Ar-Kio : Augmented Reality-Based Application as Instructional Media on the Material of the Input and Output Device Component

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Abstract:

The rapid technology development can be utilized in various fields, especially in education. One of the technologies is augmented reality-based learning media. The learning media can be applied to all the subject matter, including the subject of input and output component devices. Based on the observations that already made, there are some problems such as there is no interactive learning media and limited props in the laboratory. Though the subject of input and output component devices require three-dimensional visualization, especially input-output components that are difficult to find in the school environment. The purpose of this study is to determine the feasibility of instructional media applications that have been developed. The research method used is research development method. The tests of this media was conducted by media experts, content experts, users and smartphone devices with different specifications. Media expert testing using instruments that refer to aspects of the functionality of ISO 9126 with the percentage acquisition of 100%. Content expert testing using the instrument that refers aspects of learning design with the acquisition percentage of 88%. Meanwhile, user testing uses an instrument that refers to the usability aspect of ISO 9126 with a percentage gain of 83.4%. In addition, there are testing the software with Android smartphone platform that has different specifications. The advantages of this application can run on a smartphone with minimum 512 MB RAM specs, Android OS Jelly Bean 4.3 and qHD screen resolution.

Keywords: Instructional Media, Augmented Reality, Input and Output Device Component, ISO 9126

Introduction

Technology is something that cannot be separated from human life. Nowadays technology is undergoing rapid developments, one of which was information technology. Information technology is becoming a very important because it has many benefits that can facilitate the work of man. The benefits of information technology not only in the field of public services, culture or communication. However, it also has many benefits in the field of education.

The benefits of information technology in education can be used as tools to deliver learning material directly, distribute teaching material by using other tools (e.g., internet) and as a media communications students with expert, tutor or other students. One example of the utilization of information technology in education is the media of instruction.

According to Latuheru (1988:14), the media is all learning tools (help) or items used for teaching and learning activities, to convey the message (information) learning from the source (teacher or other sources) to the recipient (in this case the learning citizen). Thus, directly or not learning media is an inseparable part of the teaching and learning activities.

Teaching and learning activities that utilize the learning media with renewable technology is the right solution for delivering the learning information. There are many media learning using renewable technologies, one of which is media of learning that uses the technology of augmented reality. Augmented Reality or commonly abbreviated with AR is a technology to reproduce and integrate objects are virtual to the real world. An AR System allows to combine or "add" real world objects with virtual objects or layered information. The result of the virtual objects looks like the same when there is something in the real world. However, AR is not limited only to the sense of sight; AR can also be applied to all the senses such as hearing, touch, and smell. The technology of augmented reality is not limited only to the sense of sight but could be applied to some other senses such as hearing, touch, and smell (Azuma et al., 2001).

Media-based learning, augmented reality can be applied to all subject matter, where data contextual can be audio, video or 3D models. One of the lessons that can be applied to media-based instructional, augmented reality is the material of the component input device output. The material of the component input device output is one of the materials in subjects X-grade computer Assembly TKJ wearing 2013 curriculum. This material describes the various components of the device input (input) and output devices (ex.).

Based on observation and analysis done by the researcher in a vocational scholl, still found some problems in the teaching and learning activities, including interactive instructional media do not exist that explain about the material component input device output. This is due to teachers only use media is as books, chalkboards, and simple slides PPT. This findings corresponds to the research done by Luis, Mellado, and Diaz (2013). When the material is input-output device component materials that require visualization of 3-dimensional shape, especially of the component materials of the device inputs and outputs that are hard to find in the school environment. In addition, the props as a learning support material input-output components contained in the lab numbers are still limited. This causes the students can understand the material components of the device inputs and outputs that are hard to find in the school environment.

From the above problems, created a media-based instructional augmented reality on a material component of input and output devices. With this augmented reality application, students interested in instructional the material components of the device inputs and outputs as well as facilitate students in learning such material without relying on props that are present in the laboratory. For further testing, conducted in order to find out the feasibility of the instructional media that has been developed.

There are some researchs previously relevant to the research that will be undertaken, including research conducted by Luis Mellado, and Diaz (2013), where the research made on media-based instructional utilizing mobile augmented reality technology to simulate the chemical practice tools so that students can learn anywhere without having to be in the lab. Later research conducted by Sayed, Zayed, and Sharawy (2011), which made the instructional media research by utilizing the mobile device and technology of augmented reality. These instructional media use cards to illustrate object with the 3-dimensional format. The use of 3-dimensional augmented reality-based media is an effective way to visualize objects for students to learn, so objects are easy to learn.

Methods

This article will be presented the result of feasibility test the instructional media have been developed with appointing the several validators; there are a media expert, content expert, and user expert. Feasibility test Can be described as follows :

Media Expert Test

Testing is done with media experts pointed to experts who gained control of mobile applications and the technology of augmented reality as a validator. The purpose of this test is to know the functionality of applications that have been developed. This test uses an instrument that refers to the aspect of the functionality of ISO 9126. While sub-characteristics used in this test is the suitability, where on a sub-characteristics used indicator of the sufficiency of the functions. The selection of these indicators adjusted to the functionality that exists on the instructional media that has been developed (ISO/ IEC, 2000). There are 6 activities that will be tested in this media expert testing, including testing the sufficiency of the function of the activity of instructional media, opening the main page, the page content, the page instructions, about page and exit page.

Content Expert Test

Experts are testing the material performed by designating teachers who master the material components of the input and output devices. The purpose of this test is to find out the suitability of the material contained in the media instructional materials developed in accordance with the curriculum and learning objectives. This test uses an instrument that refers to aspects an instructional design according to the regional strength. While the indicators used in this test is an indicator of the precision of the accuracy of learning strategies, easy to understand, the suitability of the materials for the learning purpose and systematic, coherent and obvious logic flow.

User Test

User testing is done by pointing students class X TKJ who took the subjects of computer Assembly and particularly on the material components of the input and output devices. The purpose of this test is to find out the feasibility of the media instructional that has been developed. This test uses an instrument that refers to the aspects of usability ISO 9126. While the indicators used in the testing of this user is an indicator of the usefulness, easy to use, easy to learning and satisfaction.

To assess the feasibility of the media instructional that has been developed, measurement scales used by using a Likert scale. Data analysis was done by converting data into percentages with calculation as follows:

$$Percentage(\%) = \frac{the\ obtained\ research\ results}{the\ total\ number\ of\ research\ results} x100\%$$

The percentages are grouped into the feasibility assessment criteria. The eligibility assessment criteria learning media can be seen in Table 1.

Table 1. The Feasibility Assessment Criteria Learning Media (Riduwan, 2013)

Assessment Criteria	Percentage
Very Feasible	100% - 81%
Feasible	80% - 61%
Quite Feasible	60% - 41%
Innapropriate	40% - 21%
Very Innappropriate	20% - 0%

Result and Discussion

Result

This article explains about the feasible test the application of instructional media of input and output device components using augmented reality technology and its implementation on a smartphone with Android platform. This feasible test implemented to the media expect, material expect and user. This testing expected minimum hardware specification to run the learning media applications are (1) Jelly Bean 4.3 android version; (2) 512 MB RAM; (3) 3 MP camera.

The result from the media expert test is shown in Table 2.

Table 2. The Result of Media Expert Test

No.	Activity	Assessment
1.	Opening instructional media	6.25%
2.	Main Page	18.75%
3.	Content Page	31.25%
4.	Petunjuk's Page	18.75%
5.	About Page	18.75%
6.	Exit Page	6.25%
	Total	100%

Based on Table 2 of the test results of expert media, acquired 100% of percentage. The highest percentage (31.25%) is obtained in the content page. This is due to the material on the page there are 5 activities that should be tested for functionality. Unlike the case with the main page, and a page about the instructions page which earns a percentage of 18.75%, because of those pages, there are only 3 activities that should be tested for functionality. While the percentage lowest obtained when doing the testing functionality in the page out and while opening learning media (6.25%). This is because there is only one tested activity on that page. Based on the results of these tests, it can be concluded that the application of the learning media has been running in accordance with previously planned without an error.

The result from the content expert test is shown in Table 3.

Table 3. The Result of Content Expert Test

No.	Indicator	Assessment
1.	The Accuracy of the Learning Strategies	26%
2.	Easy to Understand	18%
3.	Material Suitability with Learning Purpose	20%
4.	Systematic, coherent and Obvious Logic Flow	24%
	Total	88%

Based on Table 2, the test obtained the percentage of 88%. On the indicators of the appropriateness of the use of the learning strategies outlined in 3 questions, obtained the percentage of 26%. This shows that the material used is packed with sophisticated technology and attracting students to learn. Then on the indicators ease to understand that spelled out in 2 questions, obtained the percentage of 18%. This indicates that the material presented makes it easy for students to use media in learning and understanding the content of the material. The indicators of the suitability of the material with the learning objectives outlined in question 2, obtained the percentage of 20%. This indicates that the material is presented in accordance with the purpose of learning and supporting achievement learning objectives. Moreover, lastly on systematic indicators, coherently, obvious logic flow outlined in 3 questions, obtained the percentage of 24%. This indicates that the material contained on the media learning (AR-KIO) correspond to the material contained in the book and the screenplay program obviously.

Meanwhile, the result from the user test is shown in Table 4.

Table 4. The Result of User Test

No.	Indicator	Assessment
1.	Usefulness	22.2%
2.	Easy Of Use	31.1%
3.	Easy Of Learning	10%
4.	Satisfaction	20%
	Total	83.3%

Based on Table 4 of the user test results, obtained the percentage of 83.3%. The number of respondents on testing the feasibility of this is 18 respondents who are a student of class X TKJ. On the usefulness of the indicators outlined in question 8, obtained the percentage of 22.2%. This indicates that the applications developed are beneficial and facilitate users in learning the material components of the input and output devices. Then in an easy to use indicators spelled out in 11 questions, obtained the percentage of 31.1%. This indicates that the applications developed are not confusing the users in using it. Next on the indicator easy of learning outlined in 4 questions, obtained the percentage of 10%. This indicates that the application that is developed is easy to operate. Moreover, last on the satisfaction indicators spelled out in 7 questions, obtained the percentage of 20%. This indicates that the user is satisfied with the applications that have been developed.

In addition to media expert, content expert, and user test, there is also the software test. Software test carried on a smartphone device that has different specifications that are estimated to be able to run applications that have been developed. The result from the software test is shown in Table 5.

Tabel 5. The Result of The Software Test

No.	Device Name	Specification	Testing		
			Installation	Basic application functions	Augmented Reality function
1	Evercoss A7E	8 MP Camera 512 MB RAM Android KitKat Screen Resolution 480 x 800 pixels	success	success	Success
2	OPPO F1S	16 MP Camera 3 GB RAM Android Lollipop Screen Resolution 1280 x 720 pixels	success	success	Success
3	Sony Xperia M	5 MP Camera 1 GB RAM Android Jelly Bean Screen Resolution 480 x 854 pixels	success	success	success
4	OPPO A11W	5 MP Camera 1 GB RAM Android KitKat Screen Resolution 480 x 854 pixels	success	success	success

Device hardware used for testing comes from several well-known brands and widely us by the community,including Xiaomi, Evercoss, OPPO and Sony Xperia. The specifications of device that become

differentiator indicators in this software test are a rear camera, RAM, Android version and screen resolution. The rear camera used in this test is a rear camera with a 5 MP, 8 MP, 13 MP and 16 MP resolutions. The RAM (Random Access Memory) used in this test is RAM with 512 MB, 1 GB, 2 GB and 3 GB capacity. The Android version used in this test is an android version of Jelly Bean, KitKat, Lollipop, and Nougat version. The screen resolution used in this test is screen resolution with qHD (480 x 854 pixels), HD (1280 x 720 pixels) and Full HD (1920 x 1080 pixels) resolutions.

Software test has done with attention the success of 3 indicators, namely success in application installation, the success of the basic functions of the application and the success of augmented reality function. Succeed the installation of the application is the successful installation of instructional media application software into the smartphone platform android order commands contained in the software can be used. Succeed the basic functions of the application, for example, if the user wants to move the page or exit the application by pressing the button, listening to the background sound, and the camera automatically turns on when the user pressed a button in the content page. Succeed the augmented reality functions is the success of camera device displaying 3-dimensional animation when marker directed to the camera device.

Discussion

The instructional media application of input and output device component (AR-KIO) is an instructional media to introduce of input and output device components that are rarely encountered in the school environment. This application contains 3-dimensional animation about input and output device components and supporting text materials.

Based on the result of media expert test, obtained 100% percentage. Cause the functions contained in the application in accordance with the planned and not found a bug or error. So it can be concluded that the learning media of component input and output components "Very Feasible" to serve as instructional media in the class of X TKJ although with some improvement.

Based on the result of the content expert test, obtained 88% percentage which consists of 4 aspects assessment, including the accuracy of learning strategies aspect, easy to be understood aspect, the suitability of the material with learning purpose aspect and systematic, coherent and obvious logic flow aspect. So it can be concluded that the learning media of component input and output components "Very Feasible" to serve as instructional media in class of X TKJ

Based on the result of user test, obtained 83.4% percentage. So it can be concluded that the learning media of component input and output components "Very Feasible" to serve as instructional media in class of X TKJ

Based on the result of software test can be concluded that application of learning media of component input and output device, can be run on a smartphone or tablet platform android with minimum specifications: (1) 5 MP rear camera; (2) 512 MB RAM; (3) Android version of Jelly Bean 4.3; (4) qHD (480 x 854 pixels) screen resolution.

The advantages of learning media (AR-KIO) are : (1) the interesting material presented; (2) the material presented can be used as a complementary learning both in class and at home; (3) student more easily understanding the component of input and output device that is hard to find in school environments; (4) this application is practical and easy to use, because the character is a mobile-based application; (5) the application works quickly, because the application is capable of running even though only 512 MB of RAM; (6) the developing application appropriate the student needed; (7) this application supports multiple Android versions, with a minimal version of Jelly Bean 4.3; (8) this application can be run on a low-resolution screen (480 x 800 pixels)

The weaknesses of learning media (AR-KIO) are: (1) text material needs to be added because the amount of text material in this application only ranged from 5 to 7 pages only; (2) 3-dimensional animation needs to be added because this application only explains three 3-dimensional animations of input device component and three 3-dimensional animations of output device component.

Conclusions

Development of the input and output component device (AR-KIO) learning media application, has done "very feasible" to be used as media of learning class X TKJ (Computer and Network Engineering) using curriculum 2013. That is based on the tests already performed by the media expert with 100% of percentage, a content expert with 88% percentage and users with 83.4% percentage.

The advantages of learning media (AR-KIO) are: (1)   the material presented interesting and easy to understand; (2) application that is developed is easy to use; (3) applications can be run on a smartphone with a minimum 512 MB RAM specs, Android version Jelly Bean 4.3 and screen resolution 480 x 800 pixels.

Meanwhile,   the weakness   of the   learning media (AR-KIO)   is the   limited material of   text   and 3-dimensional animation.

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