Development of Android Based Mobile Learning Media on Computer Assembly at a Vocational High School

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This study aims to (1) produce android based mobile learning media (2) to discover the level of validity and practicality of learning media according to material and media experts as well as users, (3) to discover the effectiveness of learning media to improve the learning outcomes of vocational High School students. The study is based on Research and Development (R&D) with Four-D model (define, design, develop, disseminate), using primary data. Data analysis follows descriptive analysis to describe the validity, practicality and effectiveness of android based m-learning media. The results of this research are as follows: (1) The validity of mobile learning media in terms of media s and material aspects (2) The practicality of android based mobile learning media based on teacher and student responses is found to be very practical (3) The effectiveness of mobile learning is declared effective in improving student learning outcomes. Based on the findings of this study it was concluded that the android based mobile learning media is valid, practical, and effective for computer assembly in vocational high schools.

Key words: *Effectiveness, Practicality, Media, Mobile Learning, Validity.*

Introduction

Significant developments of mobile technology have and will continue to determine changes in how people learn around the world. They will be able to study, interact socially and work from different places, without being physically present. Mobile technologies have the potential to increase participation in learning activities, skills of Information and Communication of Technology (ICT) for students and teachers, and the knowledge, competencies, and skills required in the knowledge society. Recent advances in computer and communication technologies have changed the methods of teaching and learning (Bentsen et al., 2013, Felicia,

et. al. 2017). Many studies have reported the benefits of mobile and wireless network technologies that offer opportunities to engage students in interacting with real-world learning targets via mobile devices (Kukulska-Hulme, 2012). Due to the improvement in technology, students and teachers have more opportunities to experience the benefits of technology-enhanced learning (Meng & Idris, 2015).

Currently, due to ease of access and expansion in of ownership, smart mobile devices have become developed an essential role in the education system (Elkhateeb et al., 2019). The rapid development of network communication technologies, an increasing number of wireless and mobile technology applications are integrated into classrooms to support teaching and learning. The use of mobile devices has become common among various age groups due to their availability and affordability. Mobile learning (m-learning) technologies have found their ways to formal education. Students can use communication technology anytime and anywhere to access educational resources (Ally and Tsinakos, 2014), (Hassan et al., 2012), (Roberts, 2013). As more and more people around the world use mobile technology for learning and everyday tasks, the question remains "What is the future of mobile learning in education?" In the future, mobile devices will look completely different from today; hence, we must plan to provide education to meet the demands of a new generation of students. M-learning is not only about technology, it is about students. Students are increasingly mobile which is at the centre of learning, and technology enables students to learn in any context (Ally and Prieto-Blázquez, 2014).

The definition of m-learning has evolved in various ways and directions since the first decade of the 2000s. According to Baran (2014), the evolution of these definitions has mainly highlighted positive characteristics of m-learning such as "access (Parsons and Ryu, 2006), mobility (Sharples et al., 2009), situativity (Cheon et al., 2012), immediacy (Kynäslahti, 2003), omnipresence (Kukulska-Hulme et al., 2009), contextuality (Kearney et al., 2012) and convenience (Kynäslahti, 2003)."

M-learning is a method that intersects mobile computing with e-learning (Chee et al., 2017), adopting the use of mobile technology to achieve ubiquitous learning (Hung and Zhang, 2012) which emphasises student mobility and personalised learning (Vázquez-Cano, 2014). Finally, in terms of outcomes, 86% of studies on m-learning present positive outcomes (Wu et al., 2012). Reports have also been found according to which "most of the 144 M-Learning studies present positive outcomes. Neutral outcome ranked next and negative outcome ranked the least" (Hung and Zhang, 2012). These results strongly represent a general positive attitude towards m-learning across much of the literature in this field. On the other hand, some authors share a sense of clear optimism regarding the integration of mobile devices within classroom. Mobile technology has great potential for facilitating more innovative educational methods (Sung et al., 2016).

The effect of using smartphones on learning processes can be either positive or negative. Although some students remain who still do not use smartphones as a learning tool. The method used by students in operating smartphones for learning is different for each individual, the teacher as an educator needs to ensure the best and most useful for the effective use of smartphones in the learning process. In order to discover whether smartphones are beneficial in learning, we can measure student learning outcomes, although the results are not necessarily accurate

At present the use of smartphones is increasing dramatically, this research aims to discover whether smartphones are used as effective learning tools. Based on results from student needs assessments, students use smartphones the majority of the time. Students mostly (in this case 45%) use smartphone for informal learning only, for example to search for information such as accessing course material. This can prove Chen and Denoyelles' assertion (2013) that students mostly use mobile technology for informal learning. Even though they believe that smartphones can be an effective learning tool, more than half of respondents admit that the main purpose of using smartphone is to access social media. The most frequent category of apps used is social media, followed by games at 25%. Books constitute only 15 % of smartphone usage and 9 % use if for listening to music is. This finding confirms what Alfawareh and Jusoh's belief) (2014) that most students do not use smartphones for learning.

Based on interviews, teachers have a difficult time delivering course material to students although several pupils are enthusiastic towards the learning process and yet a few remain less active in the learning process. Time limitations in the delivery of material are also the cause, so that the material cannot be delivered to students in its entirety as well as lack of learning support facilities. The use of textbooks is also limited due to lack of availability

The use of appropriate teaching resources or media needs more attention. In reality, in preparation for learning 67% of teachers did not create their own teaching media but obtained it from the Internet. The use of media that has not been optimised in learning such as PowerPoint is used by teachers in the learning process as additional learning media However, some learning material do not include supporting animation and exercises or quizzes which can cause a lack of student interaction in learning. The learning process is still carried out conventionally, where it is teacher-focuses, which causes students to be less motivated to learn new things that can be used as experiences in the learning process. This results in learning being less interesting and 1 optimal. Thus, the learning process is hampered and has a detrimental effect on student learning outcomes.

This problem occurs because there is still not enough media or tools for learners to explain the course material computer assembly which needed for object visualisation, which can explain the process of computer assembly. This process must be observed directly because if students

learn course material without practice and there are no learning tools to help students, the impact of these problems can include students feeling as though they do not master concept well due to lack of understanding of abstract material.

One of the abstract subjects for this course is computer assembly and operating system, which can only be completed with real media. Why should we use learning media even though we have a real tool which can be easily understood? In vocational high school 2 Padang still doesn't have enough computers for students to study, let alone use to practise computer assembly in which students need to unload the component in the Control Processing Unit (CPU) and to reinstall it This can cause a risk for functioning computers to be unused . To prevent this from happening, one solution is to develop learning media which can help students understand the course material.

The use of teaching resources in the form of media presented in smartphones is still being optimally used students in only 10% of cases, whereas computer assembly material requires more detailed and real visualisation of objects. Abstract material needs to be conveyed by presenting object visualisations and explaining each process in detail. The results of observations also reveal that students were more interested in learning using various media. They prefer learning with media that shows how to work, draw in more detail than learning by using only textbooks. Students believe smartphones can be very useful as a learning tool. Based on interviews, 92% of students agree while only 8% of students disagree that learning is more effective when using smartphones.

In conclusion, students need the development of learning media to increase motivation and improve learning effectiveness. It is necessary to develop a media that can visualise learning material, especially the subject of computer assembly which aims to facilitate students' understanding of the concepts of learning material which are abstract or cannot be observed directly and can also be used for independent learning. The research and development that will be carried out by researchers at a later stage is limited to the subject matter of computer assembly. Given the misconception related to the subject, it is often compared to other material.

However, the previous implementation and application of m-learning to various computer courses have been successful; our solution would work regarding the issue of teaching students in classes. It is important to design m-learning media includes is animation and contains video tutorials, so students can understand abstract learning materials more easily through the learning media. The use of m-learning based android is to create research media to assess the validity, practicality and effectiveness of the media in learning Computer Assembly, which can support the learning needs of students in improving learning outcomes.

Methodology

This research was conducted at the Vocational High School 2 Padang. The object of this research was an android mobile smartphone application, and the subject was Grade X Vocational High School students of studying Computer Assembly, during the academic year 2019/2020. The research approach consists of research and development, with reference to refers to the steps and procedures of the Four-D development model. The development process consists of 4 stages: (1) define (determine material); Design; (3) Develop; (4) disseminate (Thiagarajan, 1974). However, the dissemination stage is only carried out on a limited scale, compared to other classes. The selection of the development model in each study must reveal the advantages of the models. Some of the advantages of the Four-D model include: 1) the stages being completer and more systematic; 2) development involves the assessment of several experts so before field trials are conducted, revisions have been made based on assessments, suggestions and expert input (Hamdani, 2011). Data analysis technique is describing the validity, practicality and effectiveness of android based m-learning media.

Results and Discussion

M-learning media developed is the media transforms abstract material into animation in an android smartphone, because there are so many abstract material concepts in Computer Assembly subjects, so that m-learning media is expected to help students to understand the abstract material.

Figure 1. Android based m-learning media
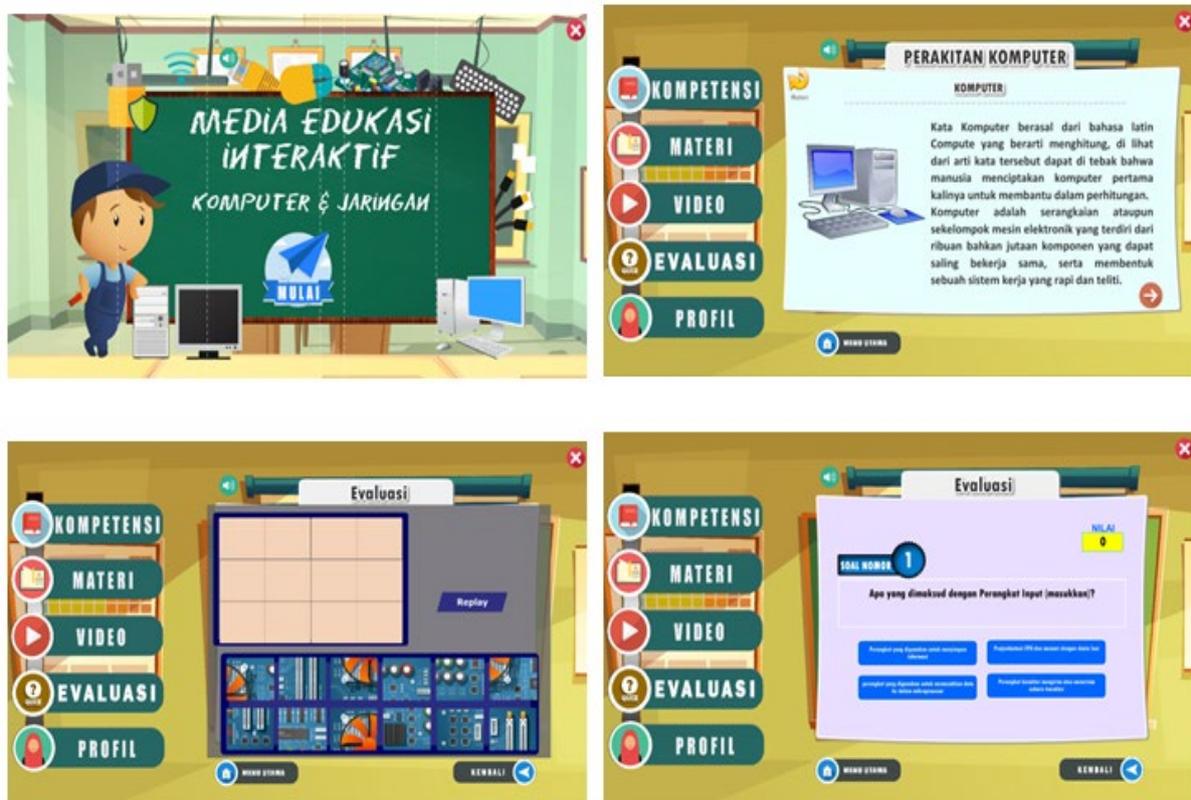
The validation test phase of the media carried out for the developed learning media can be identified based on the evaluation of the material and media expert. The purpose of validation activities is to obtain a valid status from experts. Validation test data is obtained through validation instruments which are filled by several validators who are experts of learning media and material. The results of input from experts are made into revised material. The next section consists of an analysis of questionnaire data from the results obtained from the expert validation test.

Material validation

Material validation was carried out by three experts in the Computer Assembly subject. The purpose of the validation is to find whether the accuracy and suitability of the product content developed whether is consistent with learning needs. Validation assessment data is obtained after the validator provides an assessment of the learning material in the learning media. Subsequently, the value of data validity is calculated, and the results of material validity can be seen in Figure 1.
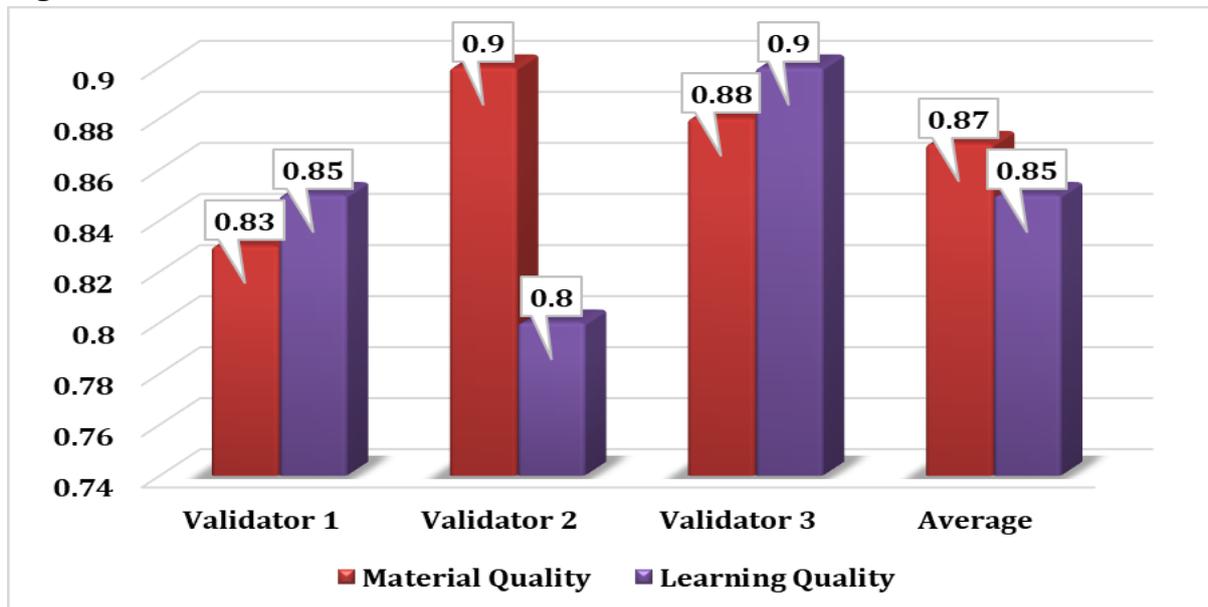
Figure 2. Results of Material Validation

Figure 1 shows the average validity percentage from material expert validators when the material quality is 0.87, the quality of learning is 0.85 and the average material and learning quality is 0.86 which is categorised as valid with some revisions to certain parts in the media about the material, so it can be concluded that android media based learning in Computer Assembly subjects is categorised as valid for use in Grade X Vocational High School students.

Table 1: Revised Learning Media Instruction List by Material Experts

No	Before Revision	After Revision
1	Material content must be according to the syllabus	The material has been adjusted to the syllabus
2	Enrich material the current state of computer development	The material has been enriched with the current conditions
3	Material content should be included one semester	Material content already includes one semester

Media Validation

Media validation consists of validating a product design which is performed by three media experts. It has three requirements, display quality, media programming and utilisation. Media validation was completed twice. After conducting the first validation, the researcher had to revise learning media based on the advice given by the media expert validator, after which the

researcher carried out the second validation to the media expert validator. Then the validator will reassess the learning media and validator assessment. The results of media validation by the validator can be seen in the Figure 2.
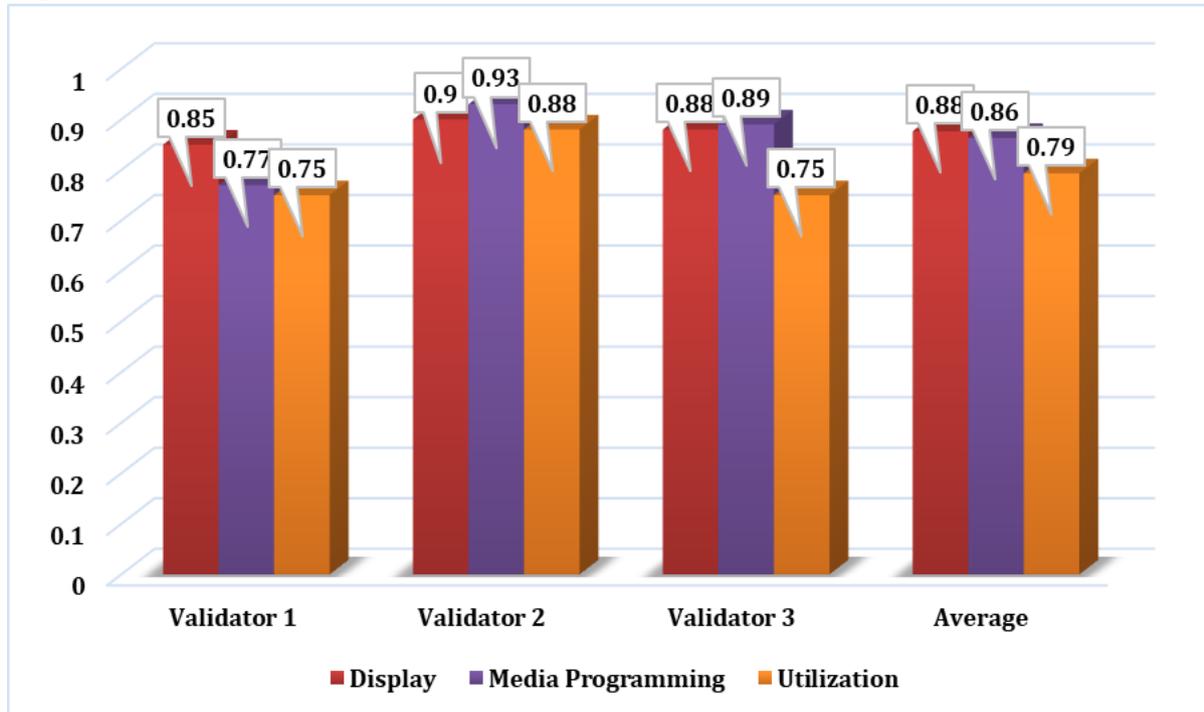
Figure 3. Results of Media Validation

Figure 2 shows that the average validity percentage from media expert validators in terms of display quality is 0.88, 0.86 and 0.79 in terms of media programming and the average validity percentage from media experts in terms of appearance, aspects of media programming and aspects of utilisation is 0.84 in the category of validity, so it can be concluded that the m-learning media in the subject of Computer Assembly is categorised as valid for use with Grade X Vocational High School students. Prior to performing a second validation, the researcher must revise in accordance with suggestions for improvements that have been provided by the expert media validator. able 2 below presents feedback and suggestions from validators.

Table 2: List of Revised Learning Media Instruction by Media Experts

No	Before Revision	After Revision
1	Find background music in applications that make the brain more relaxed for improving for brain intelligence	Background music has been changed to music that makes the brain relax more
2	Material content must be able to zoom so it can be seen comfortably	Material content already zoomed
3	The "main menu" button does not respond properly, must be corrected	The "main menu" button has been corrected
4	The button to exit the media should be placed in the upper right corner	The exit button has been placed in the upper right corner

Based on the data in the table above, it can be concluded that the m-learning media regarding Computer Assembly, especially regarding basic competence describes that he concepts of computer assembly is valid and can be used as learning media for students.

Practicality

Practicality assessment is carried out by teachers and students. The instruments used are response sheets. Practicality test were conducted by teacher who instruct computer assembly. The assessed features are product quality, presentation of material, and media utilisation. Meanwhile, the practicality test is completed by 34 students from grade X Vocational High School 2 Padang. Based on results, regarding product quality, 90% consider it a practical category, 87.5 % considered presentation of material as a practical category, and media utilisation is deemed practical by 88.8%. The teacher's average practicality test complies 88.75% with the practical category, whereas based on the results of the practicality test, product quality obtained 89.85% with practical categories, aspects of attractiveness 90.42% consistent with practical categories, aspects of presentation material 89.69% consistent with practical categories, and aspects of media utilisation obtained 90.08% with the practical category. The percentage of the average practicality test by students is 90.12% in line with the practical category. Thus, it can be said that the android based m-learning media is very practical for being used in the Computer Assembly Subject of Grade X Vocational High School 2 Padang. The provision of a variety of android based mobile learning media provides benefits the students: learning activities become more interesting, help students in independent learning, also helps students understand the materials of Computer Assembly, especially the abstract material that cannot be observed directly. In addition, android based m-learning media helps teachers deliver learning materials and makes it easier to manage classes due to of student-

centred learning. Learning using the android based m-learning media can help teachers overcome time constraints.

Effectiveness

The effectiveness of m-learning media is seen from learning outcomes in the fields of cognitive, psychomotor and student motivation. Effective cognitive skills are tested through pre-tests and post-tests. Multiple choice questions with a total of 25 questions with five answer choices are provided. A pre-test is completed at the beginning of learning before students' study with learning media. Meanwhile, post-test is completed after students learn with learning media. The pre-test and post-test are given to 34 Grade X students.

The learning media can be expressed through the learning process if it allows teachers and students to achieve learning goals. Accomplishing learning objectives can be seen from students' completeness. The minimum completeness criteria (KKM) viewed from the individual completeness of students. KKM applied at Vocational High School 2 Padang is seventy-five. Based on the pre-test, 4 students completed (11.8%) and 30 did not (88.2%). After students learn with m-learning, post-test was given to students, so all students completed the test. Based on these results, there is an 88.2 % increase in learning outcomes in the effective category. Observation sheets were used to obtain the effectiveness of affective assessment, as well as the fields of psychomotor and motivation. The results of the psychomotor assessment data analysis obtained a percentage of 97% with an effective category. Meanwhile, the results of the motivation assessment data analysis obtained a percentage of 85.95% with an effective category.

Based on the results of the data analysis, learning outcomes in the subject of Computer Assembly subject were very effective using android based m-learning media rather than using media PowerPoint which students had used before, so that android based m-learning media can improve student learning outcomes. This is consistent with previous research conducted by Leinonen (2014) which found that mobile apps that are designed for learning showed that M-learning can increase students' cognitive traits. Technological innovations and contextualized learning opportunities offered by mobile learning are appealing and exciting to learners (Shonola et al., 2016).

Mobile learning improves students' interest and motivation in learning new courses. Besides, mobile devices and wireless networks technologies are improving continuously. The evolution of these technologies helps e-learning to extend to mobile learning (Elkhateeb et al., 2019). Accordingly, several researchers have attempted to provide effective approaches to assisting learning by guiding students to learn in the real world and increasing teachers' confidence in developing mobile learning activities (Schuck et al., 2012).

These results are consistent with other studies that have shown that the application of mobile learning interventions could improve students' learning performance (Chu et al., 2010), (Liu et al., 2009). The flexibility of being able to use their mobile devices for educational purposes anytime and anywhere may be advantageous (O'Bannon and Thomas, 2015). Since the main focus is on student usage of smartphones, it can be an advantage to add academic purpose to usage, confirming the findings of the research paper by Thiagarajan (1974) Establishing a faculty focused group for m-learning can promote mobile technology's formal academic use. The result of using smartphone can be similar. Gikas and Grant (2013) have stated that mobile technologies enable learners to find, manipulate, identify and evaluate existing knowledge and successfully integrate and communicate this new knowledge into their work. In this study only limited dissemination was carried out, more specifically by disseminating and promoting end products limited to teachers and students in other classes.

Conclusion

The results of the development of this research are products from the android based m-learning media on Computer Assembly subjects. The process of developing m-learning media refers to the Four-D model, including Define, Design, Develop and Disseminate. The subjects of this learning media development experiment were Grade X vocational high school students. After the development process is complete and the m-learning media developed is declared valid, the m-learning based android is ready to be tested.

Based on the results of data analysis and discussion, it can be concluded that the android based m-learning media on computer assembly subjects for Grade X vocational high school students is valid from the percentage of media and material validation. Therefore, it can be concluded that m-learning media is valid for testing on computer assembly learning in vocational high school and can be used in the learning process. Furthermore, the results of the study also show that the practicality of android based m-learning media is in the practical category based on the results of the practicality test by teachers and students. This is based on the results of practicality by teachers and students showing that the learning media are practical for use in learning. Whereas, the results of research for the effectiveness of the m-learning media improve learning outcomes. Due to the effectiveness obtained from the results of the post-test seen from the classical completeness of students all students passed the test, and the paired t test showed a significant level of difference between pre-test and post-test with a gain score in the medium category. Based on the findings, it is concluded that the m-learning media is valid, practical, and effective to be used as a learning medium. This research recommends broader testing and providing more complete content for the sake of improvement in the development of Android-based m-learning media. There needs to be more research regarding how to design and deliver learning to reach the masses, taking into consideration learners' cultures, values, and local

contexts. Education must take advantage of this abundance of mobile technology to deliver education to students anywhere and anytime.

Acknowledgments

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