INVESTIGATING USER EXPERIENCE TO REDESIGN USER INTERFACE USING USER-CENTERED DESIGN APPROACH

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ABSTRACT. *User interface (UI) and user experience (UX) are two essential issues closely interrelated to the easiness, satisfaction, and acceptance perspectives of users. It is how the information technology (IT) products are used by users, one of the critical success criteria of product development. However, this product usability seems often to be ignored in the development process. This study was performed to evaluate the usability of a sampled application, to design UI/UX of the application, to investigate the usability of the proposed design, and to compare results of the preliminary usability evaluations with results of the post-design investigation, in the context of user-centered design (UCD) approach. Five study stages were implemented following the four research purposes. Specifically, the usability evaluations were done by employing cognitive walkthrough (CW), system usability scale (SUS) questionnaires, user experience questionnaire (UEQ), and interview techniques. Besides the proposed prototype, the improvements in success, satisfaction, and acceptance rates presented by the comparison between pre-design and post-design usability evaluations were two highlighted findings. These may be one of the reference designs for the system performance improvement and may also be one of the methodological references for others who are interested in a similar research area by considering the research limitations.*
Keywords: UI/UX, User-centered design, Cognitive walkthrough, System usability scale, User experience questionnaires

1. **Introduction.** Besides the product development life cycle and its project life cycle, the usage cycle of the product by users is also an essential issue in IT project management studies [1,2]. It may also be a common tendency that most IT project stakeholders may only focus on how IT products are developed successfully and ignore how to ensure the product is used by users. The use of IT products is often closely related to the easiness, satisfaction, and acceptance perspectives of users. These aspects can be achieved in various ways, including by presenting a good UI/UX [3]. UI/UX are two important issues related to the usability of a product, such as mobile applications. UI design of the applications focused on factors influencing the easiness of its usage [4-6]. While UX is part of the system

that acts as an intermediary between the user and the system so that it can facilitate users to interact with the system efficiently [4-6]. UCD approach is one of the UI/UX design methods focused on how the end-user needs or wants the use of a product [7-9].

The increasing development of technology and Internet users in Indonesia has an impact on various fields [10,11], one of which is the social accident insurance sector [12]. Traffic accidents are a frightening phenomenon [13,14]. Every year, the number of victims of traffic accidents in Indonesia continues to tend to increase [15]. Referring to the National Health Insurance policy [12] and realizing the digital transformation agenda of the Indonesian public insurance company, i.e., Jasa Raharja Insurance [16], the company has developed a mobile service application, namely JRku. The development was carried out to promote excellent service to the Indonesian people so that it can be easier to access the company services. However, the evaluation of the UI/UX aspects of the application is still limited to being carried out by internal parties at the final stage of the project and has not been carried out by a third party.

This research was conducted to investigate the usability of the sampled application, to redesign the UI/UX of the application, to investigate the usability of the proposed design, and to compare results of the preliminary usability evaluations with results of the post-design investigation, in the context of UCD approach [7-9]. Practically, the proposed design may be one of the reference designs for the stakeholders, in terms of system performance improvement. Besides that, the elucidation of research implementation may also be one of the methodological references for scholars in a similar research topic. Sequentially, the following sections of this article describe the methodological points of the study in Section 2, results and its discussions in Section 3, and conclusion descriptions in Section 4.

2. **Research Methods.** This study was implemented in five main stages (Figure 1) using the UCD approach [7-9]. The sampled application was the JRku version 2.1.25, a mobile application developed to help users for accessing information and services around public transport accidents and road traffic in Indonesia. The participants were 15 informants who are involved by considering their key informant characteristics [17]. Specifically, the usability evaluations were carried out within four stages: 1) CW technique was performed
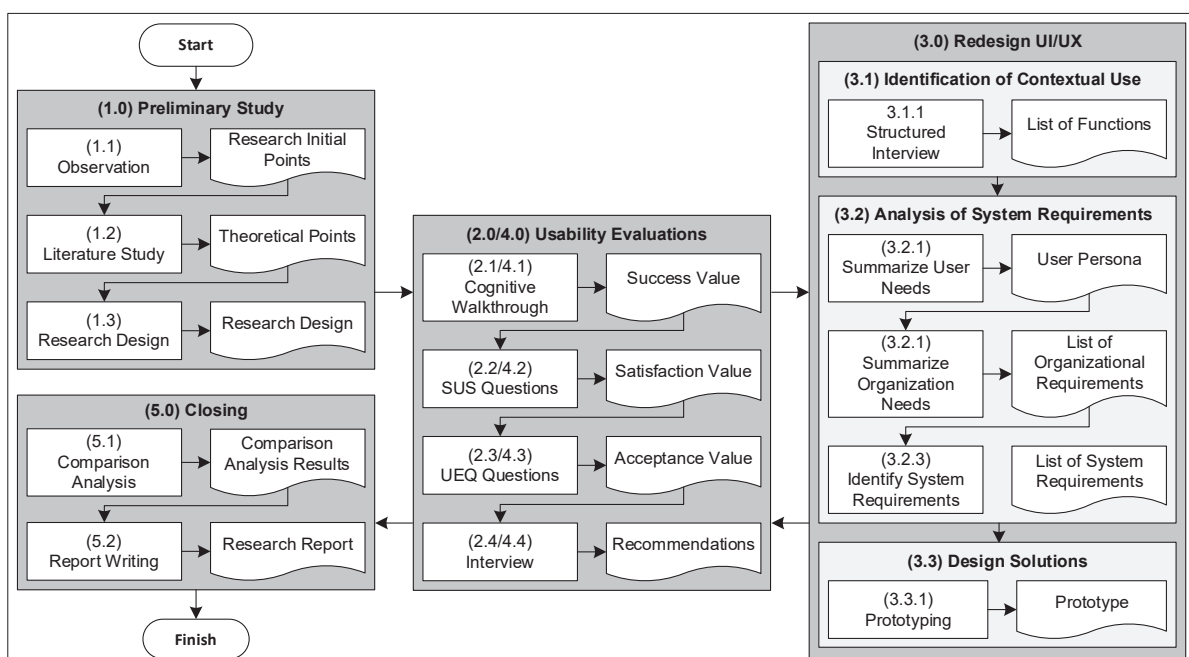

FIGURE 1. Research procedure

TABLE 1. Tasklist of cognitive walkthrough

No.	Tasks
1	Log in to the application
2	Applying for Accident Compensation
3	View the data history for Accident Compensation that has just been made
4	Check the validity period of Mandatory Road Traffic Accident Data Compensation (SWDKLLJ) from new vehicle
5	Delete the vehicle data that was just created from the SWDKLLJ list
6	Use the My Trip feature until click the finish button
7	View the history of the trip data that was recently completed
8	Make an accident report
9	Find SWDKLLJ rate information at the help center
10	Find tips on Caring for Vehicles
11	Update Profile
12	Logout from the application
13	Register for the Free Homecoming program
14	Find the Mobile Service schedule information

by asking participants to do 12 tasks (UE1) and 14 tasks (UE2) (Table 1) to know success rates of UI/UX [18,19], 2) SUS questionnaires with 10 five scale questions [20-22] were proposed into participants for assessing satisfaction rates of UI/UX, 3) UEQ with 26 seven scale questions [23] was used to measure acceptance rates of UI/UX, and 4) Unstructured interview was then employed to find out suggestions of the participants in the last evaluations.

3. **Results and Discussion.** The participants were the experienced users who are dominated by male (9 persons, $\pm 60\%$), 20-30 years (12 persons, $\pm 80\%$), bachelor degree (12 persons, $\pm 80\%$), IT knowledgeable (13 persons, $\pm 87\%$), and skilled using IT (13 persons, $\pm 87\%$). Table 2 presents the first CW, SUS, UEQ evaluations. The UEQ aspects were attractiveness (AT), perspicuity (PE), efficiency (EF), dependability (DE), stimulation (ST), and novelty (NO). Table 3 and Table 4 present suggestions and features of the

TABLE 2. Results of the preliminary CW, SUS, and UEQ evaluations

Person	Task of CW												SUS Score	UEQ Score					
	1	2	3	4	5	6	7	8	9	10	11	12		AT	PE	EF	DE	ST	NO
1	S	P	S	S	S	S	S	S	S	S	S	S	80	0.83	−1.00	0.50	0.00	−0.25	0.00
2	S	P	S	S	S	F	S	P	S	S	S	S	60	−0.33	−2.25	−1.00	−2.50	−1.25	−2.75
3	S	S	S	S	S	S	S	P	S	S	S	S	63	−0.67	−1.25	−1.00	−1.50	−0.50	−0.50
4	S	S	S	P	S	P	S	S	S	S	S	S	68	0.17	−0.50	0.00	−0.25	0.00	−0.25
5	S	S	S	S	S	S	S	P	S	S	S	S	58	−0.17	−0.75	−0.50	−0.50	0.00	−0.50
6	S	S	S	S	S	F	S	P	S	S	S	S	60	0.50	−0.75	0.50	−0.25	−0.25	−0.50
7	S	S	S	P	S	P	S	S	S	S	S	S	63	−0.50	−0.75	0.75	0.00	−0.50	−0.75
8	S	S	S	S	S	S	S	S	S	S	S	S	73	0.17	−0.75	1.25	1.50	0.25	−0.25
9	S	P	S	S	S	S	S	S	S	S	S	S	63	−0.17	−0.25	0.25	−0.25	−0.75	−1.75
10	S	P	S	S	S	S	S	P	S	S	S	S	63	0.50	0.00	0.50	−0.50	0.25	−0.25
11	S	P	S	S	S	S	S	P	S	S	S	S	75	0.83	1.25	0.50	1.00	1.50	1.50
12	S	P	S	S	S	F	S	P	S	S	S	S	65	0.50	−0.75	0.50	0.25	0.50	−0.25
13	S	P	S	P	S	F	S	S	S	S	S	S	73	0.33	−1.00	0.50	0.00	0.50	0.00
14	S	P	S	P	S	F	S	S	S	S	S	S	70	0.50	−0.75	0.75	0.25	0.75	0.00
15	S	S	S	S	S	S	S	S	S	S	S	S	80	1.17	−0.25	0.50	−0.25	0.50	−0.25
Total					90.55%								67.50	0.24	−0.65	0.27	−0.20	0.05	−0.43

Notes: S: Success, P: Partial Success, F: Failed

TABLE 3. Suggestions of the participants

No.	Suggestions
1	Fix popup contents that appeared after entering citizen ID
2	Change the name of the "Accident Info" menu
3	Fix the "Victim name is unlisted" button
4	Add notification to turn on GPS
5	Fix button for adding vehicle data
6	Fix the column to enter the destination of the trip
7	Make the read and unread notification colors more contrast
8	Change the name of "My Trip" and "Online Compensation" to Bahasa Indonesia
9	Put "Help Center" on the profile page
10	Sort dropdown list options alphabetically
11	Distinguish the color between the confirm button "Delete" or "Cancel"
12	Add introduction about the service at the first time entering the application
13	Distinguish the color between the confirmation button "Yes" or "No"

TABLE 4. Features of the application

Features	Functions
Accident compensation SWDKLLJ	Submission of road traffic accident compensation online, check the validity period of SWDKLLJ, and store vehicle data
Accident Report	Road traffic accident reporting
Trip	Record trip data, notification of road accidents, trip directions, and check the SWDKLLJ of the vehicle to be used
Coming Home Trip	Registration for the "Coming Home Trip" program from Jasa Raharja Insurance
Article, Tips Announcements, News	Contain interesting information and news from Jasa Raharja Insurance

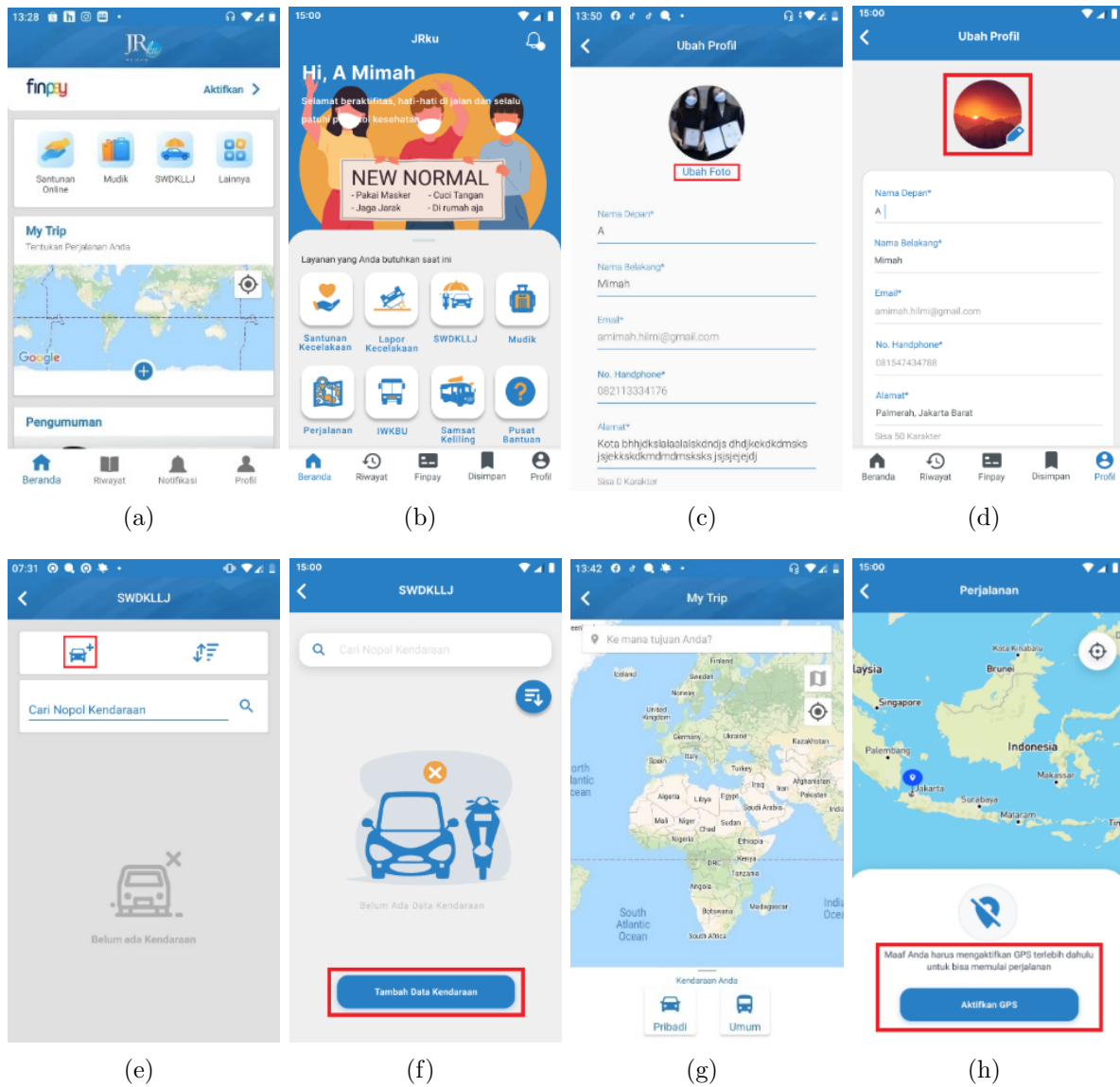

FIGURE 2. The proposed user persona

FIGURE 3. (a) Homepage, (b) the proposed homepage, (c) profile page, (d) the proposed profile page, (e) SWDKLLJ data entry page, (f) the proposed SWDKLLJ data entry page, (g) trip page, and (h) the proposed trip page with GPS activation
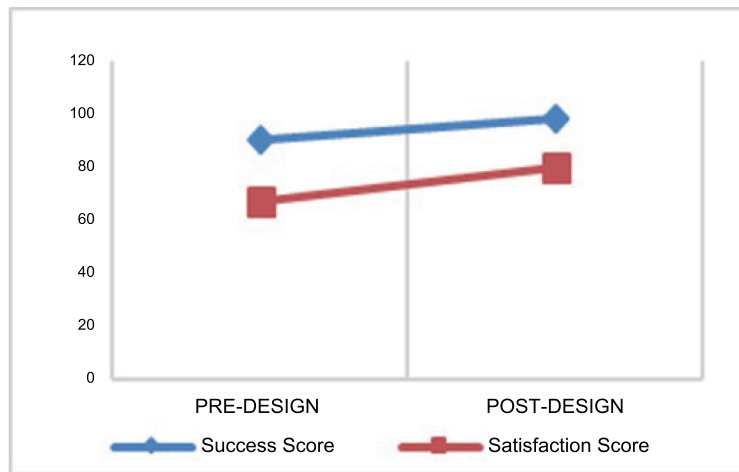
application following an interview with two IT division staff. Figure 2 shows the user persona design referring to the characteristics and needs of the users. The new UI/UX design was then proposed by the results of the first usability evaluations. Figure 3 shows the current UI/UX designs and the proposed ones using local language considering the user's characteristics. Table 5 shows the results of post-design usability investigations.

Figure 4 shows improvements of three UI/UX design aspects, including the success, satisfaction, and acceptance values of the sampled application. The increment of success scores up from around 90.55% (Table 2) in the UI/UX pre-design evaluation to 98.80% (Table 5) in the post-design evaluation and an improvement of the satisfaction rate from 67.50 to 80.17. This shows that the proposed design tended easier to understand to use by users rather than the current version [18,19] and also more satisfying to use [20]. Likewise with the level of user acceptance. Figure 4 shows the comparison of the UEQ scores between the first and second evaluations. In the second evaluation, there was an increase in the value of the six measured aspects. The attractiveness aspect increased from 0.24 to 2.07, the perspicuity aspect increased from −0.65 to 1.48, the efficiency aspect increased
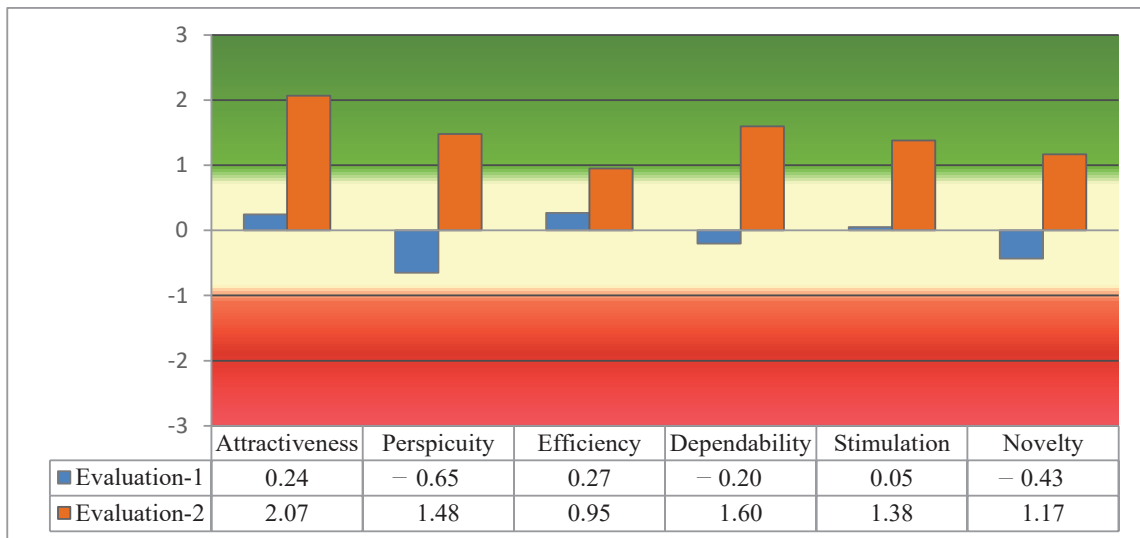
TABLE 5. Results of the post-design usability evaluation (CW, SUS, and UEQ)

Person	Task of CW														SUS Score	UEQ Score					
	1	2	3	4	5	6	7	8	9	10	11	12	13	14		AT	PE	EF	DE	ST	NO
1	S	S	S	P	S	S	S	S	S	S	S	S	S	S	80	1.83	1.25	0.75	1.25	1.00	1.00
2	S	S	S	S	S	P	S	S	S	S	S	S	S	S	90	3.00	1.75	0.75	2.25	2.00	1.25
3	S	S	S	S	S	S	S	S	S	S	S	S	S	S	98	2.67	2.00	1.00	2.00	2.25	1.75
4	S	S	S	S	S	S	S	S	S	S	S	S	S	S	88	2.33	2.50	1.50	2.25	2.00	1.50
5	S	S	S	S	S	S	S	S	S	S	S	S	S	S	78	2.83	2.50	1.50	2.25	2.25	1.25
6	S	S	S	S	S	S	S	S	S	S	S	S	S	S	70	1.67	1.50	0.50	1.75	1.00	0.75
7	S	S	S	S	S	S	S	S	S	S	S	S	S	S	78	3.00	2.75	1.75	1.50	2.00	1.50
8	S	S	S	S	S	S	S	S	S	S	S	S	S	S	78	2.50	1.75	1.50	1.00	1.50	2.25
9	S	S	S	S	S	S	S	S	S	S	S	S	S	S	78	3.00	2.00	1.50	2.25	2.25	1.75
10	S	S	S	S	S	S	S	S	S	S	S	S	S	S	75	0.83	1.00	−0.25	1.25	0.25	0.75
11	S	S	S	S	S	S	S	S	S	S	S	S	S	S	75	2.00	1.50	0.75	2.00	2.00	1.50
12	S	S	S	P	S	S	S	S	S	S	S	S	P	S	78	1.67	1.00	1.00	1.50	1.25	1.25
13	S	S	S	S	S	S	S	S	S	S	S	S	S	S	78	1.67	0.50	0.50	1.00	0.50	0.50
14	S	S	S	S	S	S	S	S	S	S	S	S	P	S	80	1.67	0.25	0.75	0.75	0.25	0.25
15	S	S	S	S	S	S	S	S	S	S	S	S	S	S	83	1.83	0.00	0.75	1.00	0.25	0.25
Total	98.80%														80.17	2.17	1.48	0.95	1.60	1.38	1.17

Notes: S: Success, P: Partial Success, F: Failed

(a)

	Attractiveness	Perspicuity	Efficiency	Dependability	Stimulation	Novelty
■ Evaluation-1	0.24	− 0.65	0.27	− 0.20	0.05	− 0.43
■ Evaluation-2	2.07	1.48	0.95	1.60	1.38	1.17

(b)

FIGURE 4. (a) The success and satisfaction scores; (b) the acceptance scores

from 0.27 to 0.95, the dependability aspect increased from -0.20 to 1.60, the stimulation aspect increased from 0.05 to 1.38, and the novelty aspect increased from -0.43 to 1.17. In short, the easiness, satisfaction, and acceptance aspects of the proposed UI/UX design in the study have refined the three above-mentioned aspects of the current UI/UX version.

In short, the six points described above concerning the four purposes of the study around the usability evaluation towards the current application, the UI/UX design based on results of the pre-design evaluation, the usability investigation of the purposed UI/UX design, and the comparative analysis of both evaluation results. Further, the next high-lighted issues are the evaluation and design processes were carried out based on the UCD [7-9] approach whereas perspectives of the users are its main focus [7-9]. For example, the evaluation criteria used were the performance [18,19], satisfaction [20], and acceptance [23] aspects of the users. However, the findings elucidated in the study may be one of the practical reference designs for the stakeholders. In addition, the research implementation may also be one of the methodological references for scholars who are interested in similar research, of course, they have to consider several study limitations around the sampled participants, methodological points, and interpretative skills used here. The other reasons may also be related to the detailed transparent of the research report. Thus, it is recommended that the above-mentioned limitations may also be one of the references for similar studies.

4. **Conclusions.** UI/UX are two important issues related to the usability of IT products, how the products are easy, satisfying, and accepted by users. However, most IT project stakeholders may only focus on how IT products are developed successfully and ignore how to ensure the product is used by users. While most UI/UX evaluations seem to be carried out by internal parties of the development team, the evaluations are still rare to be done by the external parties. This research was conducted using the UCD approach to evaluate the usability of the sampled application, to design UI/UX of the application, to investigate the usability of the proposed design, and to compare results of the preliminary usability evaluations with results of the post-design investigation. Besides the results may be one of the reference designs for stakeholders of the product development, the research implementation may also be one of the methodological references for others who are interesting in a similar research area in particular. Of course, several limitation issues around the sampled participants, methodological points, and interpretative skills used in the study may also need to be a consideration. Thus, the findings of this study cannot be generalized with the other similar studies. It is recommended that the above-mentioned issues may also be one of the references for future studies.

REFERENCES

[1] W. Y. Wong, C. W. Lee and K. Y. Tshai, A review of quality relationship between IT processes, IT products and IT services, *Proceedings of World Academy of Science, Engineering and Technology*, no.72, p.482, 2012.

[2] A. Subiyakto and A. R. B. Ahlan, A coherent framework for understanding critical success factors of ICT project environment, *International Conference on Research and Innovation in Information Systems (ICRIIS)*, Kuala Lumpur, pp.342-347, 2013.

[3] R. Hartson and P. Pyla, Chapter 1 – What are UX and UX design?, in *The UX Book (Second Edition)*, R. Hartson and P. Pyla, (eds.), Boston, Morgan Kaufmann, 2019.

[4] K. M. P. Escanillan-Galera and C. M. Vilela-Malabanan, Evaluating on user experience and user interface (UX/UI) of EnerTrApp a mobile web energy monitoring system, *Procedia Computer Science*, vol.161, pp.1225-1232, 2019.

[5] A. Subiyakto, V. Adhiazni, E. Nurmiati, N. Hasanati, S. Sumarsono and M. Irfan, Redesigning user interface based on user experience using goal-directed design method, *2020 8th International Conference on Cyber and IT Service Management (CITSM)*, pp.1-6, 2020.

[6] X. Chu and T. Wen, The impact of flow experience on perceived value and user stickiness: Taking competitive games as an example, *International Journal of Innovative Computing, Information and Control*, vol.17, no.5, pp.1775-1790, 2021.

[7] L. M. Kopf and J. Huh-Yoo, A user-centered design approach to developing a voice monitoring system for disorder prevention, *Journal of Voice*, 2020.

[8] P.-H. Huang and M.-C. Chiu, Integrating user-centered design, universal design and goal, operation, method and selection rules to improve theusability of DAISY player for persons with visual impairments, *Applied Ergonomics*, vol.52, pp.29-42, 2016.

[9] M. L. Wong, C. W. Khong and H. Thwaites, Applied UX and UCD design process in interface design, *Procedia – Social and Behavioral Sciences*, vol.51, pp.703-708, 2012.

[10] APJII, Internet survey report APJII 2019-2020 [Q2], *APJII2021*, https://apjii.or.id/survei, 2021.

[11] Kautsarina, A. N. Hidayanto, B. Anggorojati, Z. Abidin and K. Phusavat, Data modeling positive security behavior implementation among smart device users in Indonesia: A partial least squares structural equation modeling approach (PLS-SEM), *Data in Brief*, vol.30, 105588, 2020.

[12] Irwandy and A. C. Sjaaf, Impact of the implementation of the National Health Insurance policy on hospital productivity levels in Indonesia, *Enfermería Clínica*, vol.30, pp.412-415, 2020.

[13] Y.-C. Hsu, Y.-M. Shiu, P.-L. Chou and Y.-M. J. Chen, Vehicle insurance and the risk of road traffic accidents, *Transportation Research Part A: Policy and Practice*, vol.74, pp.201-209, 2015.

[14] S. Soehodho, Road accidents in Indonesia, *IATSS Research*, vol.33, no.2, pp.122-124, 2009.

[15] A. Sandhyavitri, Zamri, S. Wiyono and Subiantoro, Three strategies reducing accident rates at black spots and black sites road in Riau Province, Indonesia, *Transportation Research Procedia*, vol.25, pp.2153-2166, 2017.

[16] T. Haryanto, M. W. Wibowo, T. K. A. Rahman and A. A. Subiyakto, Developing digital transformation success model: Case study of a public insurance company in Indonesia, *Journal of Advanced Research in Dynamical and Control Systems*, vol.12, no.6, pp.2586-2599, 2020.

[17] M. Kim and J. L. Daniel, Common source bias, key informants and survey-administrative linked data for nonprofit management research, *Public Performance & Management Review*, vol.43, no.1, pp.232-256, 2020.

[18] M. Georgsson, N. Staggers, E. Årsand and A. Kushniruk, Employing a user-centered cognitive walkthrough to evaluate a mHealth diabetes self-management application: A case study and beginning method validation, *Journal of Biomedical Informatics*, vol.91, 103110, 2019.

[19] T. Mahatody, M. Sagar and C. Kolski, State of the art on the cognitive walkthrough method, its variants and evolutions, *International Journal of Human-Computer Interaction*, vol.26, no.8, pp.741-785, 2010.

[20] J. Brooke, SUS: A retrospective, *Journal of Usability Studies*, vol.8, no.2, pp.29-40, 2013.

[21] A. Subiyakto et al., Empirical evaluation of user experience using lean product and process development: A public institution case study in Indonesia, *AIP Conference Proceedings*, vol.2331, no.1, 060019, 2021.

[22] A. Subiyakto et al., Investigating quality of institutional repository website design using usability testing framework, *AIP Conference Proceedings*, vol.2331, no.1, 060016, 2021.

[23] M. Schrepp, A. Hinderks and J. Thomaschewski, Construction of a benchmark for the user experience questionnaire (UEQ), *International Journal of Interactive Multimedia and Artificial Intelligence*, vol.4, no.4, pp.40-44, 2017.