 2, pp. 117–126, 2014.
- [3] Y. G. Sucahyo, Y. Y. Rotinsulu, A. N. Hidayanto, D. Fitriyah, and K. Phusavat, "Software as a service quality factors evaluation using analytic hierarchy process," *Int. J. Bus. Inf. Syst.*, vol. 24, no. 1, pp. 51–68, 2017.
- [4] H. Noprisson, E. Hidayat, and N. Zulkarnaim, "A Preliminary Study of Modelling Interconnected Systems Initiatives for Preserving Indigenous Knowledge in Indonesia," in *2015 International Conference on Information Technology Systems and Innovation (ICITSI)*, 2015, pp. 1–6.
- [5] H. Noprisson, N. Husin, M. Utami, Puji Rahayu, Y. G. Sucahyo, and D. I. Sensuse, "The Use of a Mixed Method Approach to Evaluate m-Government Implementation," in *2016 International Conference on Information Technology Systems and Innovation (ICITSI)*, 2016.
- [6] E. Hidayat, Lukman, H. Noprisson, D. I. Sensuse, Y. G. Sucahyo, and E. D. Putra, "Development of mobile application for documenting traditional knowledge in Indonesia: A Case Study of Traditional Knowledge in Using Medicinal Plant," in *Proceedings - 14th IEEE Student Conference on Research and Development: Advancing Technology for Humanity, SCORed 2016*, 2017.
- [7] T. Wen, P. Cheng, and P. Chang, "Evaluate the Usability of the Mobile Instant Messaging Software in the Elderly," *Stud. Health Technol. Inform.*, no. 245, pp. 818–822, 2017.
- [8] S. MacIs et al., "Design and Usability Assessment of a Multi-Device SOA-Based Telecare Framework for the Elderly," *IEEE J. Biomed. Heal. Informatics*, vol. 24, no. 1, pp. 268–279, 2020.
- [9] Y. Ling, L. P. Ter Meer, Z. Yumak, and R. C. Veltkamp, "Usability Test of Exercise Games Designed for Rehabilitation of Elderly Patients After Hip Replacement Surgery: Pilot Study," *JMIR Serious Games*, vol. 5, no. 4, p. e19, 2017.
- [10] 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, pp. 22578–22591, 2018.
- [11] S. Caro-Alvaro, E. Garcia-Lopez, A. Garcia-Cabot, L. De-Marcos, and J. M. Gutierrez-Martinez, "A Systematic Evaluation of Mobile Applications for Instant Messaging on iOS Devices," *Mob. Inf. Syst.*, pp. 1–17, 2017.
- [12] S. L. Lim, P. J. Bentley, N. Kanakam, F. Ishikawa, and S. Honiden, "Investigating country differences in mobile app user behavior and challenges for software engineering," *IEEE Trans. Softw. Eng.*, vol. 41, no. 1, pp. 40–64, 2015.
- [13] K.-W. Hsu, "Efficiently and Effectively Mining Time-Constrained Sequential Patterns of Smartphone Application Usage," *Mob. Inf. Syst.*, 2017.
- [14] J. Graham, "Elderly' No More. The New Old Age - Caring and Coping," *The New York Times*, 2012.
- [15] World-Health-Organization, "Project on Minimum Data Set for Ageing in Africa," 2002.
- [16] B. Schneider and M. K. Pichora-Fuller, "Implications of sensory deficits for cognitive aging," in *The Handbook of Aging and*

- Cognition, Mahwah: Lawrence Erlbaum Associates, 2000, pp. 155–219.
- [17] E. D. Mynatt and W. A. Rogers, "Developing technology to support the functional independence of older adults," *Ageing Int.*, vol. 27, no. 1, pp. 24–41, 2001.
- [18] M. Isaković, U. Sedlar, M. Volk, and J. Bešter, "Usability pitfalls of diabetes mHealth apps for the elderly," *J. Diabetes Res.*, vol. 16, pp. 1–9, 2016.
- [19] A. Liberati et al., "The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: explanation and elaboration," *J. Clin. Epidemiol.*, vol. 62, no. 10, pp. e1–34, 2009.
- [20] D. Moher, A. Liberati, J. Tetzlaff, and D. G. Altman, "Systematic Reviews and Meta-Analyses: The PRISMA Statement," *Annu. Intern. Med.*, vol. 151, no. 4, pp. 264–269, 2009.
- [21] R. Mohamed, M. Ghazali, and M. A. Samsudin, "A Systematic Review on Mathematical Language Learning Using PRISMA in Scopus Database," *Eurasia J. Math. Sci. Technol. Educ.*, vol. 16, no. 8, p. em1868, 2020.
- [22] G. Jia et al., "Integration of user centered design in the development of health monitoring system for elderly," in *35th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC)*, 2013, pp. 1748–1751.
- [23] A. Pyae et al., "Lessons Learned from Two Usability Studies of Digital Skiing Game with Elderly People in Finland and Japan," *Int. J. Serious Games*, vol. 16, no. 2, pp. 84–99, 2017.
- [24] A. Alsswey, I. N. Bin Umar, and B. Bervell, "Investigating the acceptance of mobile health application user interface cultural-based design to assist Arab elderly users," *Int. J. Adv. Comput. Sci. Appl.*, vol. 9, no. 8, pp. 144–152, 2018.
- [25] J. G. Marin, E. Lawrence, K. F. Navarro, and C. Sax, "Heuristic evaluation for interactive games within elderly users," in *Proceedings of the 3rd International Conference on eHealth, Telemedicine, and Social Medicine (eTELEMED'11)*, 2011, pp. 130–133.
- [26] M. S. Al-Razgan, H. S. Al-Khalifa, and M. D. Al-Shahrani, "Heuristics for evaluating the usability of mobile launchers for elderly people," *Lect. Notes Comput. Sci. (including Subser. Lect. Notes Artif. Intell. Lect. Notes Bioinformatics)*, vol. 8517 LNCS, no. PART 1, pp. 415–424, 2014.
- [27] H. M. Salman, W. F. W. Ahmad, and S. Sulaiman, "Heuristic evaluation of the smartphone applications in supporting elderly," in *International Conference of Reliable Information and Communication Technology*, 2018, pp. 781–790.
- [28] Hermawati and G. Lawson, "Establishing usability heuristics for heuristics evaluation in a specific domain: Is there a consensus?," *Appl. Ergon.*, vol. 56, pp. 34–51, 2016.
- [29] I. Watkins, B. Kules, X. Yuan, and B. Xie, "Heuristic evaluation of healthy eating apps for older adults," *J. Consum. Heal. Internet*, vol. 18, no. 2, pp. 105–127, 2014.
- [30] P. A. Silva, K. Holden, and A. Nii, "Smartphones, smart seniors, but not-so-smart apps: A heuristic evaluation of fitness apps," in *Proc. Int. Conf. Augmented Cognition*, 2014, pp. 347–358.
- [31] R. Inostroza, C. Rusu, S. Roncagliolo, C. Jiménez, and V. Rusu, "Usability heuristics validation through empirical evidences: A touchscreen-based mobile devices proposal," in *Proc. 31st Int. Conf. Chilean Comput. Sci. Soc. (SCCC)*, 2012, pp. 60–68.
- [32] J. Brooke, "SUS - A quick and dirty usability scale," 1986.
- [33] A. Bangor, P. T. Kortum, and J. T. Miller, "Determining what individual SUS scores mean: Adding an adjective rating scale," *J. Usability*

Stud., vol. 4, no. 3, pp. 114–123, 2009.

- [34] T. Natarajan, S. A. Balasubramanian, and D. L. Kasilingam, "Understanding the intention to use mobile shopping applications and its influence on price sensitivity," *J. Retail. Consum. Serv.*, vol. 37, no. February, pp. 8–22, 2017.
- [35] A. Shukla and S. K. Sharma, "Evaluating Consumers' Adoption of Mobile Technology for Grocery Shopping: An Application of Technology Acceptance Model," *Vision*, vol. 22, no. 2, pp. 185–198, 2018.

Cite this article as :

Nur Ani, "Evaluation Method of Mobile Health Apps for the Elderly", *International Journal of Scientific Research in Computer Science, Engineering and Information Technology (IJSRCSEIT)*, ISSN : 2456-3307, Volume 6 Issue 4, pp. 388-394, July-August 2020. Available at
doi : <https://doi.org/10.32628/CSEIT206469>
Journal URL : <http://ijsrcseit.com/CSEIT206469>