

DEVELOPMENT OF MEDIA-BASED LEARNING USING ANDROID MOBILE LEARNING

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ABSTRACT

Today, more than 80% in 104 countries of the youth population are online using Mobile Smartphone. The percentage growth of smartphones in the world is 3%. In Indonesia, the increase amount reaches 6 million per year with the number of smartphones worldwide reaches 7.5 billion in Q3 of 2016. Moreover according to Forbes Magazine, Operation System (OS) of Android controls 65% of the worldwide smartphone market shares beat IOS, Blackberry, and others. The landscape of educational problems especially at Vocational Senior Secondary School (SMK) level in Indonesia is lack of qualified teachers, digital learning media devices such as computers which are still expensive, unclear financial governance and media for learning are not attractive to learners. Learning media is used by teachers to stimulate learners interest to learn should be interesting and interactive in teaching and learning process. In this paper we develop Media-Based Learning using Android Applications as a medium of learning to SMK Learners for the competence operation of electronic control system. The results of the assessment of media experts, teachers, and learners are assessed based on 3 aspects, namely aspects of teaching media, CAI media aspects and material relevance aspects which conclude that media-based learning using android mobile learning is very feasible. Contribution of Media-Based Learning research using android apps are concluded to increase learners interest, easy to be carried everywhere, cheap, and worthy of use as a medium of teaching and learning media after performing functionality test included: ease of navigation, application performance, and ease of operation.

Keywords: *Media Learning, Android, Senior Vocational Education, Smartphone, Teaching*

1. INTRODUCTION

The Internet has touched and changed almost the human life side [1], reached 3 million Internet users in the world in 2016 [2][3]. Predictions from Google Executive Chairman Eric Schmidt mention that by 2020 all the world's populations are connected to the Internet. The International Telecommunication Union (ITU) reports that 80% of teenagers (15-24) in 104 countries are online using Mobile Smartphones [4]. The number of Smartphone usage in Q3 2016 worldwide has touched 7.5 billion, specifically for comparison market shares operating system (OS) is controlled by Android 65%, and the rest by IOS, Windows Phone, and Blackberry [5][6]. Smartphones in Indonesia now reach about 25% of the total population or about 90 million people and increase 6 million per year [7].

Indonesia is going digital [8] with 261 million population around 13,700 islands [9][10], 33 provinces, over 500 districts with roughly 58

million learners, 3 million teachers, and 302,097 schools [11][12]. In general, the challenge of education in Indonesia is a high priority to increase learners' interest in learning [9], improving teacher quality, increasing efficiency, and effectiveness of media based learning [13][14]. In language, media is medium, meaning intermediary. Meanwhile, according to Dictionary of Education states that the media is a form of intermediaries in various types of communication activities [15]. Learning media in teaching and learning process holds the key role of success in education [16].

The obstacles in process of teaching and learning were encountered by teachers and learners through the medium of learning [17] such as multimedia, posters, films and props which do not improve the competence of vocational learners [18][19], lack of funds to purchase devices such as personal computers, and laptops which are still expensive [20], and also laboratory facilities located in every

school are still limited [21][22][23]. Therefore, in this research we develop media-based learning using Android application as teaching and learning media able to increase learners competence, teacher quality and learning can also be done anywhere and anytime, efficiency, and effectiveness.

The tests on functionality, ease of navigation, application performance, ease of operation, and the feasibility of the android app as a mobile media-based learning show the result based on the average rating with a score range of 0-100 obtained value from media experts with a score of 83.33 in the category "very feasible", assessment by teachers with a score of 80.81 in the category of "very feasible" and the results of the scoring by learners obtained a score of 76.67 in the category of "very feasible".

This paper is structured as follows, in Section 2 we describe Mobile Learning, Android Operating System, and Instructional Media. In Section 3 we describe Methodology, the hardware, and software used to development of media-based learning using android mobile learning. Section 4 on this paper is a Result of developing Android apps as Medium-Based Learning. Section 5 is part of the Conclusion and Future Work.

2. BASIC THEORY

2.1 Mobile Learning

The use of smartphones as learning through of mobile technology will enable learning to be done anywhere and anytime with a broad reach to access learning materials and information [17]. Learners do not have to wait for a certain time to study or go to a specific place to learn learners will be empowered because they can learn whenever and wherever they want [24].

Mobile Learning is able to give people the ability to use mobile technology to access relevant information or store new information regardless of their physical location. Technically it can be said to be a personal learning that connects learners with cloud computing using mobile devices [25]. Mobile learning is the opposite of learning taking place in a traditional classroom, where learners just sit, move, watch the teacher standing in front of the class [26].

The mobile learning ecosystem consists of various types of devices [26]: smartphones, mobile phones, personal digital assistants (PDA), notebook, tablet devices, computers, digital cameras, portable media players, game consoles, and portable game devices.

2.2 Android Operating System

A company called Android which was founded by Andy Rubin, Rich Miner, and Chris White in 2000 was acquired by Google, then on November 5, 2007, Google introduced Android. The development of Android by Google is supported by several companies such as HTC, Intel, Motorola, Qualcomm, T-mobile, Nvidia and Asus that formed Open Handset Alliance (OHA) [26] [27].

Android is a platform for the future, as it becomes a complete, open, and free mobile platform [28]. Four factors causing the popularity of android applications are superior to others [29]:

1. Speed factor: The efficiency of the application in providing data exactly in accordance with the user command
2. Aspects of productivity
3. Creativity design
4. Flexibility and reliability

2.3 Software

The software includes programs that execute commands in computers ranging from size, architecture, and content which were presented as computer programs and descriptive information in both hard and virtual form including all electronic media [30]. Software development criteria must be performed [31]: usability is effectiveness, efficiency, safety, utility, learnability and memorability. Effective to use (effectiveness), shows a system can work as intended. The system should allow the user to do what is expected of the system. Efficient to use (efficiency), means the system can run to support the user's work. Safe to use (safety) involves protection for users from hazardous and undesirable conditions. Have good utility (utility), has the appropriate usability and functionality in accordance with what is needed and desired by the user. Easy to learn (learnability), how the system is easy to learn. Easy to remember how to use (memorability) how users can easily recall learning materials.

2.4 Learning Media

Media are all things that carry information from the source to the recipient. Medium is considered as a learning medium when it aims to convey learning [16]. The purpose of learning media is to facilitate communication and learning [16][20]. Educational media have a sense as a tool of learning programs in the classroom or outside which are used in the framework of communication, interaction of teachers and learners in the learning process [31]. Learning media can be

used in bulk, large groups, small groups or individuals [32].

The benefits of learning media by Kemp and Dayton as follows [33]:

1. Delivering learning in accordance with the standards.
2. Make learning more interesting.
3. Learning is more interactive.
4. The length of time the lesson can be shortened.
5. The quality of learning outcomes can be improved
6. Teaching can be given anywhere and anytime.
7. Improving learners' positive attitude towards the learning process.

3. METHODOLOGY

This research was conducted at SMK Maitreyawira, in which address is at Maha Vihara Duta Maitreya, Sungai Panas, Batam City, Riau Islands 29433. Subjects and Object Research in this study are media experts, teachers and learners of SMK Maitreyawira. The object of this research is Learning Media Application.

Preparation which is required includes: basic design concepts, programming language selection, choosing programming environment, and unit testing. The language used is the java programming language. The programming environment (IDE) used is Eclipse. Software development kit is android virtual device as a unit of learning media testing Operation of Electronic Control System.

The hardware used is HP Omen Notebook and Samsung Note 2 Smartphone. Table 1 shows the specifications of the HP Omen Notebook hardware, whereas seen in Table 2 describes the specifications of the Android Smartphone device used:

Table 1: Notebook HP Omen specifications

Processor	Intel Core i7-6700HQ (Intel Core i7)
Graphics	NVIDIA GeForce GTX 965M
Memory	8GB DDR5
Display	15.6 inch Full-HD

Table 2: Android Smartphone Samsung Note 2

OS	4.4.2 (KitKat)
Chipset	Exynos 4412 Quad
CPU	Quad-core 1.6 GHz Cortex-A9
MEMORY	Internal 16 GB, 2 GB RAM
DISPLAY	AMOLED Touchscreen, 16M colors

3.1 Development Model

Development is the process of producing learning materials. The Process Development Model is shown in Figure 1, requires growth and creativity. Software development method on the development model consists of 4 kinds of activities:

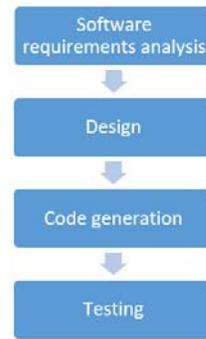


Figure 1: Development Model

The explanation of Figure 1 above is:

The development model in this research uses Waterfall Model. Waterfall Process model is started from the Analysis stage to the testing done in linear, every stage must be completely completed before stepping to the next stage [30]. Analysis needs are processes for representing information, functions, and behaviors that can be translated into data, architectures, interfaces and components. Analysis needs are grouped into 5 areas, namely:

1. Problem Introduction
2. Evaluation and Synthesis
3. Modeling
4. Specifications
5. Reviews

The software design consists of several steps that focus on 4 areas:

1. Data Design
2. Architecture Design.
3. Interface Design
4. Algorithm Design

Code Generation phase is the stage of making the product. This activity is the activity of coding and testing error in code. At this stage the reference used as a development is a model created in the previous stage. Construction consists of 4 activities:

1. Preparation
2. Programming
3. Validation
4. Testing

Once the code has finished writing, testing begins. The testing process is focused on the software's internal logic to ensure all functions have been tested. Then testing the external function to find errors that are not visible and ensure the input

can be processed and produce results in accordance with the needs.

3.2 Data Collection Techniques and Tools

Techniques used to collect data in this study are interviews, observation, black-box testing and questionnaires. Interviews and observations are used at the communication stage to get an idea of what products will be made. Black-box testing is used to test the performance of the application. Questionnaire is used to know the opinions of respondents or learners to the learning media that has been made interviews are intended to obtain an overview of the needs used to define the application to be created. The grid list of questions to be submitted is shown in the Table 3.

Table 3: Lattice grid Interview

No	Lattice grid Interview
1.	Needs of learning media
2.	User media learning
3.	Advantages of learning media
4.	Learning Resources
5.	Output of instructional media
6.	Learning media problem
7.	Use of instructional media
8.	Limitations of instructional media
9.	Relevance of interview material
10.	Expectations about learning media

Questionnaire instruments are questions that expect respondents to choose one of the available answer alternatives. This questionnaire contains the appropriateness of instructional media application of electronic control system as a medium of learning viewed from the aspect of media and material. This instrument will be used for validation prior to testing on the user.

An experimental test was conducted on 20 learners from 64 populations. A viable instrument should meet two requirements that are valid and reliable. The test was conducted by non-test test in the form of questionnaire of learners' opinion on the feasibility of android application as learning media. Validity test is done by expert judgment by 2 lecturer of Informatics Engineering, Universal University. Questionnaire items which have been prepared will be analyzed and evaluated by the expert. The items of the questionnaires declared invalid will be void or revised.

Data analysis in this research uses quantitative descriptive technique which describes the application of instructional media. The data obtained through the instrument was analyzed using quantitative descriptive statistics. This analysis is

used to describe the data characteristics in each variable as shown in Table 4 [34]:

Table 4: Category Four Scale

Value Score	Interpretation
4	Very Decent
3	Decent
2	Not feasible
1	Very unfeasible

The scores obtained are converted to values on a scale of 4 shown in Table 5.

Table 5: Assessment Category

Score interval	Category
$X > Mi + 1,5(SDi)$	Very Decent
$Mi < X < Mi + 1,5(SDi)$	Decent
$Mi - 1,5(SDi) < X < Mi$	Not feasible
$X < Mi - 1,5(SDi)$	Very unfeasible

The ideal mean (Mi) and deviation are obtained using the formula as shown below:

$$Mi = 1/2 / (\text{highest score} + \text{lowest score}) \quad (1)$$

$$SDi = 1/6 / (\text{highest score} + \text{lowest score}) \quad (2)$$

The feasibility rating scores in the table above will be used as a reference to the results of trials by material experts, teachers and learners. The results of the scores obtained from the questionnaire will show the feasibility of android applications as a medium of learning.

4. RESULT AND DISCUSSION

4.1 Application Design

Our research focus is on the side of 4 stages of activity: (1) software requirement analysis, (2) design, (3) code generation, and (4) testing. Model of instructional media application is using thumb focused interaction model [35]. This model aims to allow applications to run using one hand without difficulty reaching the menu as shown in Figure 2

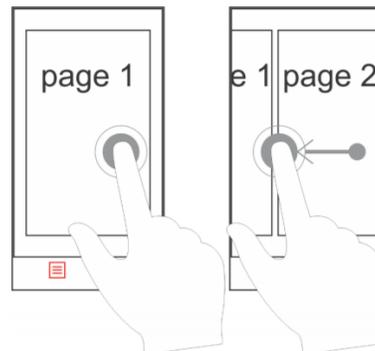


Figure 2: Swipe View

The navigation structure provides an overview of the relationship between activities in instructional media applications. Navigation structure is compiled based on data analysis software needs. Here is the design of the navigation structure with the Main Page from the Main Menu. There are four menus, such as: competence, material, questions and help seen in Figure 3

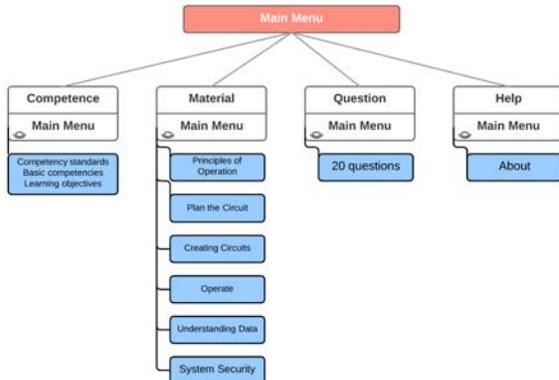


Figure 3: Application Navigation Structure

Storyboard is a brief description descriptively with the application flow Learning Media operation of the Electronic Control System from the beginning to the end of the application. The full storyboard is shown in Figure 4 which consists of Main Menu, Material, and Questions.

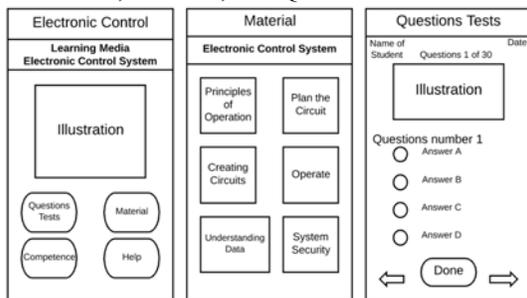


Figure 4: Application Design

Table 7: Results from the Media Expert Assessment

Validator	Rules of instructional media	Governance	CAI Media	Total score
Media Expert 1	57	24	43	124
Media Expert 2	46	18	36	100
Average	51,50	21,00	39,50	112,00
Convert raw values	81,11	83,33	86,36	83,33
Category	Very decent	Very decent	Very decent	Very decent

Table 7 above, explains the assessment results by media experts on the aspects of learning media rules which obtain average score 51.50. The score can be interpreted as application of learning media is very decent to use. Aspects of governance obtain average score 21.00, the score can be

4.2 Data analysis

Data analysis is done to analyze data of product test result through validation test, alpha test and beta test. Data analysis of validation test results which are done by experts, aims to determine the feasibility of learning media applications by media experts and material experts. The data analysis results of Alpha Test are to know the assessment response by first user (teacher). The data analysis results of Beta Test are to determine the assessment response by end users (learners).

Data validation test results by a media expert are in the form of a score converted into a standard value with a score range of 0-100. Assessment by media experts is assessed from the 32 point assessment indicators. The 32 aspects of the assessment consist of 15 aspects of learning media principles, six aspects of governance and 11 aspects of Computer Assisted Interaction (CAI) media. The following categories of valuation have been converted into the default values shown in Table 6.

Table 6: Category Assessment Scale 4 Media Experts

Score interval	Category
75,00 < x ≤ 100,00	Very Decent
50,00 < x ≤ 75,00	Decent
25,00 < x ≤ 50,00	Not feasible
0,00 < x ≤ 25,00	Very unfeasible

The results of media expert assessment data on the product are based on aspects of instructional media, governance and CAI media that have been converted shown in Table 7.

interpreted as application of learning media is very feasible to use. Aspects of CAI media obtain average score 39.50, the score can be interpreted as application of learning media is very decent to use. Overall learning media applications get a score of

112.00 with these scores can be interpreted as application of learning media is very decent to use.

principles, management, CAI media and the relevance of material that has been converted shown in Table 8.

The results of teacher assessment data on the product based on the aspects of learning media

Table 8: Teacher Assessment Results

Validator	Rules of instructional media	Governance	Media CAI	Material Relevance	Total score
Teacher 1	41	20	20	33	114
Teacher 2	42	22	18	35	117
Teacher 3	44	19	15	30	108
Average	42,33	20,33	17,67	32,67	113,00
Convert raw values	84,25	79,62	84,44	75,56	80,81
Category	Very decent	Very decent	Very decent	Very decent	Very decent

The Table 8 can be explained as results of assessment by the teacher on aspects of instructional media which obtain a mean score of 42.33 which means the application of learning media is decent to use. Aspects of governance obtain average score of 20.33 with these scores can be interpreted as application of learning media is very feasible to use. Aspects of CAI media obtain average score of 17.67 with the score can be interpreted as application of learning media is very feasible to use. Aspects of material relevance obtain average score of 32.67 with the score can be interpreted as application of learning media is very decent to use. Overall learning media applications

get a score of 113.00 with these scores can be interpreted as application of learning media is very decent to use.

Results of Beta Test data by learners in the form of score are converted into standard value with score range 0-100. Assessment by learners uses 23 assessment indicators. There are 23 assessment indicators which consist of 12 aspects of learning media rules, 5 aspects of CAI media and 6 aspects of material relevance. Results of data of learners appraisal to product are based on instructional method aspect media, CAI media and material relevance that have been converted shown in Table 9.

Table 9: Results of Learners Assessment Data

Respondents	Rule Learning Media	CAI Media	Relevancy material	Total score
Learners 1	46	18	24	88
Learners 2	42	15	18	75
Learners 3	37	15	18	70
Learners 4	43	18	18	79
Learners 5	39	18	18	73
Learners 6	45	19	24	88
Learners 7	39	18	18	75
Learners 8	40	17	20	77
Learners 9	47	20	24	91
Learners 10	37	14	18	69
Learners 11	37	17	18	72
Learners 12	33	13	17	63
Learners 13	43	17	18	77
Learners 14	41	18	18	77
Learners 15	40	17	18	75
Learners 16	47	20	24	91
Learners 17	37	15	18	70
Learners 18	36	14	18	68
Learners 19	39	14	18	71
Learners 20	37	14	18	69
Average score	40,20	16,45	19,25	75,90
Value conversion	78,33	76,33	73,61	76,67
Category	Very decent	Very decent	Decent	Very decent

The results of the learners' assessment on the learning media method obtain the average score of 40.20 which means the application of learning media is suitable for use. Aspects of media CAI obtain a mean score of 16.45 which means the application of learning media is very decent to use. Aspects of material relevance obtain average score of 19.25 which means the application of learning media is feasible to use. Overall learning media applications obtain a score of 75.90 which means the application of learning media is very decent to use. Data in Table 9, is arranged into the table of frequency distribution as shown in Table 10.

Table 10: Frequency Distribution of End User Test Results

Category	Score	Frequency	Percentage (%)
Very Decent	$75,00 < x \leq 100,00$	11	55
Decent	$50,00 < x \leq 75,00$	9	45
Not feasible	$25,00 < x \leq 50,00$	0	0
Very unfeasible	$0,00 < x \leq 25,00$	0	0
Total		20	100

Table 10 shows that 55% of learners in Beta Test which is stated the application of instructional media in the category "very decent" as a medium of learning, and 45% of learners said the application of learning media in the category "decent" is used as a medium of learning. No learners says the "improper" or "very unfeasible" learning media app is used. These results can be interpreted that the application of learning media is very feasible to use.

The final product of the development result is the application of learning media to the operation of the electronic control system. This android application product can further be utilized for learning activities of electronic control system operation in class XI Electricity Engineering Installation Skill, SMK Maitreyawira, Batam, Indonesia. Here is a visual overview of the application product learning media operation of the electronic control system main page, material pages and questions which run using Android 4.4.2 KitKat with 5.5 inch screen size shown in Figure 5



Figure 5: Media Learning Application Competence Operation of Electronic Control System

The subject matter on the competence of the operation of the electronic control system is grouped into: (1) the operating principle, (2) plan the circuit, (3) make the circuit, (4) operate, (5) understand the data, and (6) the security system. The evaluation model in this app aims to be a problem exercise for learners. The valuation model uses a choice of 20 questions. Options on using radio button to select the answer. Displayed Test Questions can be a matter with pictures or just a matter of course. The number of Test Questions is

20 questions, stored in a database that will be displayed randomly each starting of test Question. The Test Question begins with a name. After filling in the name the questions will appear and start time countdown. Evaluation results are displayed at the end containing the scores obtained and incorrect answer numbers.

The impact of adopting an Android-based mobile learning is learners have a digital environment in their learning media. Learning objectives can be achieved so as to make learners

enthusiastic in ongoing learning as they see, discover and feel a new thing.

Mobile Learning Technology allows learners to easily obtain information and learning materials effectively and efficiently with the result of increasing the competence of learners. The impact for teachers is that they can control information, materials and tests to learners from anywhere and at anytime

5. CONCLUSION AND FUTURE WORK

The conclusion can be taken based on data of research result and discussion of android application development as learning media is very decent. The delivery of information and learning materials to the learner's from teachers is more interactive, involving more contact, communication and collaboration with people easily, inexpensively and accessibility anywhere and anytime. Comparison with other digital learning media such as using desktop-based/notebook-based multimedia is quite troublesome, expensive and immobile for the learner [32][36] [37].

The assessment of media experts is based on 3 aspects, namely: aspects of instructional media, governance and media CAI get a score of 83.33 or including "very decent". Assessment of material experts is assessed based on 3 aspects: the aspects of learning media principles, management aspects and material relevance aspects get a score of 71.53 which means "decent" is used.

Assessment by teachers is assessed based on 4 aspects, namely aspects of learning media, management aspects, aspects of CAI media and material relevance aspects get a score of 80.81 or including the category "very decent" is used.

Assessment by learners is assessed based on 3 aspects namely aspects of instructional media, aspects of CAI media and material relevance aspects. 55% of learners stated learning media applications "very decent" is used.

For the future work, the instructional media application for competence operation of electronic control system needs to be added animation feature and simulation feature so that learners learning is more interactive, easy, and also available for IOS or Microsoft operating system.

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