The Faculty of Computer Science Universitas Indonesia e-Learning team has developed an LMS  
known as Student Centered e-Learning Environment (SCeLE) based on Moodle. Until now SCeLE  
Mobile application development has never been done, but one of the strategies to increase the use of  
LMS is by developing a mobile application [2]. At the time of developing the application, the risk of  
failure also needs to be considered. According to Weinschenk, three of the 12 common causes of  
failure of software development projects (applications) are closely related to the user experience [3]:  
the needs are not well defined; Lack of communication between developers and users; And  
stakeholder politics. Weinschenk also added that the user experience problem can be overcome with  
user-centered design, which focusing on gaining a deep understanding of the pre-users throughout  
design and development life-cycle [4].  
Therefore, it is necessary to implement and evaluate the SCeLE Mobile design with user-centered  
design into mobile application. In this study, we will develop the mobile applications and then  
evaluating for known what needs to be improved. The main purpose of this research is to continue the  
implementation of SCeLe Mobile from previous research, evaluation as improvement material for  
further research, to see suitability of application to user requirement, and get feedback for future  
research and development

SCeLE Based on User-Centered DesignUser Centered Design (UCD) is a framework of designing and developing products that focus on  
understanding the potential users [4]. This framework also guarantees the product (software or  
website) will easy to be used [5]. The International Usability Standard ISO 13407, which is the basis  
for UCD, stated six things that must be pointed out in UCD [5]. It emphasizes the user involvement in  
design, development, and evaluation.  
The design prototype of SCeLE based on user-centered design was introduced by Ibadurrahman  
[6]. He developed the prototype by improving a previously made prototype which designed based on  
Moodle Mobile, a mobile app created using HTML 5. By using UCD he constructs the prototype using  
Material Design principal, which is commonly used on Android devices. Using commonly used design  
principal will make the user easier learning the application.  
2.2. Android Platform-Based ApplicationPlatform-based apps are an application that is specifically created and used on a specific platform, for  
example only on the Android operating system [7]. This type of application is developed using a  
specific programming language (e.g. Java), but is more dependent on the use of application  
frameworks, supporting libraries and runtimes in the form of thousands of lines of code typically  
written in C and C ++ [8]. In the Android operating system, applications are usually developed using  
the Java programming language with the help of application frameworks that provide access to the  
API framework so that it can be used by core applications [9].

Usability evaluation

Tan, Ronkko and Gencel (2013)

Tan, Ronkko, and Gencel highlighted usability dimensions for mobile application usability evaluation whereby nine dimensions and sixty-three criteria were identified as measurement guidelines for effective usability study. These usability dimensions include Efficiency, Effectiveness, Satisfaction, Productivity, Learnability, Safety, Accessibility, Generalizability, and Understandability. The framework was developed to serve as a support for companies who wish to develop their usability and user experience evaluation instruments. Despite the model being designed for a specific purpose, the study did not provide adequate descriptions on how each usability measure was selected and the relationship between them. The study also introduced few metrics which are not comprehensive enough to be related to their corresponding criteria for the convenient evaluation. Therefore, it may take a longer time for a usability practitioner to study the model and apply it to other mobile applications. This framework is particularly designed for mobile companies to trace and deduce collected data on the usability and user experience of their products. The framework is adapted from 13. Moreover, the defined usability dimensions and criteria are generally centered on user experience with mobile phones. The model was evaluated using a case study in a small telecommunications company.

Baharuddin, et al (2013)

In an attempt to address the challenges facing the usability evaluation of mobile applications, Rosnita Baharuddin, Dalbir Singh, and Rozilawati Razali, came up with a usability evaluation model which contains ten dimensions for measuring the usability of mobile applications. The dimensions were proposed based on the level of importance which are influenced by the four contextual factors introduced by21. These four contextual factors include user, environment, technology and task/activity which are within the HCI principles. However, even though the model is well equipped with the relevant dimensions, it lacks adequate descriptions on how the model can be used to evaluate a specific mobile application, since the model is designed for general mobile applications. Mobile applications are different both in term of features, functions and sometimes even the type of its users7. As such, there should be a comprehensive guideline that may support a usability practitioner on how to choose certain dimensions within the model to evaluate the usability of a specific mobile application as suggested by 13, 22, 23.Similarly, author 24did not provide supported metrics for each dimension defined in the model to support convenient and effective usability evaluation approach particularly for a defined mobile application. Therefore, evaluating different applications with this kind of model requires an extra effort by a domain expert to provide relevant measurements for effective and valid evaluation13. Additionally, issue on trust concerning the security and privacy are concerned issues in many applications which are not supported in this model. This model requires evaluation to examine its accuracy of evaluating the usability of mobile applications.

PACMAD usability model (2013)and Extended PACMAD (2015)

(Ojokoh, 2015)Author 15argued that mobile devices require specific usability models. They thus developed the PACMAD. The aim of their model is extending existing usability models, such as Nielsen’s or the ISO, to the context of mobile applications. For example, they argued that, during the application development, additional functionality services can be appended to a software application to allow user more accomplishment with the application. However, when it comes to mobile devices, this additional functionality increases the software complexity. Thus, the user’s primary goal became difficult to accomplish via the device. The PACMAD model has seven components. For each, the authors offer definitions, measures, and associations. The component amounts to Effectiveness, Efficiency, satisfaction, learnability, memorability, errors and cognitive load. The inclusion of cognitive load is considered as PACMAD’s usability model main contribution for the study of usability. Similar to models, PACMAD also lacks guidelines and metrics related to chosen dimension and also require evaluation to examine its accuracy for mobile applications. Thus25fill this gap by extending PACMAD to include relative low level metrics in addition to usability attributes. This extended version comprises of 21 metrics. GQM guides to develop usability metrics matching those metrics yielded from literature. Two evaluation instrument task list and user satisfaction questionnaire are used to collect objective and subjective data for complete usability evaluation of extended PACMAD.

# References

(n.d.).

1. Abuhlfaia, K., & Quincey, E. d. (July 04 - 06, 2018). The usability of E-learning platforms in higher education: a systematic mapping study. *HCI '18 Proceedings of the 32nd International BCS Human Computer Interaction Conference* (p. Article No. 7 ). Belfast, United Kingdom : BCS Learning & Development Ltd. Swindon, UK ©2018.
2. Banimahendra, D., & Santoso, H. B. (2018). Implementation and evaluation of LMS mobile application. *Journal of Physics*, 012024.
3. Hadullo, K., Oboko, R., & Omwenga, E. (2018). Factors affecting asynchronous e-learning quality in developing countries. *International Journal of Education and Development using Information and Communication Technology* , Vol. 14, Issue 1, pp. 152-163.
4. Kiruthika, J., Khaddaj, S., Greenhill , D., & Francik, J. (2016). User Experience Design in Web Applications. *2016 IEEE Intl Conference on Computational Science and Engineering (CSE) and IEEE Intl Conference on Embedded and Ubiquitous Computing (EUC) and 15th Intl Symposium on Distributed Computing and Applications for Business Engineering (DCABES)*, 642-646.
5. Oboko, R., Omwenga, E., & Hadullo, K. (2018). Status of e-Learning Quality in Kenya. *International Review of Research in Open and Distributed Learning*, Volume 19, Number 1.
6. Ojokoh, B. a. (2015). A Mobile-Based E-Learning System. *International Journal of Web-Based Learning and Teaching Technologies*, 1-17.

Remy, C., Bates , O., Dix, A., Thomas , V., Hazas, M., Friday, A., & Huang, E. M. (April 21 - 26, 2018 ). Evaluation Beyond Usability: Validating Sustainable HCI Research. *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems* (p. 216). Montreal QC, Canada: ACM New York, NY, USA ©2018.