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DEVELOPMENT OF AN ANDROID-BASED REWARD SYSTEM TO ENHANCE THE ACTIVITY OF LEARNING

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ABSTRACT

The students' learning activity is an influential factor in the success of learning. New technology can be used to design applications to facilitate the learning process. The objectives of this study were (1) to produce a reward application system to improve the students' activity, (2) to examine the feasibility of the developed application, and (3) to analyse the difference and the effectiveness of the application in learning compared to conventional learning. This study used the development research method adopting the 4D (define, design, develop, disseminate) model. The application was tested using ISO 25010 standards by media experts, teachers, and ten students of class X Axioo in Vocational High School also known as Sekolah Menengah Kejuruan Negeri 5 Surakarta. The effectiveness was tested using an experimental design. This study produced a proper and an efficient reward system application. The feasibility of the application for functionality, portability, usability and efficiency were 100%, 100%, 86.2% and 77% respectively. The results showed different effectiveness in learning activities between learning using the reward system application and using the conventional model.

Keywords: android, learning process, reward system, student activity

INTRODUCTION

Education is the most critical part of progress indicators of a nation. Success in the education sector is directly proportional to the human resources, i.e., the more advanced the education of a country the higher the level of human resources. The Law of the Republic of Indonesia No. 20 of 2003 on National Education System article 18 explains that vocational education is secondary education that prepares learners primarily to work in industries. With the characteristics of vocational education that focuses on the achievement of skills and competencies, enabling learning in Vocational High Schools also known as Sekolah Menengah Kejuruan (SMK) is active student learning. Besides, the learning process is the integration of knowledge, skills, and attitudes (Baartman & Bruijn, 2011). Thus, in the learning process, students are actively involved in learning and can master the competence in the field. Teachers must be respected because the success of learning is highly dependent on professional educators. Teachers also have a role as a facilitator of learners in learning process activities. The choice of a learning model in a classroom determines the success of learning. The model can improve the students' learning outcomes. In the curriculum 2013, students are required to be independent and active in learning because the learning process does not continue to be centered on the teacher.

Learning is a process of changing behavior towards a better and relatively fixed behavior, and the effect of it may be changing knowledge, understanding, attitude, behavior, and skills. The liveliness of learners is a situation where students are active in learning. The activity of learning includes the involvement of students in the learning process as diverse as listening to the teacher's explanation, doing discussions, making reports, and completing the tasks. Learning activities of students include cognitive, affective and regulative activities (Vermunt & Verloop, 1999). The activity of learners in learning is an important and fundamental problem that must be understood, based and developed by every teacher in the learning process. Activity-Based Learning is a practical experience method for

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students to analyze and learn from the activity (learning by doing) (Lijanporna & Khlaisang, 2014). The power of the student's activity by nature will develop in a positive direction when the environment provides a good space for the development of that activity (Aunurrahman, 2009). In other words, the level of the students' activity is influential in learning achievement, as indicated by Ramlan, et al. (2014) that there is a significant influence on the learning achievement with the significance value of 0.001 which is less than 0.05.

In recent decades, the ownership of mobile Android devices is increasing. On September 3, 2013, Google announced that around 1 billion active mobile devices worldwide use the Android Operating System. The Android operating system is opensource and has multitasking capabilities to run multiple applications in Smartphone devices. It is the appeal of users, especially the price of Smartphones today is more affordable in the community. More and more people who own and use mobile devices open up opportunities for the use of mobile devices in education.

The use of mobile devices in the learning process is known as mobile learning. Using mobile devices allows students to not just stay in one place. Students can access something as long as there is internet from anywhere and anytime without the limitation of space and time. This is demonstrated by Edgar et al. (2016) who studied the use of Short Message Service (SMS) as a medium for evaluation of learning. His study is whether the use of SMS can increase the students' participation in learning. He used Blended Learning strategy, combining face-to-face classes with online activities. The results of the analysis showed that the students using the mobile message-based learning evaluation significantly performed better learning than the students from the control group who did not get the mobile message-based learning evaluation. Nearly 20% of the experimental group was more effective in completing the assigned activities than the control group. Besides, the questionnaires answered by the experimental group showed that they were satisfied with the use of this technology. In addition, Paisal (2015) claimed that the students who use the internet in the learning activities will have positive attitude towards learning activities. Information and Technology based media can facilitate the students' learning better (Suryanto & Kusumawati, 2017; Arief & Umniati, 2012)

To encourage and motivate the students to play an active role during the learning process, the students need a reward in every active role undertaken by students. The reward can be an additional score given to students in an open and real-time manner. Thus there is a need for an application that stores and displays the additional scores, where the application can be monitored in real-time by the students. Android-based applications that are installed on the student's smartphones can do this. When one student gets a score because his activity in the class, it expected that it will motivate the other students to participate actively in learning as well to get the additional sore. The student activity at the time of learning process needs attention from a teacher so that the teaching and learning process get the maximum result. Thus finding effective and efficient ways to improve student activity is crucial.

METHOD

This study used the method of Research and Development with 4D models consisting of 4 development stages namely define, design, develop, and disseminate. The disseminating stage was used to develop an Android-based learning system application. The data collection methods were questionnaires and documentation. The defining stage produced an analysis of activities for development needs and product development requirements by user needs. The designing stage produced a design of reward system applications based on user requirements. The developing stage was feasibility testing of the application. The feasibility test was based on ISO 25010 that

consisted of testing the application in the aspects of functionality usability, efficiency, and portability. The tests were conducted by media experts, teachers and ten students of class X Axioo in SMKN 5 Surakarta. The collected data were quantitative data. The aspects of testing refer to ISO 25010 which includes aspects of functionality, usability, efficiency and portability.

Meanwhile, the techniques of data analysis using data.percentages.

$$Percentage\ of\ Results\ (\%) = \frac{Total\ score\ of\ acquisition}{Total\ score\ maximum} X\ 100 \quad (1)$$

From the percentage, then it was consulted with the Feasibility criteria of the application. adapted from Riduwan (2013).

Table 1. Application Feasibility Level Criteria

Criteria	Percentage
Very Decent	81% to 100%
Well worth it	61% to 80%
Less eligible	41% to 60%
Not feasible	21% to 40%
Very Inappropriate	0% to 20%

At the disseminate stage, experiments were conducted in the classroom using an experimental design with a posttest-only control group design. This experiment was conducted in SMK N 5 Surakarta. The data collection used a questionnaire of the learning activity.

Table 2. A Questionnaire Grid of the Learning Activity

Aspect	Indicator	Item number	
		Positive	Negative
Visual Activities	Read the material, observe the experiment	1,2,20,50	31
	Enthusiastic students in following the lesson	10,14,19, 24,36	12,13,17, 26,28,39,47
Oral Activities	Asking questions	8,18,46	21,37
	Express opinions	5,9,42,43,48,49	25,27,29
Listening Activities	Listening to ongoing lessons	16,22	30
	Group collaboration	3, 4,38	
	The activity of students in groups	6, 7,43,44	35
Mental Activities	Given the learning that has been taught	11,32	40
Writing activities	Keeping track of all that the teacher has taught	15,33,34	41

This experiment involved 39 students of class X MM2 and 39 students of class X MM3 as the experimental group and the control group respectively. The experiment assessed the comparison of the students' learning activity between conventional learning and learning using the reward system application. The experimental design of this study adapted from Sugiyono (2013) is presented in Table 3.

Table 3. Experimental Design

Group	Treatment	Posttest
Experiment	X_1	Q_1
Control	X_2	Q_2

Where
Q_1: Postest from the experiment group
Q_2: Postest from the control group
X_1: Learning with the reward system application
X_2: Learning without the reward system application

The data analysis technique was descriptive statistical analysis using was t-test analysis and gain index analysis. The descriptive statistical analysis was intended to describe the level of interest of students of SMKN 5 Surakarta before and after the treatment of the reward system application with the frequency distribution table. The hypothesis testing used t-test analysis with significance level 0.05 with the criterion that Ho is rejected if t_{count} is more than t_{table} and Ho is accepted if t_{count} is more than t_{table}. While the gain index calculation used the gain calculation according to Hake (1999):

$$g = \frac{posttest\ score - \text{pretest score}}{maximum\ score - pretest\ score} \quad (2)$$

The result g was then referred to the gain index criteria adapted from Sundayana (2015). It is presented in Table 4

Table 4. Gain Index Criteria

Value	Criteria
$0.7 < g < 1$	High
$0.3 \leq g \leq 0.7$	Medium
$0 < g < 0.3$	Low

RESULTS AND DISCUSSION

The results of this study are the realization an Android-based reward system application that can store and present the score data embodied in the form of medals so that by using this application, the teachers can simplify the provision of rewards for the active students. Students can also view and monitor the score in real-time and continuously without limitation of space, distance and time.

The concept of the hierarchical structure explains the program structure of the page in the application. The application of the reward system is divided into two branches, namely students and teachers. Teachers and students have different structures as shown in Figure 2. Students can only view lesson data, basic competence data, and scores data. Meanwhile, the teacher can see maple data, manage basic competence data and scores data. The structure of the program hierarchy is shown in Figure 1.

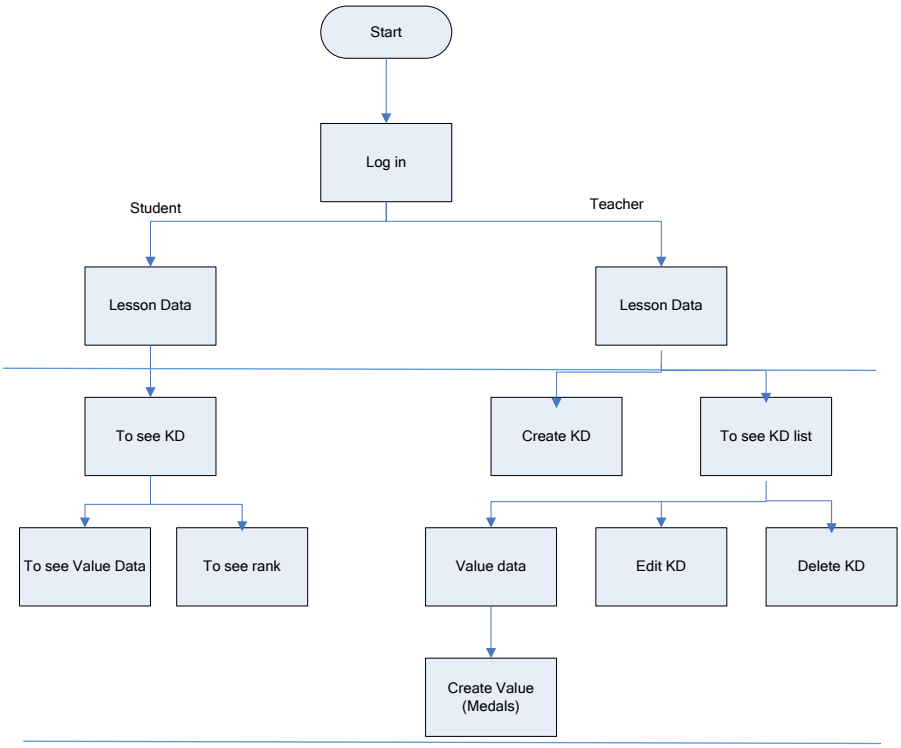
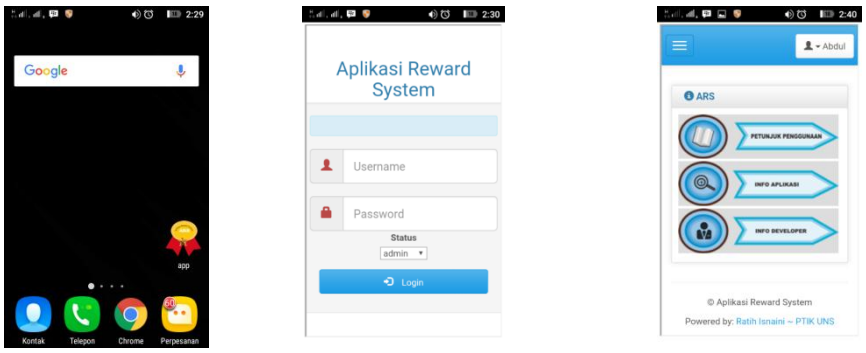


Figure 1. Structure of the Program Hierarchy

To design the reward system application, PHP MySQL was used and to display utilizing bootstrap template, notepad ++ software was used. XMPP and Google chrome were used to build its Android applications utilizing Intel XDK software. The results of the implementation of the sequenced code are presented in Figure 2.



a b c

Figure 2. (a) App Icon Display (b) View of Login Page (c) Homepage Viewer

Furthermore, the feasibility testing of the reward system application was addressed to media experts, teachers and students. The test was done by referring to ISO 25010 mobile application standards by testing the aspects of functionality, usability, efficiency, and portability. The results of the test are shown in Table 5.

Table 5. Test Results of Media Expert

No	Aspect	Percentage	Criteria
1.	Functionality	100 %	Very Decent
2.	Portability	100%	Very Decent

Table 5 shows the percentages of the aspects of functionality and portability performed by media experts by logging in the application as students and teachers. The aspect of functionality shows that the function of each page both login as a teacher and as a student. has the percentage of 100%. The portability aspect was conducted by installing the reward system application on various types of Android versions of ice cream sandwich 4.0 to nougat 7.0 and also testing on various screen sizes with portrait and landscape orientation then the percentage result shows 100%.

Figure 3 shows the efficiency aspect by logging in as students and teachers. The testers assess the response time required when running each page of the application. The results for the response time are the response time that is less than 3 second, between 3 to 9 seconds, between 10-12 second and over 12 seconds were 85%, 15%, 0% and 0% respectively. It means the users who feel very satisfied with the response time of fewer than 3 seconds are 85%.

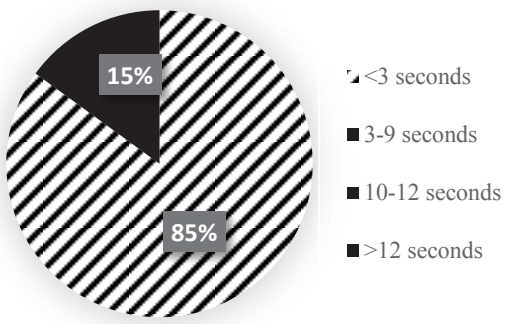


Figure 3. Diagram of the Efficiency Aspect to Media Experts: Response Time

The testing on functionality and usability aspects were performed by teachers and students. The functionality test checks the

function of each page of the application both login as a teacher and as a student. Its percentage results show 100%. The usability test of the application includes several indicators of usability, satisfaction, ease of use and ease of learning of the overall total obtained 86.2%. The percentage results are categorized as very decent criteria. They are presented in detail in Table 6.

Tabel 6. Test Results of Teachers and Students

No	Aspect	Percentage	Criteria
1.	Functionality	100%	Very decent
2.	Usability	86.2%	Very decent

While testing the efficiency aspect, teachers and students assess the response time of each application page when it is executed. The result is the percentages of page indicator requiring a response time of fewer than 3 seconds, 3 to 9 seconds, between 10 to 12 seconds and over 12 seconds were 69%, 29%, 1% and 1% respectively. It means that the users who were very satisfied, satisfied, less satisfied, and not satisfied were 69%, 29%, 1%, and 1% respectively. The results are shown in Figure 4.

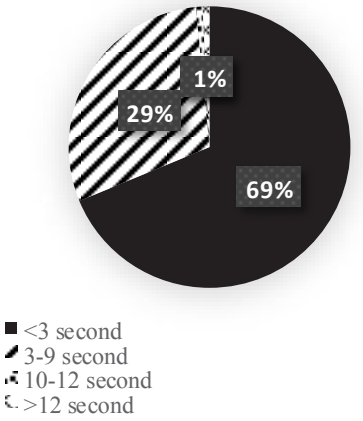


Figure 4. Diagram of the Efficiency Aspect to Teachers and Students: Response Time

The disseminate stage is carried out using experiments in the class to obtain data about the effect of the application on the activity of students' learning. Table 7 presents the experimental results of the learning implementation. The experimental group is a group with a reward-based learning system, the other group is the control group with the traditional learning.

Tabel 7. Descriptive Statistics Analysis of the Experimental Group and the Control Group

Group	Pretest			Posttest		
	Maximum score	Minimum score	Average	Maximum score	Minimum score	Average
Experiment	167	127	145.69	178	132	155.46
Control	150	121	142.54	160	128	144.79

Table 7 shows the results of initial measurements before the treatment. Both the experimental and the control groups show relatively the same average scores of learning activities. However, the results of final measurements after the treatment by using the reward system application in the experimental group and the conventional model in the control group, there is a significant difference. The activity of learners had a significant increase between the two groups, but the higher level obtained by the experimental group. From the data, the posttest scores show that the conventional model reached the highest score of 160 and the lowest of 128 from 50 questionnaires with maximum, minimum, mean and standard deviation scores of 200, 50, 144.79 and 12.60 respectively. Table 8 presents the posttest data in the control group in the form of frequency distribution table.

Table 8. Frequency Distribution of the Posttest Score in the Control Group

No	Interval	Control group	
		Freq.	Percentage (%)
1	128 to 135	7	17.9
2	136 to 143	8	28.2
3	144 to 151	11	20.5
4	152 to 159	7	17.9
5	160 to 167	6	15.4
6	168 to 175	0	0
7	176 to 183	0	0
	Total	39	100

Table 8 shows that the most substantial frequency of the control group is 28.2% or 11 students located in the interval of 144 to 151 and the lowest frequency is 15.4% or 6 students in the interval of 160 to 167. Meanwhile, the activity data from the posttest of learning activity of students on learning using the reward system application shows the highest score of 178 and the lowest score of 132 from 50 questionnaires with maximum, minimum, mean and standard deviation scores of 200, 50, 155.46 and 12.87 respectively. Tabel 9 presents the posttest score of the experimental group in the form of frequency distribution table.

Table 9. Frequency Distribution of the Posttest Score in the Experimental Group

No	Interval	Experimental group	
		Freq.	Percentage (%)
1	128 to 135	1	2.6
2	136 to 143	8	20.5
3	144 to 151	8	20.5
4	152 to 159	4	10.3
5	160 to 167	6	15.4
6	168 to 175	9	23.1
7	176 to 183	3	7.7
	Total	39	100

The data from Table 9 shows that the most significant frequency of the experimental group is 23.1% or 9 students in the interval of 168-175 and the lowest frequency is 2.6% or 1 student in the interval of of 160 to 167. Based on the distribution table, it can be determined the tendency of student learning variables, by groupping based on ideal value (Mi) and ideal Deviation Standard (SDi) with calculation steps adapted from Arikunto (2012) as follows:

Mi = ½ (Ideal score + ideal lowest score)
= ½ (178-132)
= 155
SDi = 1/6 (ideal low score- ideal score)
= 1/6 (178- 132)
= 7.6

From the calculation results then the determination of activity criteria is as follows: (1) High activity = X ≥ Mi + SDi that if the score obtained is more than 162.6, (2) Medium Activity = Mi-SDi ≤ X <Mi + SDi ie if the score obtained is between 147.4 up to 162.6; (3) Low Activity = X <Mi - SDi ie if the score is less than 162.6. Using these criteria, the activity calculation is presented in Table 10.

Table 10. The Trend of Activities

Category	X MM 2 (Experiment)		X MM 3 (Control)	
	Frequency	Percentage	Frequency	Percentage
Low	11	28.2%	20	51.3%
Medium	14	35.9%	19	48.7%
High	14	35.9%	0	0%
Total	39	100%	39	100%

In the experimental group, the students with the activity categorized as high, medium and low were 14 students with the percentage of 35.9%, 14 students with the percentage of 35.9%, and 11 students with the percentage of 28.2% respectively. In other hand, in the control group the number of the students with the activity categorized as medium and low were 19 students with the percentage of 48.7% and 20 students with the percentage of 51.3% respectively. There are not students with the activity categorized as high. Thus it can be concluded that the trend of the activity in the experimental group is in the medium and high category, but the control group is in the low and medium category. Meanwhile, to know the difference of effectiveness of the application on the students' learning activity, the experiment result data are analyzed using a t-test and a gain score. The results are presented in Table 11.

Table 11. The Difference in Effectiveness from the Students

Group	Value	T_{count}	Sig	Declaration
Experimental & Control	Posttest	3.790	0.000	Ho reject

Table 11 identifies the T_{count} of the posttest scores from the experimental and the control groups are 3.790 with the significance of 0.000. It can be concluded that the significance si less than 0.05 and tcount is higher than ttable that is 3.790 higher than 2.642 (76), hence Ho is refused. It can be concluded that there is a difference in effectiveness between learning with and without the reward system application. The next step is to determine which is more effective using a gain score test.The results of the gain score test are presented in Table 12.

Table 12. Comparison of Gain

Group	Gain	Criteria
Experimental	0.302383	Medium
Control	0.128941	Low

Table 12 shows that the gain calculation in the experimental group and the control group is 0.302383 and 0.128941 respectively. The experimental group shows the medium criteria, but the control group indicates the low criteria. From both calculation, it can be concluded that learning with the developed reward system application is more effective than the conventional learning.

CONCLUSION

The results of the study showed that teachers and students can use the developed reward system application through Smartphones with an Android operating system. The Android operating system to be used for the application is minimally Ice Cream Sandwich 4.0 and maximally Nougat 7.0. The developed application functions as an application to store and present data of reward for active students in the learning process. The application is real-time in-app data which is accessible anytime and anywhere. The results of reward system application testing conducted by media experts, teachers and students stated that the application has fulfilled the aspects of functionality, usability, efficiency and portability. The feasibility of the application for functionality, portability, usability and efficiency were 100%, 100%, 86.2% and 77% respectively. The results of the study also showed different effectiveness in learning activities between learning using the reward system application and using the conventional model. The data analysis shows learning with the reward system application is considered more effective than conventional learning measured by t-test and a gain score.

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