



Development of Students' Worksheet of Physics Practicum Based on Augmented Reality and Qur'an Integrated on Electricity in Senior High School

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Abstract. Currently, there are many of the latest technological breakthroughs, the world of education is expected to be able to adapt and utilize technology as a support for learning activities. One of them is in the form of teaching materials or worksheet practicum. The lack of availability of worksheet practicum can affect the quality of learning. Lack of scientific competence, interest in student science, and interest in reading student teaching materials. Students are less able to complete tasks using practicum tools, especially electrical devices. So that students create 3D image visualizations using Augmented Reality technology in order to attract students' interest in learning. Previous teaching materials have not been integrated with Quranic verses. The research is aimed to develop students' worksheet of physics practicum based on Augmented Reality and Qur'an Integrated on electricity materials in senior high school. The development used in this study is 4-D (Definition, Design, Development, and Dissemination). The development stage is the validation and practicality test of the worksheet practicum. The results of the worksheet validation of the AR-based physics practicum were 88.68%. The practicality test of worksheet physics practicum based on AR students by 89.30% and teachers by 90%.

Keywords: Worksheet Practicum, Augmented Reality, Electricity, Qur'an Integrated

1 Introduction

In the era of globalization in the 21st century, there are many rapid technical breakthroughs that have brought many changes, especially to the world of education. According to Ministry of National Education, the appropriateness of educational content is "everything that is given by teachers directly to students in order to achieve a certain competency in education" [1]. This is an example that the world of education must be able to adapt and be able to utilize technology which has developed very rapidly to support educational activities and be able to keep up with changes [2]. One of the supports in educational activities is in the form of teaching materials. According to [3] teaching materials are learning tools provided by teachers that enable stu-

dents to focus their attention on the learning process in order to achieve the desired learning goals. Lack of availability of teaching materials can affect the quality of learning. The importance of teaching materials or students' worksheet, if used well, can improve the quality of learning, especially if they are developed to meet the needs of teachers and students [4].

In current conditions, many technological media are used in the world of education and teaching. Moreover, electronic-based technology, such as e-books and e-learning. This electronic technology still has shortcomings, namely that it is difficult to access. This electronic learning media requires students to use technology such as old laptops or cellphones and use the maximum internet network [5]. Currently, there are many technologies that can be used without having to use a quota or internet network. Augmented reality applications are interesting applications to develop in the world of education and teaching, because these augmented reality applications are able to change virtual displays to appear in the real world. Augmented Reality (AR) is a technology used on computer devices where processor-generated graphics are created over real objects to enhance the sensory experience in real time [6]. Augmented reality is also a technology that can change an object into 3 dimensions, projecting the virtual world into the real world in real time, so that it can be used and developed to attract students' attention in learning [7] [8].

Siahaan et.al [9] research on electrical circuits and geometric optics uses augmented reality technology to provide a practical guide for Basic Physics II. The electrical and geometric optical circuit material developed is valid and tested using the average percentage validity test. amounting to 86.74 percent which is included in the very good category according to the research results. The hobby of using augmented reality media during practicum shows how well students respond to practicum guidance [10]. Developing students' worksheet using augmented reality on Vibration and Wave material obtained quite good validation results of 77.7% and received student responses in the good category of 78.67%. The results of this research can fulfill the requirements that the modules developed are of good quality and can be used in the learning process [11].

According to PISA research results, the level of scientific literacy of students in Indonesia is still relatively low [12]. This should be an example of how science education in Indonesia must be further improved [13]. In the development of science and technology, especially in the world of education, the most important point is scientific literacy skills. Directly, scientific literacy plays an important role in building a new generation that has scientific attitudes and thinking. Individual students' abilities in skills and knowledge prepare them in the era of sophisticated technology in the future [14].

The West Sumatra regional government issued a regulation that SMA/MA physics material be integrated with verses from the Koran. The aim is to increase students' intelligence, as well as foster students' religious and spiritual character [1]. According to research results [15], practical students' worksheet teaching materials that integrate Al-Qur'an verses can increase students' learning motivation and increase students' interest in reading. Making integrated practical students' worksheet with verses from the Qur'an, is teaching material that aims to maximize the teaching and learning pro-

cess which is made in an interesting and Islamic nuance. So, it is necessary to integrate the values of the Koran to be able to think critically. With this in mind, it is necessary to design teaching materials to build student knowledge. This practical students' worksheet integrated with Al-Qur'an verses is able to make students understand and increase their interest in reading it, so that students can understand the material provided by linking it to the values of the Al-Qur'an.

The use of the internet is closely related to technology, but augmented reality technology is able to operate without the use of the internet. Practical students' worksheet is one of the teaching materials that is able to develop students' knowledge in learning. Integrating Al-Qur'an verses into teaching materials is still rarely used today. Students need visualization in teaching materials, so that they can attract students' interest in reading. Students need an attractive image display from the students' worksheet, this augmented reality application can be projected onto the students' worksheet to display real 3-dimensional image visualizations, with the aim of making students motivated to read teaching materials.

Based on the results of interviews with SMA 1 physics teachers, the lack of availability of practicum students' worksheet is due to limited learning hours, due to the pandemic, so that practicum activities are not carried out enough. Lack of students' scientific literacy skills, especially students' scientific competence and science skills. Students have difficulty explaining scientific phenomena related to everyday life. In carrying out practicum assignments, students are less able to complete the practicum due to students' lack of knowledge regarding the form of practicum equipment, especially the electrical equipment used.

Therefore, the presence of augmented reality-based physics practical worksheet integrated with Al-Quran verses was developed to be able to meet the needs of teachers and students. Awareness of the importance of developing learning media makes it necessary to make an effort to create interesting media for teaching materials in the future. Teachers strive to increase students' potential, improve skills in creating different learning media. Based on the reasons above, the researchers tried to develop a physics practical worksheet based on augmented reality integrated with Al-Qur'an verses, aiming to broaden students' insight in an interesting and innovative way. The practical students' worksheet was created using the Electricity AR application on Electricity material, so that it can be useful and useful for teachers and students.

2 Methodology

This research uses research and development methods (Research and Development). Through systematic steps, the feasibility is then tested in terms of material, media, interpretation and attractiveness of the teaching materials developed for students. This development model refers to the theory put forward by Sudjana with the 4-D model, namely; defining, designing, developing and disseminating [3];[16]. However, the procedure that researchers carried out was only 3 stages, namely, definition, design and development. This is because there are several limitations for researchers in de-

veloping AR-based practicum students; worksheet integrated with Al-Qur'an verses, such as costs and implementation time.

The definition stage includes front-end analysis, learner analysis, task analysis and concept analysis. Front-end analysis was aimed to know the problem that students face during learning process. Learner analysis was aimed to see the characteristic of the students. Analyzing all students task in learning process in order to achieve minimal competency is part of task analysis. Concept analysis consists of syllabus analysis and teaching material analysis. The design stage includes identifying the program, creating a flowchart or flow chart, preparing the overall product design, collecting materials that will be used such as; materials, images, etc., the final stage is finishing. The development stage includes validation of AR-based physics practicum students' worksheet integrated with Al-Qur'an verses, validation of teacher and student response questionnaires and results of teacher and student practicality analysis of AR-based physics practicum students' worksheet integrated with Qur'an verses.

The instruments used in this research were validation sheets and practicality sheets. The research was carried out at a different school, due to conditions that made it impossible to carry out research at the previous school. Research subjects included students in class XII Science 1 of Raudatul Jannah Islamic High School Payakumbuh. The number of students who attended the research was 18 people. The data analysis techniques used in this research are validity analysis and practicality analysis. Using qualitative data is data taken from validation results from validators in the form of suggestions, observations and interviews with physics lecturers and interpretation lecturers. Meanwhile, quantitative data is data obtained from the results of the AR-based physics practicum LKPD assessment integrated with Al-Qur'an verses from the validator, and data from the results of teacher and student practicality questionnaires.

3 Result and Discussion

The results of the definition stage started with front-end analysis. In this step, the information obtained that during the learning process practicums were not carried out at school and the availability of teaching materials in the form of physical practicum students' worksheet were not available. This problem was caused because during the COVID-19 pandemic learning hours were limited, so that practical activities were not carried out optimally. On the other hand, the West Sumatra Provincial Education Office issued instructions to integrate Al-Qur'an training and Minangkabau Natural Culture in school/MA physics learning. The aim of this integration is to realize that students have spiritual values, intelligence, nationalism, integrity, mutual cooperation, outlook on life and independence. In learner analysis, the students did not understand the practicum tools, especially electrical practicum tools. From task analysis, it is obtained that Students work on practice and evaluation questions in the teaching materials or modules provided. However, for experimental or practicum problems, students have not been able to do and carry out practicums at school. Concept analysis showed that syllabus used in the school follows 2013 curriculum. Teachers use textbook as provided by government. Thus, development Students' Worksheet of Physics

Practicum Based on Augmented Reality and Qur'an Integrated on Electricity Materials in Senior High School is designed to help and motivate students in carrying out learning and overcome obstacles faced by students. This is done so that students know and are familiar with practicum tools and materials and can carry out practicum activities with the availability of worksheets for practicum students. In the end, this student worksheet is expected to be able to increase student knowledge.

The results of the design stage with AR-based physics practicum students' worksheet integrated with Qur'an verses in Electricity material for senior high school, which were developed are as follows; The first thing to do is identify the program, including; subject, class/semester, main material (Basic Competency, indicators, learning objectives), title and media. Then make a flowchart or flowchart consisting of a cover, foreword, table of contents, instructions for using the practicum students' worksheet, core competencies, basic competencies and indicators, Chapter I and Chapter II and a bibliography. At this design stage the product is designed using Corel Draw and Ms. Word 2019, aims to make the process of creating designs for backgrounds, covers and contents of students' worksheet and others. The application is designed with a supporting Android application "Electricity AR" which can be downloaded via the Play Store using internet access [17]. This AR application can operate without using an internet network. Next, there is the use of a QR code to find the application download page. Collecting design objects or collecting charts such as material texts and others in accordance with the design of teaching materials. Then the programming part consists of the stage of combining teaching materials with AR applications. This combination consists of a QR code that directs users to the application download page and an AR marker that functions as a trigger so that the AR model can appear. The AR model in the practical students' worksheet is placed in the tools and materials section, because the AR model is used to display images of practical tools with a 3-dimensional display.

According to Subagiya [18], the integration of Al-Qur'an verses is a guide so that humans can interpret various natural events according to the instructions that God has given. The integration section of Al-Qur'an verses in the practical students' worksheet is placed after the explanation of the electricity material and its interpretation. The AR display model on the physics practical worksheet and section of Al-Qur'an verses can be seen in Fig. 1c.

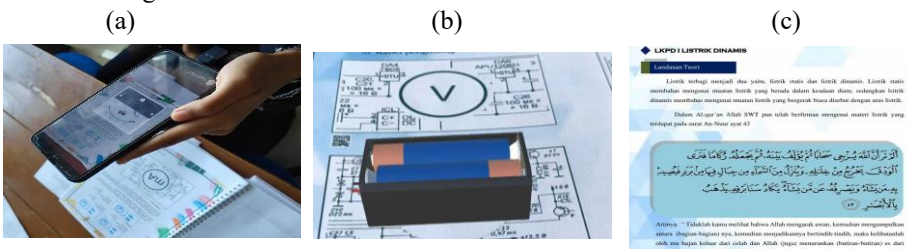


Fig. 1. Students' worksheet based on AR and Qur'an integrated. (a) mobile phone display, (b) image appears from mobile phone (c) Qur'an verse in students' worksheet.

After the theoretical explanation of the material, there is an explanation of the verses of the Al-Qur'an which tell about the processes and power of Allah relating to the phenomena that have been given, with the aim of so that students can interpret various natural events according to the instructions that Allah has given. The finishing part is the process of trying out the readability of the program on printed teaching materials.

The next step is development step. The results of the validity stage of the students' worksheet AR-based physics practicum integrated with Qur'an verses carried out by the validator can be seen in Table 1.

Table 1. The results of the validation of Students' Worksheet of Physics Practicum Based on Augmented Reality and Qur'an Integrated on Electricity Materials in Senior High School

Aspect	Percentage	Category
Content	88.88	Very valid
Presentation	88.02	Very valid
Language	89.06	Very valid
Graphics	89.06	Very valid

Table 1 shows that the results of the validation of the physics practicum worksheet based on augmented reality integrated with Al-Qur'an verses were assessed from the appropriateness aspect of the content, presentation, language and graphics. Content aspect is assessed the theory, images of AR and Qur'an explanation in the worksheet. The theory presented is in accordance with the truth of valid teaching material sources. There are images of AR-based tools and materials in students' practicum worksheets that can be used. Explanation of the integration of verses from the Qur'an with physics material is appropriate and does not violate the meaning. The integration of Qur'an verses provided can motivate students in the learning process. The presentation of practicum student worksheets is in accordance with the format and draft of practicum student worksheets. There is integration of Al-Qur'an verses in the material, the contents of the practicum student worksheets contain elements of scientific literacy, in the form of scientific knowledge in the form of phenomena related to the material, presentation of AR-based material which can visualize the appearance of 3D objects. The language aspect is declared valid because the language used is good and correct, appropriate to the students' level of thinking, communicative, motivates students to participate in learning activities, and the information conveyed is clear. The graphic aspect is considered valid because the size of the student worksheet is in accordance with ISO standards, the cover design depicts the content or material, there is a balance between picture illustrations and writing, and the markers used as 3D objects are attractive and clear. The results of the validation stage of the AR-based physics practicum worksheet integrated with Al-Qur'an verses were categorized as very valid with a percentage of 88.68%.

At the practicality stage, the responses obtained from students and teachers can be seen in Table 2 and Table 3.

Table 2. Students' Practicality Results

Aspect	Percentage	Category
Ease of use	88.54	Very practical
Attractiveness	87.96	Very practical
Efficiency	91.66	Very practical

Table 3. Teachers' Practicality Results

Aspect	Percentage	Category
Ease of use	93.75	Very practical
Attractiveness	83.33	Very practical
Efficiency	91.66	Very practical

In Table 2 and Table 3 it can be seen that the results of the questionnaire on the practicality of student and teacher responses assessed at this stage are; in terms of easy to use aspects, interesting aspects and efficient aspects. The results of the practicality questionnaire for student and teacher responses from the AR-based physics practicum worksheet integrated with Al-Qur'an verses were categorized as very practical with percentages of 89.30% and 90% respectively. This result was obtained because the student worksheets had instructions for use, the AR application was easy to use and made it easier for students to understand electricity material. According to the need analysis [19], students' worksheet assisted by augmented reality help students to increase their scientific literacy requires. That is why this worksheet is needed in order to improve their study especially in electricity materials. Moreover, the use of augmented reality applications in the world of education and teaching is very interesting to do because this application is able to make virtual displays appear in the real world in real time so that it can attract students' interest in learning [20]. On the other side, the integration of the Qur'an verses contained is easy to understand and the interpretation is in accordance with the concept of electricity. By correlating Qur'an verse and the concept of electricity, students feel more convenient and solidify their faith in their study. This also relatable with the previous study result [21] about Qur'an-oriented physics worksheet that proven effective in learning. The recent study by [22] and [23] about teaching materials using Augmented Reality and Qur'anic verse integration are practical to be used.

4 Conclusion

Students' worksheet of physics practicum based on AR and Qur'an integrated on electricity materials in senior high school have been developed. This worksheet has been designed as a printed media using AR application. The worksheet is also integrated with Qur'an verses as a part of government policy. The worksheet then validated to some experts in education and media. In this case, we invited 4 validators as

the experts. The result shows that the validity of the worksheet reached 88.68%. It means, tis worksheet is very valid. Furthermore, the worksheet was tested to the students and physics teachers in Raudhatul Jannah Senior High School. After that, they are given the questionnaires about the worksheet. The data obtained from the student response was of percentage of 89.30%. It is categorized as very practical. The response of the teachers also showed the same result, which is very practical with a percentage of 90%. From these data, we can conclude that Students' worksheet of physics practicum based on AR and Qur'an integrated is very valid and very practical to use in the learning process, especially electricity material.

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