Usability Evaluation Model for Mobile Banking Applications Interface: Model Evaluation Process using Experts' Panel

Hamisu Ibrahim Abubakar, Nor Laily Hashim, Azham Hussain
School of Computing, Universiti Utara Malaysia, Kedah Darul Aman, Malaysia.
laily@uum.edu.my

Abstract—**Many of the existing usability evaluation models for mobile applications have not been evaluated to determine its usefulness, accuracy and applicability in to the real world environment. This may not provide confidence on the side of the evaluator and the results may not be comprehensive and valid. A model for evaluating the usability of mobile banking applications interface is developed in response to usability practitioners and m-banking applications developers' needs. The experts implemented the model using various m-banking application platforms through heuristic evaluation method. A list of predefined validation measures were used by the experts' in order to determine the accuracy and applicability of the proposed model. The results show that the model is useful, accurate and can be used for evaluating the usability of m-banking applications interface. Therefore, this paper will benefit both the research community and the usability practitioners towards better understanding of model validation process.**

Index Terms—**Evaluation Process; Experts' Model Evaluation; Mobile Banking.**

I. INTRODUCTION

Usability is regarded as quality characteristic of a product that signifies how easy such product allows users' to learn and use without any difficulty [13], [18]. Usability is an important component of any software or application products, for the reason that easy to learn and use is a value characteristic of any emerging technology (products) and this leads to complete acceptability of such product and of course intensify reliability and satisfaction in the heart of a user.

Therefore, Nielsen [19] defined usability as ease of use and correctness of a system for a specific class of users carrying out particular tasks in a precise environment. In this case, ease of use affects the user's performance and their satisfactions, while acceptability determines whether the product is used by its users' [24]. Usability of mobile application products is usually verified through its interfaces [5]. Therefore, suitability to use any mobile application product depends mainly upon the satisfaction of users' and this can be achieved based on the simplicity and ease of use of such product [16].

Mobile banking is one of the noteworthy financial applications, as m-payment, m-transfer and m-finance are all connected to banking services [7], [23]. The m-banking offers a variety of financial transactions which includes; bill payment, fund transfer, investment/insurance and recharge card payment.

Unfortunately, literature shows that lack of friendly user interface and trust on security affecting users interactions with m-banking applications [2], [8], [9], [10]. Therefore, on the basis of the forgone statement, there are needs to offer a usability evaluation approach of m-banking applications interface [8].

Many usability evaluation models are difficult to use due to lack of adequate descriptions on how to use them for a specific mobile application [6], [9]. Additionally, most of the existing usability evaluation models for mobile applications are not validated to determine its usefulness, accuracy and applicability in to the real world environment. This may not provide confidence on the side of the evaluator and the results may not be comprehensive and valid [17]. Therefore, evaluating the usability of m-banking applications with such models may not comprehensively yield accurate and dependable results that could be used for decision making.

A model for evaluating the usability of m-banking applications interface is developed (refer to Appendix 1) and there are needs to evaluate to examine its usefulness and accuracy in the real world environment. Model evaluation is a process of ensuring that the model is adequate, useful and accurate for the purpose at which it was developed [20], [21]. It measures whether the model is directly meets the needs of its users and it can be used for the evaluation of the intended application.

Therefore, the main aim of this paper is to evaluate the new model in order to determine its usefulness, accuracy and whether it can be implemented in the real m-banking applications interface. Evaluating a developed model will provide confidence in the side of mobile applications developers and usability practitioners [14].

II. MODEL EVALUATION PROCESS

To examine the usefulness, accuracy and applicability of the proposed model, a heuristic evaluation method in HCI was conducted with domain experts. This heuristic evaluation approach was chosen as the evaluation approach of the proposed model, because it is an important approach of achieving usability model evaluation and can provide valuable comments [18], [11]. Moreover, the heuristic evaluation approach is convenient and reliable technique to collect feedbacks from domain experts [1]. It is the most widely used inspection method and can be used with a small number of experts.

The domain experts' are mobile applications developers and usability practitioners, though it is required to use individuals who are both mobile applications development and usability expert [13]. These domain experts were selected as the participants of the model evaluation, since they are the ones' to use the proposed model for designing or improving the existing m-banking applications interface. In chosen the domain experts, three criteria were considered [14], [15] which comprises i) skilful in software/mobile applications development and evaluation, ii) relevant organisational membership iii) at least five years' experience. However, for heuristic evaluation, three to five experts is the recommended number for any heuristic review [12], [13], [18]. Therefore, in this study, six domain experts' were selected to evaluate the model and provide feedbacks concerning the usefulness and accuracy of the proposed model.

III. INSTRUMENTS DEVELOPMENT

The evaluation measures for the proposed model were adapted from the studies of [4], [14] to determine the success of the proposed model. The adopted evaluations measures have been used by many studies such as [22] and yield significant results. The Table 1.1 presents the evaluation measures and a list of items. Hence, two measurement scale, "Agreed" and "Disagree" are used for the evaluation instrument as used by [22].

Table 1
Evaluation measures for the proposed model

Evaluation measures	Variables	Source
Gain satisfaction	• Perceived usefulness • Decision support satisfaction • Comparison with existing usability evaluation models • Clarity • Relevant to the intended applications	
Interface satisfaction	• Task appropriateness • Perceived ease of use • Internally consistent • Organisation (well organised) • Presentation (readable and useful format)	[4], [14], [22]
Task support satisfaction	• Ability to produce expected results • Ability to produce relevant and useful results • Completeness • Understandability (easy to understand) • Easy to implementation	

IV. DATA COLLECTION

Prior to the implementation of the evaluation, documents were sent to the experts which comprises of assessment form and validation form. Though, some experts were contacted face to face and those that cannot be contacted directly, a discussions have been made via a telephone calls in order to get more comments concerning the state of the proposed model. The assessment form contains details guideline of the objective and subjective evaluation including diagrammatical representation

of the proposed model. Whereas, the validation form contains all the evaluation measures and their individual items accordingly. The feedbacks were collected within two and half months via emails, phone calls and direct contact.

V. DATA ANALYSIS

The results were collected from the domain experts via their emails and direct collection for analysis using SPSS tool (descriptive statistics) in order to find the average percentage of each variable based on individual item of the three evaluation measures from the experts. Similarly, the overall percentage scored were extracted accordingly (refer to Table 2). Furthermore, comments/suggestions made by the experts for each variable were critically analyzed accordingly.

VI. MODEL EVALUATION IMPLEMENTATION

In this stage, after the documents were sent to the selected experts, two weeks later they were reminded concerning the evaluation status of the proposed model. Telephone calls were made to each of the expert and explained further the main objective of the evaluation and what they are expected to do during the model implementation and evaluation. Moreover, the experts were given more chance to ask questions on any section from the evaluation documents provided to them for further explanation. Furthermore, the six experts implemented the proposed model and completed the assessment/validation forms accordingly. The feedbacks were received from each of them (experts A, B, D & E) via their emails.

Whereas, expert C and F were contacted directly as mentioned earlier, documents were given to them accordingly and a discussion were made with the each of the expert concerning the objective of the evaluation. Therefore, based on the documents provided, the experts were asked to implement the proposed model by evaluating the usability of any m-banking application interface. Similarly, the experts were also told to validate whether they are satisfied with the proposed model using the validation form provided. The evaluation was completed for about 1 hour and the assessment/validation forms (results) were collected from the expert.

VII. RESULTS AND DISCUSSION

The proposed model has been implemented by the domain experts whereby different m-banking applications interface were evaluated. The domain experts evaluated the proposed model based on a predefined set evaluation measures (refer to Table 1). Each of measure has a list of variables (items) associated. The experts were asked to choose the level of these items, as "agreed" or "disagreed". The outcomes of these three measures are the confirmation of the validity of the proposed model in practice. The results were received from the experts' and calculated by getting the mean score for each item and overall mean of each of the three measures as presented in Table 2.

As indicated in the Table 2, each evaluation measure has five items which are used by the domain experts after the implementation of the proposed model. Therefore, the mean

scores for each of the items under "Gain Satisfaction" measure are "perceived usefulness", "decision support satisfaction", "comparison with existing usability evaluation models" and "relevancy to the intended application" scores higher with 1, whereas "clarity" scores 0.83.

Table 2
Mean scores for Model evaluation by experts

Evaluation Measures	Number of Experts'	Mean	Overall Mean
Gain Satisfaction			
Perceived usefulness	6	1.00	
Decision support satisfaction	6	1.00	
Comparison with existing usability evaluation model	6	1.00	.97
Clarity	6	.83	
Relevancy to the intended application	6	1.00	
Interface Satisfaction			
Task appropriateness	6	1.00	
Ease of use	6	.83	
Internally consistent	6	1.00	0.93
Well organised (organisation)	6	.83	
Presentation (readable and useful format)	6	1.00	
Task support satisfaction			
Ability to produce expected results	6	1.00	
Ability to produce relevant and expected results	6	1.00	
Completeness	6	0.83	0.93
Understandability	6	0.83	
Practicality (Ease of implementation)	6	1.00	

While, the mean scores for the items under "Interface Satisfaction" measure are "tasks appropriateness", "internally consistent" and "presentation (readable and useful format)" scores 1 each, whereas the item "ease of use" and "well-organised" (organisation)" scores 0.83 respectively.

Moreover, the mean scores for the items under "Task Support Satisfaction" measure are "ability to produce expected results", "ability to produce relevant and useful results" and "practicality (ease of implementation)" scores 1 which is relatively higher compared to "completeness" and "understandability which scores 0.83 each. Therefore, overall mean scores using the results of the five items for each of the three criteria: "Gain Satisfaction" scores .97, "Interface Satisfaction" scores .93 and "Task Support Satisfaction" scores .93 respectively. Hence, the result shows that the proposed model is useful, accurate and can be used for the usability evaluation of m-banking applications interface.

VIII. EXPERTS' COMMENTS

The comments received from the domain experts are reported based on the three measures used for the validation of the proposed model. Therefore, based on the comments provided on the validation form by the experts, it shows that the model is useful, accurate and practical to be implemented in the real m-banking applications interface usability evaluation. Additionally, experts highlighted that the proposed model allows faster decision making concerning the results obtained after the evaluation compare to other usability evaluation approaches.

Furthermore, the comments provided by the experts' after the

execution of the proposed model, it shows that the components of the model are appropriate, consistent, readable, well organised and easy to be implemented for the usability evaluation of m-banking applications interface. Also, considering the results obtained during the evaluation, experts revealed that all the tasks provided in the proposed model are applicable for the intended applications and can produce useful results.

IX. CONCLUSION

The proposed model was evaluated by six domain experts' using heuristic evaluation approach. During the implementation of the model, a number of different m-banking application platforms were used in order to examine the accuracy and usefulness of the proposed model. The model found to provide significant results which could be used for improvement of the existing m-banking applications. According to the results obtained from the domain experts, the model appeared to be accurate, useful and can be implemented in the real world environment for m-banking applications interface usability. Furthermore, the domains experts highlighted that the metrics in the proposed model are appropriate and they are accordance with features and functions of m-banking applications.

The proposed model is a new innovation and has been validated by the domain experts using heuristic evaluation method. There are needs to apply the model with real m-banking applications users in order to strengthen its accuracy and usefulness for the intended applications. For instance, by using the model to conduct usability test or control laboratory experiment to test the usability of any m-banking applications interface.

REFERENCES

[1] Agrawal, H., Dhotre, K., & Williams, J. *A streamlined interface documentation methodology for mobile user interfaces*. Paper presented at the Proceedings of the 10th International Conference on Human Computer Interaction with Mobile Devices and Services, 2008.

[2] Ahmed, S. S., Rayhan, S. J., Islam, M. A., & Mahjabin, S. *Problems and prospects of mobile banking in Bangladesh*. Journal of Information Engineering and Applications, 2012, 1(6), 16-34.

[3] Alnanih, R., Ormandjieva, O., & Radhakrishnan, T. *A new quality-in-use model for mobile user interfaces*. A Paper presented at the Eighth and 23rd Joint International Conference on Software Process and Product Measurement (IWSM-MENSURA), 2013.

[4] AL-Tarawneh, F.H. *A Framework on COTS Software Evaluation and Selection for COSTS Mismatches Handling and Non-functional Requirements*. (Unpublished doctoral dissertation). Universiti Utara Malaysia, Kedah, Malaysia, 2014.

[5] Baharuddin, R., Singh, D., & Razali, R. *Usability Dimensions for Mobile Applications-A Review*. Research Journal of Applied Sciences, 2013, 5(6), p2225-2231.

[6] Coursaris, C. K., & Kim, D. J. *A meta-analytical review of empirical mobile usability studies*. Journal of Usability Studies, 2011, 6(3), 117-171.

[7] Dewan, S. M. *Issues in M-banking: Challenges and opportunities*. Paper presented at the 13th International Conference on Computer and Information Technology (ICCIT), 2010.

[8] Ensor, B., Montez, T., & Wannemacher, P. *The state of mobile banking*. Forrester Research, USA, 2012.

[9] Ghotbi, A., & Gharechedaghi, N. N. *Mobile Banking, Challenges and Strategies in the Banking System of Iran*, 2012. Retrieved on 23/6/2013 from http//:www.researchgate/publication.

[10] Goyal, V., Pandey, U., & Batra, S. *Mobile Banking in India: Practices, Challenges and Security Issues*. Journal of Advanced Trends in Computer, 2012b, 1(2).

[11] Hearnshaw, HM, Harker, RM, Cheater, FM, Baker, RH & Grimshaw. *Experts Consensus on the Desirable Characteristics or review Criteria for Improvement of Health Care Quality*. Quality in Health Care; 2001, Vol. 10, pp. 173–178.

[12] Holzinger, A. *Usability engineering methods for software developers*. Communications of the ACM, 2005, 48(1), 71-74.

[13] Kantner, L., S. Rosenbaum. *Usability studies of WWW sites: Heuristic evaluation vs. laboratory testing*. Proc. SIGDOC, Snowbird, UT, 153–160, 1997.

[14] Kunda, D. STACE: *Social technical approach to COTS software evaluation*. Component-Based Software Quality, 2003, pp. 64-84. Berlin Heidelberg: Springerverlang.

[15] Liamputtong, P. *Focus group methodology principles and practices*. London: SAGE Publication, 2011.

[16] Lin, W.-R., Wang, Y.-H., & Hung, T.-E. *Selecting Mobile Banking System Service for Consumers by Using a Combined DEMATEL and ANP Approach*. Journal of Accounting, Finance and Management Strategy, 2011, Vol. 7, 1-14.

[17] McLellan, S., Muddimer, A., & Peres, S. C. *The effect of experience on System Usability Scale ratings*. Journal of Usability Studies, 2012, 7(2), 56-67.

[18] Nielsen, J. *Heuristic evaluation*. Usability inspection methods, 1994b, 17(1), 25-62.

[19] Nielsen, J. *Durability of usability guidelines*. Retrieved, 11(15), 2005.

[20] Rogers, Y., Sharp, H., & Preece, J. *Interaction design: beyond human computer interaction*: Wiley, 2011.

[21] Singh, A., & Wesson, J. *Evaluation criteria for assessing the usability of ERP systems*. Paper presented at the Proceedings of the 2009 annual research conference of the South African Institute of Computer Scientists and Information Technologists, 2009.

[22] SP, Mohammed. *A process Based Approach Software Certification Model for Agile and Secure Environment*. (Unpublished doctoral dissertation). Universiti Utara Malaysia, Kedah, Malaysia, 2015.

[23] Suleiman, A., Jaafar, N. I., & Mohezar, S. *An overview of mobile banking adoption among the urban community*. International Journal of Mobile Communications, 2007, 5(2), 157-168.

[24] Suoranta, M. & M. Mattila. *Mobile banking and consumer behavior: New insights into the diffusion pattern*. Journal of Financial Services Marketing, 2004, Vol. 8, No.4, pp. 354-366.

APPENDIX: A USABILITY EVALUATION MODEL FOR MOBILE BANKING APPLICATION INTERFACE