STUDENT RESPONSE IN USING SMARTPHONE-ASSISTED AUGMENTED REALITY VIDEO IN LEARNING

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Abstract

Smartphone-assisted video augmented reality was developed to facilitate students who want to study anywhere, and anytime. This media can be used for distance higher education students. The material studied includes the presentation of information about the work procedures of a concept being practiced. This study aims to get student responses about the use of augmented reality videos in chemistry learning. The activity was preceded by developing a video program and being validated by a media expert, followed by making markers and developing applications. The results of the development were tried on 8 male students and 31 female students, as well as 4 teachers. The data was obtained based on the instrument in the form of a questionnaire containing questions related to the use of augmented reality videos that have been developed. Data were analyzed by descriptive qualitative. The results obtained showed that the questions given were responded well and very well by the students. Student responses stated that Augmented Reality (AR) video shows were able to 1) introduce students to the basic material of chemical experiments (100%), 2) build an understanding of teaching materials (92.3%), 3) provide an initial understanding before working in the laboratory (95.9%) %), 4) introduce the object of the experiment to be carried out (100%), 5) represent the form of the components of the tool and chemicals as they are, 6) explain the procedure for using the tool easily (100%), 7), analyze in-depth thoughts, and theory about the chemical experiment to be carried out (94.6%), 8) obtaining new interpretations and ideas (97.4%), 9), after following the AR broadcast given, looking forward to the next practical topic experiment (100%). Meanwhile, the response given by the teacher included that although this media can be used, there are still some parts that need to be revised because the image disappears when the camera is moved, and the image starts again from the beginning when rescanning, so the application needs to be modified.

Keyword: augmented reality video, chemistry learning, student response

1 INTRODUCTION

Augmented Reality (AR) is defined as a technology that combines the real world with the virtual world, is interactive in real time (Azuma, 1997). James R. Vallino (1998) stated that Augmented Reality is a technology that combines two-dimensional or three-dimensional virtual objects and then projects these virtual objects in real time. Augmented Reality (AR) can be defined as a technology capable of incorporating virtual objects in two dimensions or three dimensions into a real environment and then displaying or projecting them in real time.

In learning chemistry, especially for chemical experiments, augmented media can be used, both in the form of interactive and those given through video shows. The use of video is intended

so that the work process can be seen as a whole, and it is easier to use and manufacture. Especially if the process of carrying out an experiment requires a long time and uses a rather complicated set of equipment, so the use of augmented applications for learning videos can be an option. One of the advantages of using video is that it is expected to be able to provide an overview or present overall performance (Hauff and Laaser, 1996).

The current use of AR has expanded to various aspects of our lives and is projected to experience very significant developments. This is because the use of AR is very interesting and makes it easy to use in doing something, for example in learning chemistry. By utilizing AR technology as well, augmented applications through video programs can be used to provide experimental examples that are displayed virtually using an Android mobile device.

An introduction to chemical experiments needs to be introduced to students in order to help students understand the experimental material to be carried out. This is so that dangerous things do not happen because of the nature and presence of chemical substances before students work in the laboratory.

Consideration of using a program-based augmented reality application because AR can combine real and virtual environments in the introduction of chemical experiments. The existence of a video is expected to be able to provide an overview or present the overall implementation procedure (Hauff and Laaser, 1996). This application can be used by students anywhere as long as the institution has provided flexibility for students to use it and at the same time can assist students in providing an introduction to working in chemical laboratories and introducing students to carrying out work procedures.

The results of research conducted by Adji, S.S. and Nurhayati (2022) students still need to be given an overview of work in the laboratory including the reintroduction of laboratory equipment before students work in the laboratory. With the spread of students and independent study students, students need to be equipped with an introduction to virtual work procedures before they work in the laboratory. Provision of knowledge that can describe / visualize the existence of a tool and work procedures for chemical experiments is intended so that there are no obstacles to doing practicum. In addition, the development of web and internet technology makes it possible to provide experimental material for chemical experiments through electronic learning. However, the development of this device needs to be tested on students. In connection with that matter

1. How is the prototype development for chemistry learning the video program-based augmented reality application by using smartphone?
2. How is the student's response to the chemistry learning prototype the video program-based augmented reality application by using smartphone?

2 METHOD

This study uses a research and development approach based on the ADDIE method which has five steps, namely: analysis, design, development, implementation, and evaluation. By using the ADDIE method, the research and development steps are shown in the following diagram.

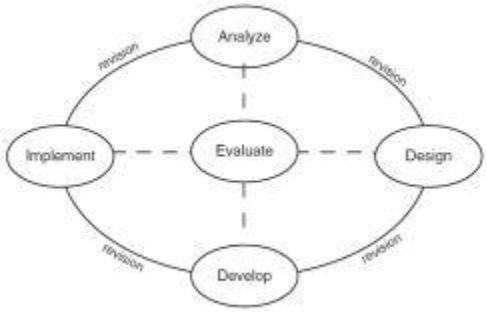

Figure.1 R&D research steps using the ADDIE approach (Branch, 2009)

This procedure is based on the steps described above, and the purpose of this research is to develop and implement an augmented reality application to determine student perceptions of a given program.

2.1 Analysis (Analysis)

The analysis stage is the initial stage to find out what is needed in mapping the problems that occur in the process of implementing learning in the Chemistry Practicum course. To map the problem, the researcher conducted a study of the results of previous research related to chemistry practicum, as well as interviews or direct discussions with students. The results obtained are used as an initial framework for improving or developing a research design. The results of the analysis phase obtained answers received from student respondents related to the need for video shows as follows.

- Learning through video still needs to be done
- We recommend that apart from videos there is also a zoom schedule so that students can directly interact with teachers/lecturers. If there is something you don't understand, you can explain it right away.
- Work procedures can be written in detail and included in the video

- Students need examples of practicum presentations
- Practicum can be assessed through an online form

2.2 Design

After completing the analysis phase and determining that the video program-based augmented reality application will be the product to be utilized, then determine the basis for product development, design the product form and design, determine program usefulness indicators from the augmented application quality assessment tool for video programs, and finally compile a questionnaire for applications that have been developed.

2.3 Developed

The research was conducted by involving 2 video program developers and 3 AR developers. At the development stage obtained augmented reality applications from videos of chemical experiment tools and examples of chemical experiments. The AR being developed is AR 2 D and has not included direct interaction between the user and the teaching materials. AR is developed based on videos that have been made before.

2.4 Evaluation

This research is to develop an augmented reality application that utilizes chemical experiment tools and videos of chemical experiment examples. This video was previously developed and verified. A questionnaire of 39 students and 4 chemistry instructors was used to assess the quality of the development results of this extended application. The developed questionnaire device was verified by two chemistry education instructors and one learning designer. During data collection, students are assembled in a room, given an initial briefing, and then divided into small groups of 2-4 students to try out the augmented reality application individually. After trying them out, students were given a question-based tool to assess the quality of their augmented reality applications. The questionnaire results received were descriptively and qualitatively analyzed.

3 FINDINGS AND DISCUSSION

3.1 The Prototype Development for Chemistry Learning Using Video Program-Based Augmented Reality Applications

The video program-based augmented reality application developed is a 2D AR. The development of augmented reality applications was first developed as markers read through Android mobile phones using app address links. Then download and install the AR app. An icon will appear on the HP screen. Then click the Android phone's icon to open the installed

app and point the HP camera at the marker to access the video. An animated video will appear on the phone screen showing you the practical steps of a simple laboratory instrument.

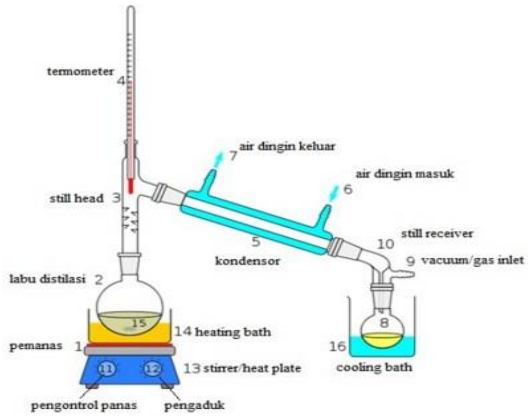

Figure 2. Distillation apparatus markers

Figure 3. Marker identification of double bond lipids

Figure 4. Marker determination of dissolved oxygen levels

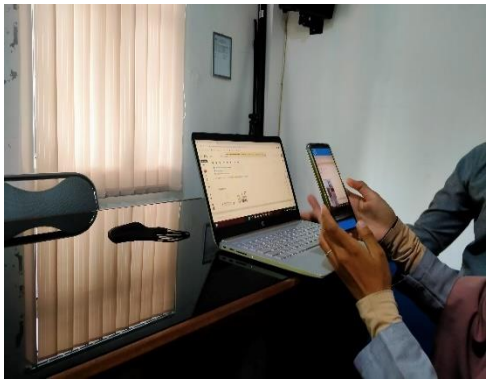

Figure 5&6. Using android to access AR video

3.2 The Student's response to the Chemistry Learning Prototype Using the Video Program-Based Augmented Reality Application

The results obtained showed that the questions given were responded well and very well by the students in term of display quality as shown in Table 1. Student responses stated that Augmented Reality (AR) video shows were able to shows the clarity / sharpness of the image and displays an attractive image. In addition, it also shows the suitability of illustrations, easy to remember and there is information about instructions for carrying out experiments. They also show clear articulation with language that is easy to understand. According to Solomon (1979) individuals learn new ideas more easily and quickly while information is presented simultaneously in the form of images and words.

Table 1. Student responses to the clarity of the presentation

No	Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1	AR video showing an introduction to the lab equipment and examples of hands-on experiments demonstrating image clarity/sharpness	25.60%	74.40 %	0.00%	0.00%	0.00%
2	Show an AR video Introduction to lab equipment and real-life experiment examples showing relevancy of illustrations.	38.50%	61.50 %	0.00%	0.00%	0.00%
3	AR video introducing lab equipment and experimental examples with easy-to-remember tool illustrations.	30.80%	59.00 %	10.30 %	0.00%	0.00%
4	AR video show Intro to lab equipment and interesting visual display experiment examples	30.80%	66.70 %	2.60%	0.00%	0.00%
5	The use of the given AR is able to introduce the experimental object to be carried out	33.30%	66.70 %	0.00%	0.00%	0.00%
6	AR video show Lab equipment demo and test examples show clear articulation	25.60%	66.70 %	7.70%	0.00%	0.00%
7	AR shows use communicative and easy-to-understand language	30.80%	64.10 %	5.10%	0.00%	0.00%

Through the data listed in Table 2 it can be explained that the material in the AR learning media regarding the introduction of laboratory experiments and experimental examples is in accordance with the learning objectives. Besides is in accordance with the material needed/taught in practicum activities. This is because the existing shows are in accordance with the topics that will be practiced as stated in the modules provided and can introduce students to the basic material of chemical experiments and have been presented in a sequential manner. Therefore, the AR shows provided are very useful for students. According to Cai et al., (2014) AR technology enhances the science learning capabilities of the students.

Table 2. Student response to suitability with the teaching materials

No	Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1	The material in the AR shows is in accordance with the material needed/taught in practicum activities	35.90%	61.50%	2.60%	0.00%	0.00%
2	The material in the AR learning media regarding the introduction of laboratory experiments and experimental examples is in accordance with the learning objectives	23.10%	74.40%	2.60%	0.00%	0.00%
3	The material in the AR learning media is in accordance with the topic to be practiced as stated in the given module	25.60%	69.20%	5.10%	0.00%	0.00%
4	Material in AR learning media can introduce	43.60%	56.40%	0.00%	0.00%	0.00%

	students to the basic material of chemical experiments					
5	The material broadcast has been presented in a sequential manner	23.10%	71.80%	5.10%	0.00%	0.00%
6	The AR impressions provided were very useful for me	59.00%	41.00%	0.00%	0.00%	0.00%

AR technology positively affected the students' laboratory skills. AR technology both improved the students' laboratory skills and helped them to build positive attitudes towards physics laboratories (Akçayır, et.al., 2016).

Based on the data listed in Table 3 it can be explained, this study shows that students agree that an AR video showing an introduction to laboratory equipment and examples of practicum experiments is given before the experimental / practicum activities take place. The AR video showing the introduction of laboratory equipment and experimental examples has been able to explain the characteristics of the types of equipment such as an explanation of the functions of the equipment that can work properly and easy to follow. In addition, the images displayed already represent the shape of the original components, so that they are able to introduce the various types of experiments that will be carried out by students. Thus the use of AR video is able to introduce the object of the experiment to be carried out, and students are satisfied with the AR presentation of the introduction of tools and practicum experiments given.

Table 3. Student responses to display quality

No	Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1	AR video showing introduction to laboratory equipment and examples of practicum experiments are given before the experimental activities / practicum activities take place	56.40%	43.60%	0.00%	0.00%	0.00%

2	Although still carrying out actual practicum activities (hands on activity), learning via video is still needed	30.80%	61.50%	7.70%	0.00%	0.00%
3	AR video display Introduction to laboratory equipment and experimental examples explaining the function of the equipment properly	30.80%	59.00%	10.30%	0.00%	0.00%
4	AR video display Introduction to laboratory equipment and experimental examples explaining the characteristics of the types of equipment	35.90%	61.50%	2.60%	0.00%	0.00%
5	All symbols of the components of the experimental topic are displayed clearly on the mask according to the standard	17.90%	79.50%	2.60%	0.00%	0.00%
6	The characteristics of the experimental subject components are clearly displayed in the AR book	23.10%	71.80%	5.10%	0.00%	0.00%
7	The displayed image already represents the shape of the original component	38.50%	59.00%	2.60%	0.00%	0.00%
8	Display pictures have introduced students to the components of the experiment to be carried out	30.80%	69.20%	0.00%	0.00%	0.00%
9	The instructions given are presented and easy to follow	35.90%	64.10%	0.00%	0.00%	0.00%
10	The use of AR provided is able to overcome the	41.00%	59.00%	0.00%	0.00%	0.00%

	limitations of the experimental tools to be carried out					
11	AR presentation about the experiment motivates me to prepare me for the practicum	46.20%	51.30%	2.60%	0.00%	0.00%
12	The AR shows that are given are very interesting to follow	56.40%	41.00%	2.60%	0.00%	0.00%
13	I am satisfied with the AR presentation of the introduction of the tools and practical experiments given	23.10%	76.90%	0.00%	0.00%	0.00%

4 CONCLUSION

Learning science in the field of science, among others, requires the results of experimental work with certain standards, learning science, for example, chemistry, cannot be done only with theoretical material only (Faika & Side, 2011). The implementation of practicum activities has a very crucial role to support the quality of learning outcomes and processes because practicum activities will be more effective in increasing student expertise in observing and improving psychomotor skills/aspects as well as a means of practicing in using or utilizing existing tools and materials in the laboratory (Wahyudiati, 2003). The basic skills that can be observed during the practicum include (1) take materials, (2) use tools, (3) observe, (4) communicate, (5) work safety (Kartini, 2018). Practical activities as a method that puts forward processes and work to find a scientific concept based on a process, observation, analysis, proof and drawing conclusions from an object (Rahman et al., 2015). Practicum activities that must be carried out online have received more attention because in practicum activities, not only the results of student work are the material for assessment, but the process during which students carry out practicum activities is also a separate assessment. Even though they are still carrying out actual practical activities (hands on activity), learning through video is still needed especially if the video is given before the practical activities are carried out.

Media can be one that causes the success of learning, for example video media, can make learning more interesting and fun. In addition, video media can help clarify material to clarify the message conveyed in the teaching and learning process. The use of learning media in

science learning needs to be considered. Learning video is one of the media that can be used in the learning process because it contains audio and visual elements. It can be used to convey messages and stimulate thoughts, feelings, and desire to promote the emergence of a deliberate, purposeful, and controlled learning process. Students are less interested in the learning material because of its complicated and complex nature. If the teacher can choose the right learning material, it will affect the students' ability to grasp the material presented.

Student participation in practicum activities is still being carried out even though there are some obstacles due to limited facilities and infrastructure. Meanwhile, Sarah-Jane Gregory and Giovanna Di Trapani (2012), explained that the lack of laboratory equipment facilities can lead to a reduction in the understanding of learning. Meanwhile, communication constraints have also been anticipated by institutions by providing guidance assistance through web tutorials.

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