The Development of Mobile Gamification Learning Application for Web Programming Learning

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Abstract. This study aims to develop an android-based learning mobile application with gamification concept for the Web Programming course. The development of the learning media refers to a model by Alessi & Trolli based on the course's semester lesson plan. After a series of testings, the product is deemed "good" and appropriate for use in the Web Programming learning. The result of the paired sample t-test suggests that the developed media successfully improves the students' learning outcomes.

1. Introduction

The efforts made by the Yogyakarta State University in realizing its vision to become a world-class university needs to be supported by several aspects. One of them is the availability of learning materials and learning media that meet the international standards. For this reason, the university's teaching staff is expected to conduct an in-depth and intensive study on various models, strategies, and methods that can encourage improvement/regeneration. One of the expected improvement is for the lecturers to develop an innovative learning process, whether the method or the media used, so that students are motivated to be active, creative, and high-achieving.

As one of the integral parts of Yogyakarta State University, the Informatics Engineering Education study program does its best in conducting revitalization in the learning process, one of which is by renewing the learning media for some subjects/courses. Learning media is only one of the many components of the teaching system that turns to be the most dominant factor in supporting the success of teaching learning process. Learning media can be defined as the tool or means that can deliver the learning materials [1]. An exciting learning media can improve the interest and motivation of its users to study, and this is what eventually makes the users to fully comprehend the given material [2]. Learning media is believed to help lecturers to deliver their materials to the students.

To this day, the students' learning process in the Web Programming course has been experiencing some problems as the current learning media is no longer relevant and outdated. In addition to that, the current use of learning media has been said to be less optimal in enhancing students' comprehension and motivation in learning about a subject. This becomes a concern as it may affect the graduates' competencies, especially when they fail to address the required qualification in the working world, whether in the industry or educational institutions.

Based on the problems, this study recognizes the need for an efficient and effective learning media, especially a mobile-based application. The use of mobile-based learning media is considered to be the most effective due to the observation revealing that nearly all students have Android-based smartphones.

Mobile application has an advantage of high accessibility as it is neither limited by time nor by space or location. In other words, it can be accessed anytime and anywhere. The mobile application learning media is expected to improve the students' learning outcomes, as well as their motivation in the learning process. As technology advances, the development of learning media gets more refined with the concept of gamification. Gamification is one of the learning approaches that use some elements from video games. The purpose is to motivate the users and make the most of the enjoyment and engagement when the learning process takes place [3]. In addition, the media also works to attract the users' interests by inspiring them to keep up with the learning [4].

This study aims to produce mobile application-based learning media with gamification concept for the Web Programming course that is effectice and efficient for the students of Informatics Engineering Education program study at the Yogyakarta State University. In addition, the developed learning media can also be used as independent learning facility as well as a positive input to improve the students or users' interest and participation in the learning process.

2. Literature Review

2.1. Learning Media

Reiser [5] defines learning media any means that can be used to deliver the learning materials and stimulate the students' senses, mind, interest, and attention in order to achieve the learning outcomes. One of the most instrumental components in the learning system is learning media. The communication process in the learning process will not work as optimally without the support of learning media.

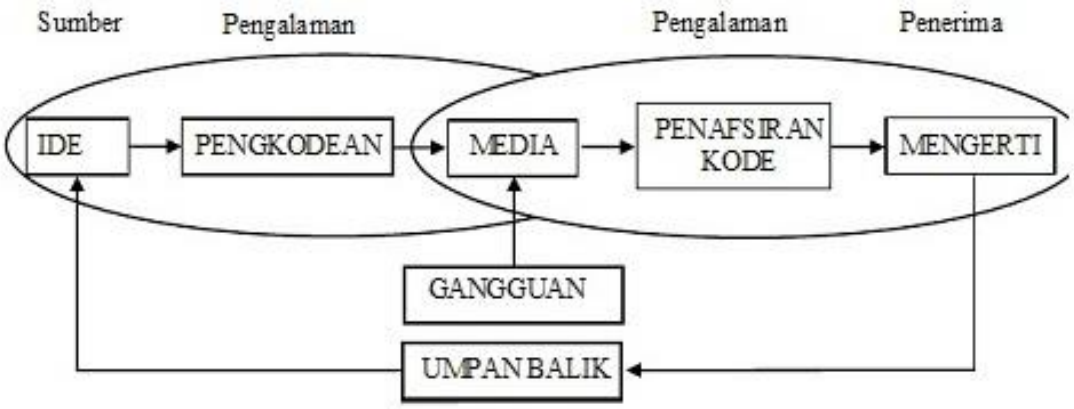

Figure 1. The role of media in the learning process

A successful learning process occurs when the students are able to comprehend and master what the instructor teaches. According to Kemp & Dayton [6], the role of media in the learning process involves: 1) standardized content delivery; 2) more interesting learning; 3) more interactive learning; 4) more efficient use of time; 5) optimized learning quality; 6) flexible and accessible learning process according to needs; 7) the students' improved positive response to the learning process and learning materials; and 8) the more positive role of the instructors.

2.2. Mobile learning

Quinn [7] pictures mobile learning or m-Learning as somewhere between mobile computing and e-Learning. Mobile learning can easily be accessed anywhere, has a strong tracking ability and rich interaction, as well as promote effective learning and performance-based assessment. The notion of e-Learning in the process itself does not rely on space and time. It is a learning model which utilizes effective information and communication technology. The strength of the model lies on the availability

of learning materials which can be accessed anytime, in addition to the attractive visualization of the content. However, it needs to be noted that not all teaching materials are suitable for mobile learning. The term mobile learning refers to the use of mobile devices in regards to the information technology development such as tablets, cellular phones, and notebooks. In the scheme presented in Figure 2, mobile learning can be classified into electronic learning or also known as e-Learning, which is a part of a bigger scope of distance learning or d-Learning.

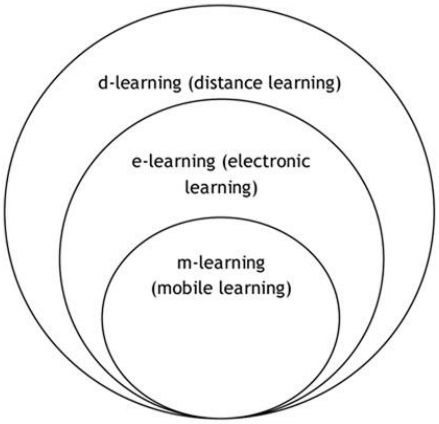

Figure 2. Mobile learning in the learning scheme [7]

2.3. Gamification

Kapp & Coné [8] describes gamification as a process of problem solving and using the mind and the game mechanism in order to engage the user. In a more specific explanation, Kapp & Coné define the term as a concept that uses game mechanism in motivating students and promoting learning through a mind game for learning and problem solving purposes. A study by Su & Cheng [9] on gamification and mobile learning found that mobile learning and gamification can improve the students' learning achievement and motivation better than traditional learning.

3. Materials and Methods

This research is aimed at developing a product of learning media device using the Research and Development method by adopting the multimedia learning model proposed by Alessi & Trollip [10]. The learning model is grouped into three steps, namely (1) planning, (2) design, dan (3) development. Each step has a substep as pictured in Figure 3.

Figure 3. The Model of Developing Multimedia [10]

In order to maximize the findings of the study, there is an addition of (4) summative assessment/product testing in the final stage. As part of the learning media development scope, there needs to be an identification process of the Web Programming course's semester lesson plan in the Informatics Engineering Education program study of Yogyakarta State University. The testing of the developed product in the study consists of expert validation and product testing in the larger scale. The expert testing involves validation on the materials and media with an expert lecturer in the subject content, namely the lecturer of the Web Programming course, and two competent media validators. The larger scale testing was conducted among 38 students of the second semester in the Informatics Engineering Education program study of Yogyakarta State University who took the Web Programming class during the research. The product testing was conducted in the Programming laboratory of the Faculty of Engineering of Yogyakarta State University. Additionally, this study compares the pretest and posttest scores, and the t-test in order to measure the effectiveness of the product.

4. Results and Discussion

The mobile gamification learning application (MGLA) for supporting the Web Programming learning has been made by addressing the course's semester lesson plan, and successfully installed on an Android platform mobile device. The product is named Megie, short for Media Gamification in Education. The interface design has been adjusted according to the users' characters based on the observation done. This stage involves the development of interface of the media, starting from the main page, menu, and contents, such as the login and register pages.

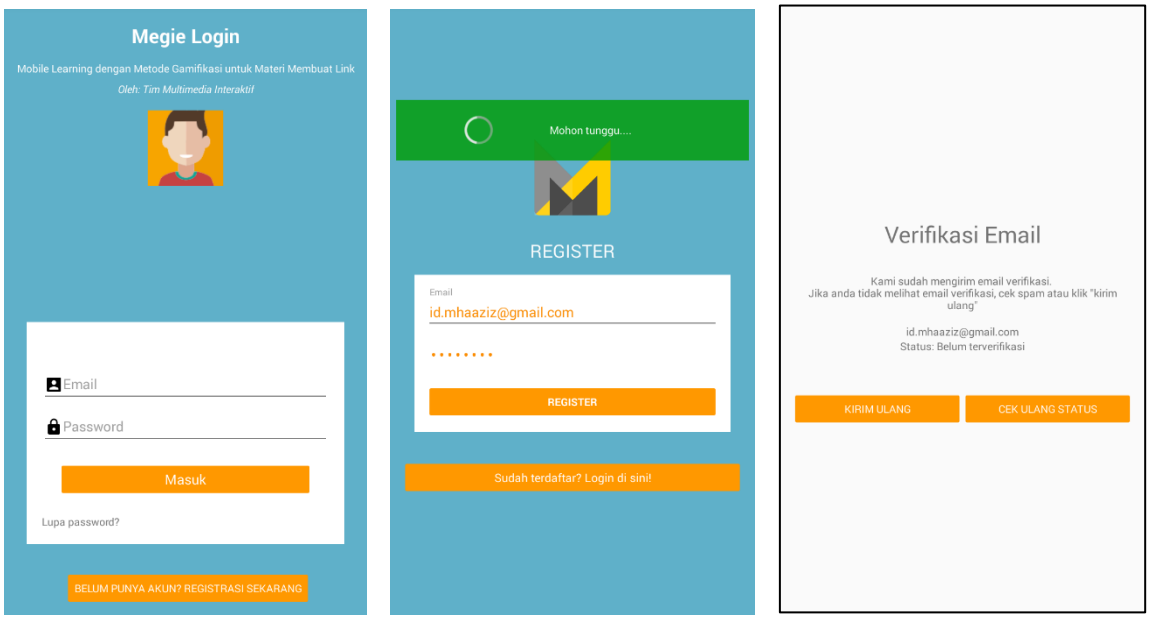

Figure 4. Login Page

On the login page, user will be asked to submit their email dan password as a part of the account's authentification process. If the user does not have an accout, they will be directed to the register menu to register and conduct a verification process.

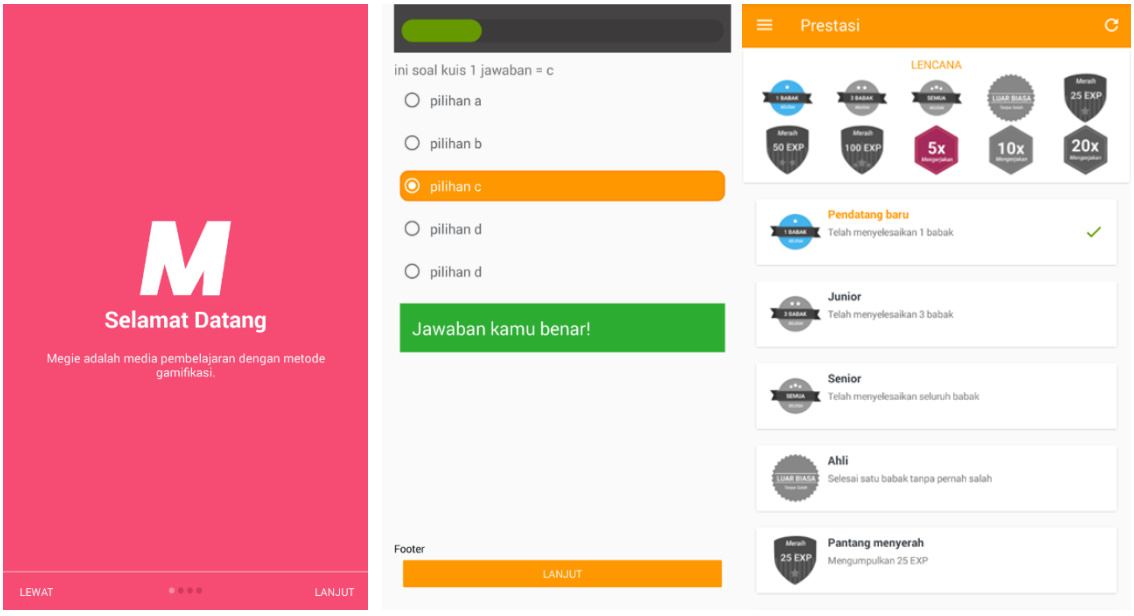

Figure 5. Quiz & Reward Page

Once the log in process succeeds, the materials and quizzes will be ready for access. In order to open the locked materials, the user must pass the quiz of previous materials. The application will provide a score on the user's result on the quiz. The media is improved based on the feedback given both from the experts and users after a series of trials. The feasibility test involves a series of testing steps involving

alpha testing done by one subject material expert and two media experts, followed by beta testing involving 38 students as the Megie users.

The overall mean values in the alpha testing shows very good results. The subject expert's test on the quality of Megie based on the subject material content, as well as the quality of learning, results in the mean value of 4.82 (very good) and 4.89 (very good), respectively. Meanwhile, the results of assessment by two media experts on the quality of Megie based on the interface aspect are 4.31 and 4.15, both can be considered as very good. In the robustness aspect, the final scores from the media experts are 4 (good) and 4.25 (very good), and in the pedagogical aspect, both media experts give the same score of 4.14 (very good).

Similarly, the summative assessment shows that in the beta testing of the media development, the following aspects receive good to very good results: additional information (3.93), user's behavior (4.09), visual communication (3.90), program's efficacy (3.84) Based on the results, it can be confirmed that Megie can be categorized as good, and is therefore feasible for use.

Next, t-test was conducted in order to measure the effectiveness of the product. The paired-sample t-test shows the t-value of 10.816 with 0.000 probability. As the probability value is < 0.05, both mean values of the population are confirmed to be non-identical. This means that there is a difference between the pretest and posttest scores, as the posttest results in a higher score than the pretest. In conclusion, the MGLA learning has been proven to independently improve the students' learning outcomes and motivation.

Table 1. Paired-sample Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Pretest - Posttest	-20.27632	11.55568	1.87458	-24.07457	-16.47806	-10.816	37	.000

5. Conclusion

Megie (Media Gamification in Education), a mobile gamification learning application (MGLA) for the Web Programming learning, has been successfully developed based on the model by Alessi & Trollip. The alpha testing by the subject expert and media expert find that the application is "very good," while the result of the beta testing is "good," thus confirming that Megie is feasible for use in the Web Programming learning.

According to the pretest and posttest of the competency test, as well as the analysis on the paired sample t-test, Megie is effective in improving the students' learning outcomes in the Web Programming course.

The education field offers a lot of alternative methods for development. By incorporating the MGLA in the learning process, this study provides an alternative for a better learning media. The combination of gamification and mobile learning is especially interesting due to the mobile learning's dynamic nature, as well as the gamification's effect on the students' increased motivation. This allows the students to be more independent and not merely rely on the lecturers' ability in creating a conducive learning process. Through the advances of learning media, students are encouraged to take a more active role in their own learning process

Acknowledgments
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