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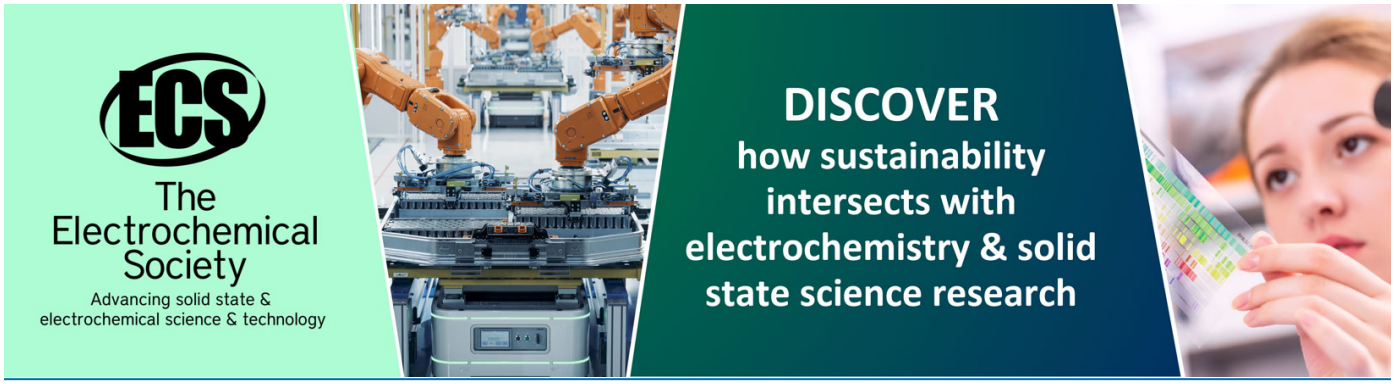

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The use of android-based teaching materials in physics learning process at vocational high school

S R Hakim[1], R Kustijono[2], dan E Wiwin[3]

[1]Department of ICT Education, Universitas Muhammadiyah Sidoarjo
[2]Department of Physics, Universitas Negeri Surabaya
[3]SMK Negeri 12 Surabaya

E-mail: septian@umsida.ac.id

Abstract. This study is purposed to describe the effectiveness of Android based teaching materials for physics learning at vocational school (SMK). Digital teaching materials that are made consist of learning materials equipped with video and animation that can be played through an Android-based smartphone. This research implemented pre experimental design based on one-shoot study case. The effectiveness of Android-based digital teaching materials is examined based on concepts understanding and respons of students. The subject of the research is 40 students of SMK in Surabaya. The concepts understanding is measured by exam test and the students' response is measured based on Likert-scales. The data analysis used is a descriptive statistic. Android-based digital teaching materials are effective if the average score of students' conceptual understanding ≥ 60 and the percentage of students' responses ≥ 61% (good or very good). The results obtained are: the average score of students' conceptual understanding x = (85 ± 6) and students' response is categorized very good (percentage of effectiveness are 85%). The results showed that Android-based digital teaching materials are effective to use in Physics learning process at vocational school.

I. Introduction

The 21st century is marked by the advancement of information and communication technology (ICT) that is developing so rapidly to meet the needs of human life in the century which includes critical thinking and problem solving, creativity and innovation, collaboration, and communication [1]. The development of ICT also has an impact on Indonesia which also penetrates in various fields of life including education and teaching. The progress and development one of them can be seen by how much the empowerment and utilization of ICT in the field of education and teaching. The use of ICT in the field of teaching aims to make learning more effective and efficient, for example using it as a learning medium, packing learning materials into digital teaching materials, delivering learning materials to students online etc. The impact of the development of ICTs is also followed by the rapid development of smartphones so that almost every week new-generation smartphones always emerge. Smartphones today have become very common in everyday life, including students so that their existence can disrupt the learning process in conventional classes [2]. The technology plays a neutral role so that it has a good or bad impact on its users. Teachers should use ICTs including smartphones in learning, so that the

technology is useful in learning, and at the same time adjusting to the needs of the 21st century. In the last decade, the use of smartphones in learning began to be popular especially those used to learn through digital communication between student groups and between students with the teacher Digital teaching materials can be used by teachers to create more interesting learning, by adding videos and animations. Android is currently the most widely used operating system on smartphones because it uses visual block programming that does not require coding in making applications, so it can be the most appropriate alternative choice in empowering smartphones for learning. Smartphone users simply use, manage, and drag-drop visual objects in making applications [3]. Physics learning requires media that can explore material to present both facts, concepts, processes, and metacognitive to students. Physics is the product of ideas produced and tested through a scientific inquiry about the physical properties of the universe. Mastery of the Physics concept requires a learning process that can provide opportunities for students to process their intellectuals optimally. Generally, physics learning in vocational schools is less attractive for students because it only adaptive lessons, while they pay more attention to productive subjects. One of the standard competencies of graduates in SMK is to demonstrate the ability to think logically, critically, creatively, and innovatively in decision making. To meet these standards, teachers can apply various learning methods and approaches, and one effort to synergize Physics learning with the productive fields of Multimedia majors is to utilize information and communication technology (ICT). Therefore, this study aims to describe the effectiveness of the use of Android-based digital teaching materials in learning physics in vocational schools.

Currently, the use of Android-based smartphones that are growing rapidly, allows teachers to package paper-based teaching materials into digital-based teaching materials so that they can utilize Android-based smartphones to become effective learning facilities. Digital teaching materials allow students to do activities to receive the materials, direction, and various learning information wherever and whenever that is not limited to space and time. Digital teaching materials are also able to train students to learn independently from various sources provided. Through the use of smartphones teachers can create mobile learning that should be able to increase students 'attention to learning material, because it reduces students' boredom in conventional classes [2]. The development of digital teaching materials aims to ensure students can plan their own learning period and choose the appropriate learning process, in addition to being used also to reflect on the learning that students have passed [4]. To assess the effectiveness of digital teaching materials, in this study only measures the construction and synthesis of knowledge, which leads to basic scientific knowledge or conceptual understanding of students [5]. Research conducted has found that digital teaching materials can improve students 'abilities in mathematics and science, which means it can help improve students' cognitive aspects [6]. The development of digital teaching materials can involve the role of teachers and the role of students actively together in developing learning materials commonly referred to as collaborative learning. In the last decade there has been a significant increase in the use of digital teaching materials in high school science [7].

Digital teaching materials can give birth to 6 categories of conceptions in learning held by the teacher consist of: prioritizing interaction with students, designing classes efficiently, improving the quality of learning, learning not always in class, focusing on student independence, and expanding the scope of learning material. The development of digital teaching materials requires the support of secondary school teachers who voluntarily participate because they must be interested in using a smartphone in the learning process. The impact of teachers' interest in digital-based learning allows teachers to act as innovators where they can be eager to try new ideas in digital-based learning [8]. Digital teaching materials can be used to analyze students' ability to construct concepts correctly and position physics with everyday life and improve success in solving problems [9]. Previous research has found that the use of Android-based Physics media is effective in training science process skills [3], and can motivate students in learning Physics [10] and [11]. Physics taught in Vocational Schools is only given to certain students as supporting subjects, one of which is the Multimedia Department. In order for Multimedia vocational students to be able to focus their learning and regardless of ICT products can be motivated to learn Physics, the teaching materials are packaged using media around Multimedia. This study focuses

on the effectiveness of using Android-based Physics teaching materials in mastering the concept of Physics of Vocational High School students.

2. Research Method

This study uses a pre-experiment with the design of one shot case study, which is one group treated and then observed results, which treatment is a manipulation variable and the result is the dependent variable [12]. Manipulation variables in this study are learning to use Android-based digital teaching materials while the dependent variable is mastery of physics concepts and student responses in learning using the teaching materials.

The research procedures are: 1) making Android-based digital teaching materials, 2) using Android-based digital teaching materials made in learning at SMK, 3). Measuring students 'abilities by being given questions related to Physics material from Android-based digital teaching materials, 4) giving questionnaires to students to determine students' responses to the use of Android-based digital teaching materials. Based on the limitations encountered, the topic of Physics used in this study was Thermo, and the research subjects were 20 students of class X majoring in Multimedia at SMK Negeri 12 Surabaya.

Data collection techniques use written tests and questionnaires. Physics concept mastery score is netted with multiple choice objective tests total of 20 questions that have been validated both content and content by three physicists (one teacher and two lecturers), students 'responses are netted from the scores of students' assessment of Android-based digital teaching materials using questionnaire instruments with Likert scale (very less = 1, less = 2, good = 3, and very good = 4). Data analysis uses a description of the scores obtained by students on mastery of the concept of physics. Learning to use Android-based digital teaching materials is declared effective if individual scores reach the criteria of completeness of at least 60 and classically the average score reaches the minimum completeness criterion (70 ± 10). Student response criteria are obtained by adding up all the average scores given by students divided by the maximum score multiplied by 100%, learning using Android-based teaching materials is declared effective if the score obtained is ≥ 61%. Physical learning using digital teaching materials is declared feasible to be used in learning in vocational schools if the scores and responses of students are declared effective.

3. Results of the Research

3.1. Description of Android-based digital teaching materials

Teaching material is one part of learning resources, which is something that contains learning messages, both those that are special and those that are general that can be used for the benefit of learning. Android-based digital teaching materials are teaching materials that are packaged in digital form and prepared for learning using Android-based smartphones. The procedure for making android-based digital teaching materials in this study is: 1) preparing material for teaching material for temperature physics (in the form of text, images, audio, animation, and video) along with systematics; 2) designing delivery navigation; 3) compile instructional materials according to the systematic and navigational design; 4) apply the instructional material that has been compiled into the Android application worksheet (MIT App Inventor); 5) If the teaching material is ready to export it into the android base extension (.apk); 6) files for Android-based digital teaching materials are ready to be used in learning. The procedure is presented in a flow diagram like Figure 1 as follows:

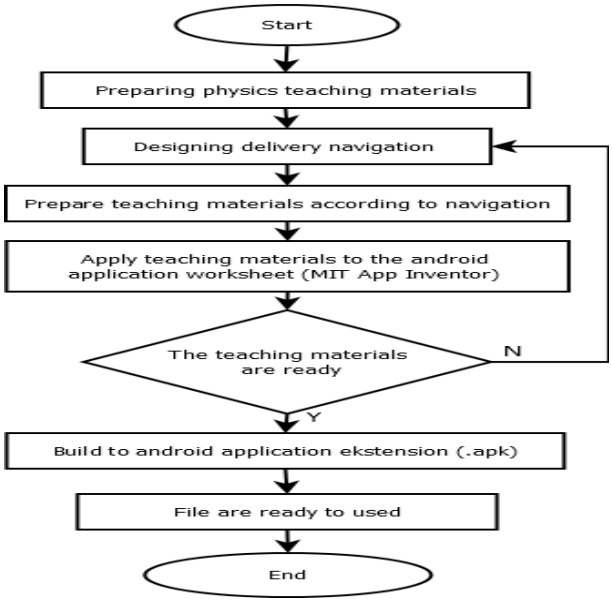

Figure 1. Flowchart of the procedure of making Android-based digital teaching materials

The prepared teaching material files are then distributed to students to be installed on students' Android-based smartphones. Furthermore, the file has become an application of teaching materials, and students just run it. Some examples of slides from teaching materials can be presented as shown in Figure 2 as follows:

Figure 2. Some sample slides from teaching materials

Teaching materials such as picture 2 are based on multimedia consisting of text, images, audio, animation, and videos which are very familiar to students of the Multimedia majors. The teaching material then becomes a supporter of learning Physics for the topic Temperature. After students use and learning materials contained in the teaching material, students are then given a test to find out how mastery of the physics concepts that students have.

3.2. The effectiveness of the use of teaching materials in terms of the mastery of students' concepts

Mastery of concepts is very important for students because it can be an indicator that students have fully understood what has been taught, not just memorizing. Mastery of the concept can help students in solving problems, not only in learning in school but also in everyday life. The mastery of concepts obtained by students after the exam can be seen as shown in Figure 3:

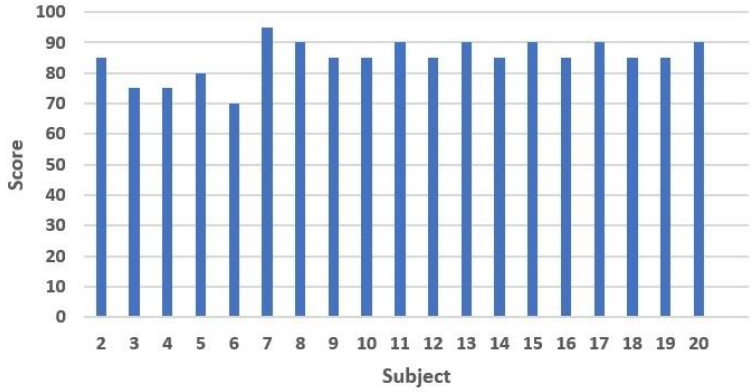

Figure 3. Score mastery of student concepts

Based on Figure 3, it can be seen that individually all students have values above the minimum completeness criteria, which is ≥ 70. In addition, classically, the average student score is x = (85 ± 6), which means greater than the classical minimum completeness value. Based on these results, the use of Android-based digital teaching materials that have been made is effective in terms of students' mastery of the physics concept score.

3.3 Students' responses to the use of digital teaching materials

The effectiveness of using Android-based digital teaching materials in the learning process is also seen from the responses given by students. Related questionnaires The use of Android-based digital teaching materials is given to students to assess how effective the learning process is. The results obtained are shown in Figure 4 as follows:

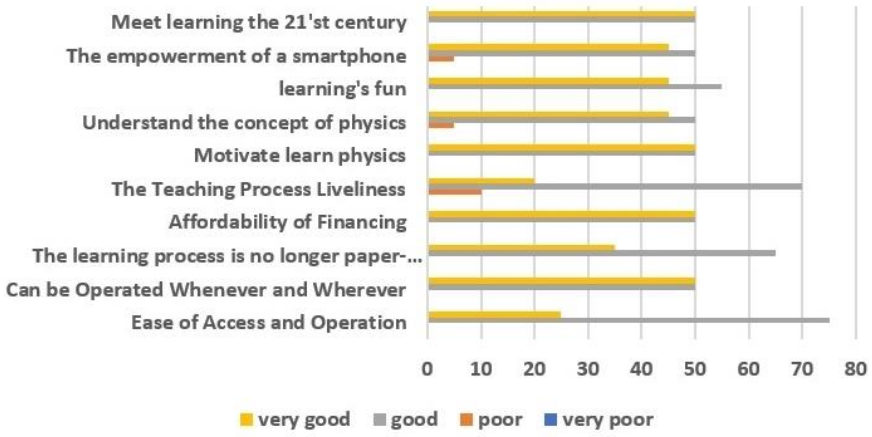

Figure 4. Percentage of student response

Based on Figure 4, it can be seen that the student response mode to physics learning using Android-based digital teaching materials is good. Overall, the percentage of effectiveness of the use of Android-based digital teaching materials is 85% which far exceeds the requirement of only 61%. Based on these results, the use of effective Android-based digital teaching materials is used in learning in multimedia majors.

4. Discussion

Conceptually the use of Android-based digital teaching materials in physics learning has the potential to get a good reception from students because it makes it easier for students to use it in learning and facilitate students in accessing the teaching materials that the teacher has prepared. Figure 1 shows that

the application files that are prepared are easy to install on Android-based (.apk) smartphones, while figure 2 shows that the files installed on smartphones can present multimedia so that it has the potential to be fun and make it easier for vocational students majoring in multimedia in understanding teaching materials. This is consistent with the fact that mobile-based media contributes to learning where students access material so as to help students complete their learning [13], and the use of online learning also receives a positive response from secondary school teachers [14].

The results showed that the use of Android-based digital teaching materials supported the mastery of the physics concept seen in figure 3 with the individual scores of all students ≥ 70 and the average score of students (85 ± 6). The score obtained has exceeded the minimum set criteria that are = 60 for individuals and (70±10) for classical. These results indicate that the use of Android-based digital teaching materials can effectively support the mastery of students' physics concepts. These results also correspond to the findings that the use of Android applications can be used to study Gas Ideal topic physics with virtual laboratories in high schools with good results [15]. The use of Android-based digital teaching materials makes students more quickly understand the material and practical exercises, feel more prepared to face the subject matter and can provide motivation to learn [16].

Student responses to the use of Android-based digital teaching materials are presented in Figure 4, which explains that: fulfilling 21st century learning, empowering smartphones, fun understanding concepts, motivating learning, active in the learning process, affordable costs, learning is not paper-based, can be operated whenever and wherever , and easily accessible and operated. The students' responses are all in a good mode with an effectiveness percentage of 85% that far exceeds that required at least 61. The results are in line with previous research, namely the use of Android-based digital teaching materials in the learning process can be more flexible because it can be done anytime, anywhere, and under any conditions [17]. The use of social media with smartphones in learning physics can encourage students to be active in learning, reduce paper use, understand concepts, and minimize costs [10]. Based on the students' response, it can be seen that the use of Android-based digital teaching materials is effectively used in learning physics in vocational schools.

5. Conclusions

The results showed that: (1) the process of learning physics using Android-based digital teaching materials was effective with individual students 'mastery scores 70 and classically (85 ± 6); (2) students' responses to physics learning using digital-based teaching materials Android is very good with an effectiveness percentage of 85%. The conclusion is that the use of Android-based digital teaching materials is effectively used in learning physics in the Multimedia majors in terms of mastery of concepts and student responses.

The suggestion that can be delivered is for learning to use Android-based digital teaching materials, it is necessary to consider the memory capacity and the type of smartphone used. This is based on the fact that when Android-based digital teaching materials are used as alternative learning materials, there are obstacles where some smartphones do not support and there are several smartphones that take a long time to open the application. The smartphone which supports the use of Android-based digital teaching materials, at least has a memory specification of at least 1 gigabyte.

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