3D AR Learning Media on Human Respiratory Organs to Train Elementary Science Process Skills

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Abstract

The background of this research was carried out because there was no application of digital media in schools and only used media in the form of books. At this time there is a great need for learning media that is interactive, interesting, and motivates students so that learning in the classroom becomes fun. However, the learning media used is only conventional media, especially in learning the material of the respiratory organs in humans. Through this statement, researchers plan to design and develop 3D Augmented Reality learning media based on the characteristics of grade V students of SDN 068 Sindanglaya. This study was made to determine the science process skills of students with the subject matter of human respiratory organs using 3D Augmented Reality learning media. The research method used is the Weak Experiment method with One-Group pretest-posttest Design. The results of the media feasibility test based on teachers, student responses and observation questionnaires of science process skills obtained an average percentage of 92.6% which indicates the category "Very Feasible". So it can be concluded that the 3D Augmented Reality learning media of respiratory organ material in humans is very feasible to use in the learning process in the classroom to train students' science process skills.

Keywords: Learning Media, 3D Augmented Reality, Science Process Skills

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INTRODUCTION

Education is one of the ways for humans to develop themselves with the learning process that has been obtained (Fitri, 2021). In accordance with the 1945 Constitution Article 31 Paragraph 1 which states that "every citizen has the right to education". Education is Indonesia's first key to creating a smart future. Education is a process in humanising humans which can be interpreted as humanisation. In striving to educate the nation's children, education is needed. With education, the younger generation will learn important things, such as the goals of national education which want the nation's children to believe in God Almighty, have noble character, be knowledgeable, be physically and mentally healthy, and be responsible (Desstya et al., 2018). According to (Angrayni, 2019), education can be interpreted as an effort made by humans for the sake of humans themselves and also for the wider community. Education is a part that will always be attached to humans. Starting from the womb, then growing into an adult human being, then developing again into an elderly person. All of that is through a process called education.

In the current digital era, humans are considered individuals and no longer considered groups. It is said so because humans are users of information and communication technology which makes it one of the main parts that underlie human life in the digital realm (Prisgunanto, 2018). When Indonesia enters this digital era, the Indonesian people must prepare themselves to face this. What the younger generation must have is proper knowledge and skills. Young people are prepared to become strong, competitive, and competent human beings. Apart from that, the younger generation is also prepared to become a generation that has a creative mindset, can make accurate decisions, and is able to solve a problem (Afifah, 2017).

Occupying an era with technological developments that have gone global, technology also affects various fields, namely politics, economy, social and culture, and education. According to (Maritsa et al., 2021) technology-based education can support when the education or teaching and learning process takes place. Planning a lesson requires a procedure that requires qualified technology. In implementing learning in schools, there are five components needed, namely goals, materials, methods, media, and evaluation. There is one component, namely media that can be used as a tool in learning that can affect motivation, conditions, and the environment (Hayes et al., 2017). In order to attract the attention of students when providing learning materials, teachers are expected to use interesting learning media so that students can easily understand the material provided by the teacher.

According to (Setiyawan, 2017), what can affect the high quality of learning is to provide opportunities for students to develop their potential and talents. One way that can be done is by developing information technology that already exists in the implementation of education that can be used in general or can be used as learning media in the classroom. In the midst of the rapid development of technology today, many teachers have not taken advantage of this technology. According to (Sunami & Aslam, 2021) learning media is a way to make it easier for teachers to convey learning material to students. Using various technology-based learning media such as visual, audio, and audio-visual media can help increase students' interest in understanding the material provided. In an effort to overcome the problems that exist in schools, researchers decided to make 3D Augmented Reality learning media to train science process skills in elementary school. This is in line with the statement (Riskiono et al., 2020) that learning media that apply Augmented Reality to the media is an interactive learning media that makes students more eager to learn.

Science process skills are the skills or abilities of students in using scientific methods in order to digest, describe, and be able to achieve a science (Rahayu & Angg, 2017). Training and developing science process skills in students will be very useful for students not only as a process for building knowledge in learning but also useful in everyday life, so science process skills are very important for students (Yati Lestari et al., 2018). According to (Eliyana, 2020) the development of science process skills can be done through direct experiments. Science process skills will involve students directly as a learning experience. According to (Yuliati, 2018), science learning in elementary schools should be realized by including nature in the environment so that students can adventure with the natural environment. Science process skills are essential for students in elementary school during scientific inquiry activities so that science problems can be solved. For elementary school students really need basic process skills in order

to complete themselves. According to (Sayekti & Kinasih, 2018), there are two types of Science Process Skills, namely basic process skills and integrated process skills. Basic process skills include observing, classifying, communicating, estimating, reporting the relationship between space and time, concluding and estimating. In addition, integrated process skills include problem identification, variable identification and control, hypothesis formulation, data interpretation, operational definitions, graph reading and conducting experiments.

3D Augmented Reality is one of the media that can help the learning process of science process skills (Nugraha et al., 2021). Augmented Reality is a technology that combines two-dimensional or three-dimensional virtual objects into the real world and then the virtual objects are projected and look real. With the 3D Augmented Reality media, it can attract the attention of students to pay more attention to the material provided by the teacher, and can easily understand it. It can train the science process skills of elementary school students. By using 3D Augmented Reality learning media in the material of respiratory organs and their functions in humans, students can see real images of respiratory organs displayed through three-dimensional Augmented Reality media through smartphones from each student.

The design of 3D Augmented Reality learning media aims to create a learning media that is packaged as interesting as possible to educate students on the learning material of human respiratory organs and also to increase the diversity of learning media in visual form and also to train students' science process skills, so that it can support teachers in learning procedures by realizing an exciting and useful situation for students. One of the reasons researchers want to use 3D Augmented Reality in this study, so that students can easily visualize the respiratory organs in real life and researchers hope that by using this learning media can train students' science process skills. In addition, students are also expected to better understand the material presented by the teacher.

According to Harlen (1992) (in Fitriyah & Cintamulya, 2018) divides 7 aspects of science process skills, namely observing, proposing hypotheses, interpreting data, planning experiments, carrying out experiments, drawing conclusions and communicating. This research is interesting to do because of the problems experienced by students, namely the lack of science process skills applied to students and the lack of variations in learning media provided by teachers. So that researchers want to make interactive learning media that can bring out the science process skills of students.

METHODS

In this study using the Weak Experiment method or pseudo-experiment with One-Group pretest-posttest Design by looking at changes in learning outcomes before learning with after learning.

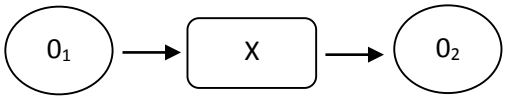

Figure 1. One-Group pretest-posttest Design according to Sugiyono in (Haque et al., 2016).

0_1 = Pretest score before using the media
X = Use of teaching materials
0_2 = Posttest score after using the media

The initial stage of applying this method is starting with conducting an initial stage test (pre-test). The pre-test is carried out before the provision of material and before using learning media. After being given material and using the media, a post-test was conducted (Rifqiawati et al., 2020).

This study used 20 students and also 1 fifth grade teacher of SDN 068 Sindanglaya as research subjects. Data collection was carried out by giving multiple choice questions to students and filling out questionnaires.

Table. 1 Normalized gain criteria (N-Gain)

N-Gain	Kriteria Peningkatan
G < 0,3	Low Improvement
0,3 ≤ G ≤ 0,7	Moderate Improvement
G ≥ 0,7	Height Increase

Source: (Kurniawan, 2014)

To calculate the results of the questionnaire that has been filled in by students and teachers, namely by using the following calculation formula:

$$Percentage = \frac{sum\ of\ assessment\ scores}{maximum\ number\ of\ scores} \times 100\%$$

Tabel 2. Range Percentage and Qualification

Range (%)	Qualification
81% ≤ X ≤ 100%	Very Good
61% ≤ X < 80%	Good
41% ≤ X < 60%	Medium
21% ≤ X < 40%	Not Good
0% ≤ X < 20%	Not Very Good

Source: (Tarigan & Siagian, 2015)

RESULTS AND DISCUSSION

3D Augmented Reality learning media is an audio-visual learning media in which there are images of respiratory organs displayed in three dimensions that can be seen in real life. In addition to three-dimensional images, there is also text and audio that explains the function of the respiratory organs displayed. There is also a video tutorial on the use of 3D Augmented Reality media that can be accessed through the youtube link https://youtu.be/FGvFMIv6yWE. And also infographics on how to use the 3D Augmented Reality learning media given to students.

Figure 2. Augmented Reality 3D Media Infographic

Science Process Skills

At the initial stage in the search for initial data obtained through the problem identification stage. In line with the statement of Peffer, et al (in Apriansah et al., 2022) which makes the problem identification stage an initial stage to detect existing problems in schools. The assessment data used in this study were obtained from the results of the pre-test and post-test given to students. The pre-test was conducted before the material and 3D Augmented Reality learning media were given to grade V students. While the post-test is given after the exposure of material and learning media 3D Augmented Reality about the respiratory organs in humans is given. This is based on a statement from (Nuryanti, 2019) which states that students are given a pre-test question before taking action, after being given the action students are given a post-test question.

In this study, the ability of students' science process skills is measured based on aspects developed by Harlen (1992), which are divided into 7 aspects, namely (1) Observing; (2) Hypothesizing; (3) Data Interpretation; (4) Planning Experiments, (5) Conducting Experiments; (6) Drawing Conclusions and (7) Communicating. Pre-test and post-test were given to determine the effectiveness of 3D Augmented Reality learning media on students' science process skills using N-Gain improvement. According to the opinion (Wahab et al., 2021) N-Gain is used when calculating the improvement in science process skills and cognitive learning outcomes between before and after learning.

The results of data analysis showed that there was an increase in students' science process skills. The increase in students' science process skills is influenced by the 3D Augmented Reality media that is designed to train students' science process skills. It can be clearly seen the increase between the pre-test and post-test results. More clearly, the improvement that occurs in each indicator of science process skills is in Figure 3.

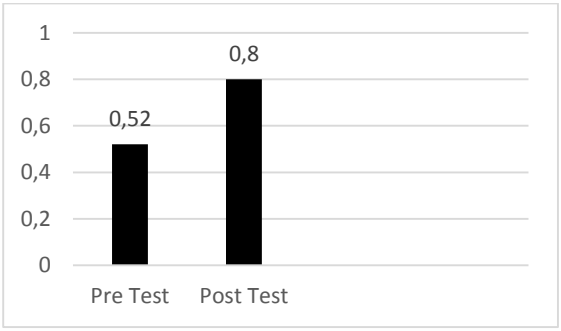

Figure. 3 Pre-test and Post-test scores

More clearly, the improvement that occurred in each indicator of science process skills is shown in Figure 4.

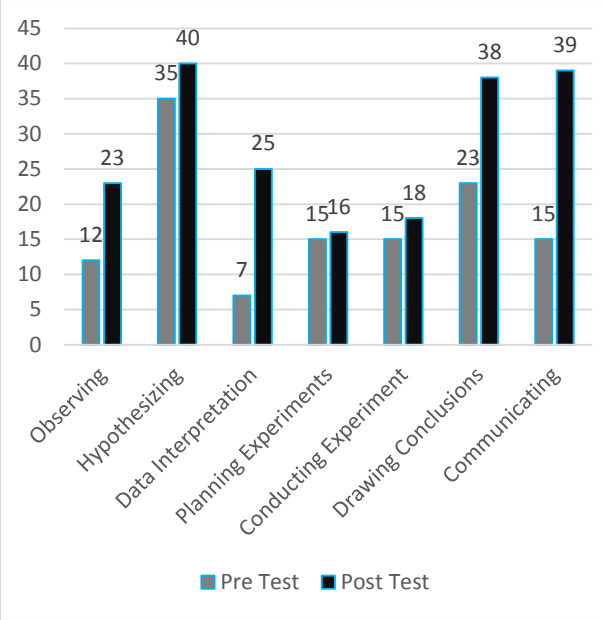

Figure. 4 Pre-test and Post-test Scores of Students' Science Process Skills on Each Aspect

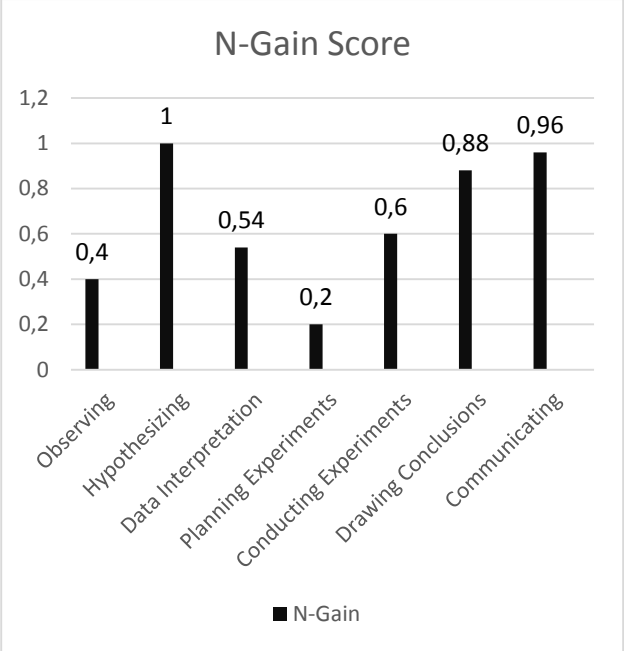

Figure. 5 Pre-test and Post-test N-Gain Results

Figure 4 shows that in each aspect of the science process skills of grade V B students of SDN 068 Sindanglaya have increased after the provision of 3D Augmented Reality learning materials and media.

There is an increase in science process skills based on 7 aspects which include (1) Observing; (2) Hypothesizing; (3) Data Interpretation; (4) Planning Experiments; (5) Carrying out Experiments; (6) Drawing Conclusions and (7) Communicating. The following is the N-Gain score of each indicator of science process skills presented in Figure 5.

Based on the N-Gain score data above, it can be seen that in each aspect of science process skills has increased. The improvement category is classified into three categories, namely low improvement, moderate improvement, and high improvement. Of the 7 aspects analyzed, there is 1 aspect that is classified as low, namely the aspect of planning experiments. Then there are 3 aspects that are classified as moderate, namely observing, interpreting data, and carrying out experiments. Finally, there are 3 aspects classified as high, namely the aspects of proposing hypotheses, drawing conclusions, and communicating.

The highest increase in aspects of science process skills is the aspect of proposing hypotheses with an average N-Gain value of 1.00. This happens because of the provision of 3D Augmented Reality learning media that can make students remember the material well. The form of visualization displayed in 3D makes students able to hypothesize. The lowest increase in science process skills aspects is in the aspect of planning experiments with an average N-Gain value of 0.2. This was caused by students who were not used to planning experiments. The lack of student activity in planning experiments is due to students who are not accustomed to and only accustomed to lecture method learning.

In teaching science process skills to students, there is an observation sheet given to the teacher in order to find out the science process skills possessed by class V B students of SDN 068 Sindanglaya.

Based on the results obtained from filling out the science process skills observation questionnaire by the teacher using the Likert scale formula, 91%. With the results obtained from filling out the science process skills observation questionnaire, it shows that the media made by researchers are included in the very good category.

User Response to 3D Augmented Reality Learning Media

Research participants are teachers and students who take part in assessing the design of 3D Augmented Reality learning media development products. The existence of teacher and student responses based on this media has the aim that teachers and students provide responses or responses regarding 3D Augmented Reality learning media on human respiratory organs material to train science process skills in grade V SD. The statement is in line with (Nahdlatul et al., 2021) that teachers and students can provide responses related to media products made by researchers.

3D Augmented Reality learning media involves 2 research subjects, namely students and teachers. The questionnaire was given to students when learning the material of the respiratory organs in humans using 3D Augmented Reality media has been completed. Learners who filled out the questionnaire of 3D Augmented Reality learning media as many as 20 learners. In general, students give a good response to the 3D Augmented Reality media. The percentage obtained is based on aspects of the learner response questionnaire, namely the quality of content and objectives with an average acquisition of 93.5%, the quality of learning 93.43%, and the technical quality of the media 90.41% The following is a recapitulation of the results of learner responses in Figure 6.

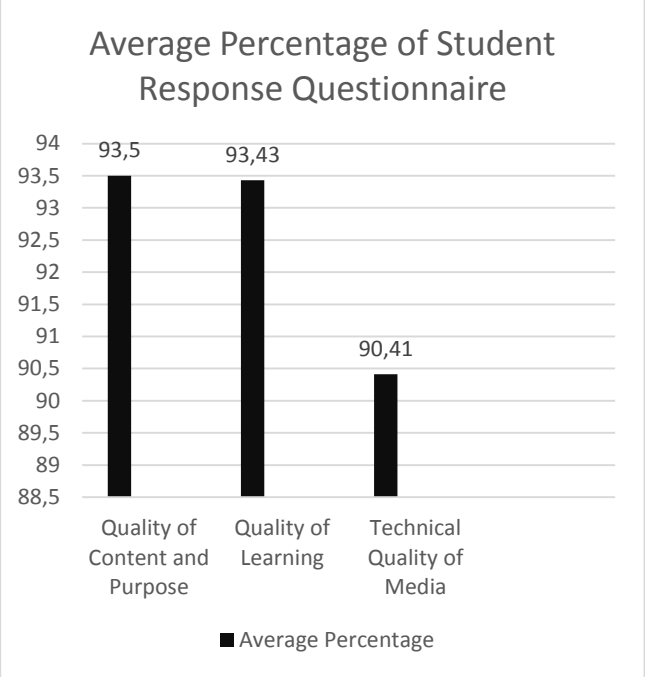

Figure. 6 Average Percentage of Learners' Responses to 3D Augmented Reality Learning Media

Apart from students who respond to the 3D Augmented Reality media that has been given, there are also teachers as educators who respond in the form of a questionnaire. Teachers are given a questionnaire to see how effective 3D Augmented Reality learning media. This response was taken from one of the teachers of class VB SDN 068 Sindanglaya. The percentage obtained is based on aspects of the teacher's response questionnaire, namely the quality of content and objectives with an average acquisition of 100%, the quality of learning 85%, and the technical quality of the media 100%. A recapitulation of the results of teacher responses is presented in Figure 7.

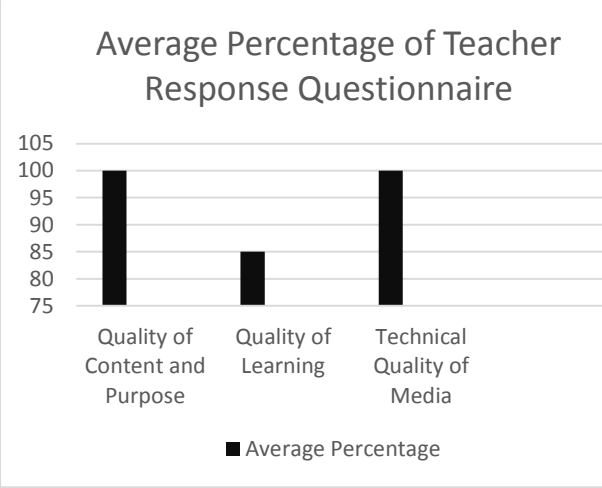

Figure. 7 Average Percentage of Teacher Responses to 3D Augmented Reality Learning Media

Based on this assessment, the 3D Augmented Reality learning media of human respiratory organs material to train science process skills in elementary school can be declared as "very feasible" media. This is in line with the statement (Hidayah et al., 2020) that the learning media must make students interested, in order to motivate and increase student learning interest.

Implementation of Learning Media

Figure. 8 Implementation of 3D Augmented Reality Learning Media on Learners

Based on the results of the implementation of 3D Augmented Reality learning media, the advantages and disadvantages of this learning can be stated. The advantages of 3D Augmented Reality learning media include (1) learner-centered learning; (2) the images provided on 3D Augmented Reality learning media can clarify learners to see the real respiratory organs; (3) facilitate learners in the use of 3D Augmented Reality learning media; (4) can be an alternative for learners to practice science process skills integrated through 3D Augmented Reality learning media; (5) 3D Augmented Reality learning media that can be accessed anywhere with only a smartphone.

The weaknesses of 3D Augmented Reality learning media are (1) there are some students who bekum understand how to use the media; (2) not all students who have smartphones; (3) not accustomed to teachers in making 3D Augmented Reality learning media.

CONCLUSION

Based on the data and analysis that has been done about 3D Augmneted Reality learning media to train students' science process skills, it can be concluded that 3D Augmented Reality learning media can train students' science process skills. Proven by the N-Gain score of 0.58 medium improvement category. Then the teacher gave a positive response to the 3D Augmented Reality learning media in the teacher response questionnaire with a percentage of 94.2%. And students also gave a positive response to the 3D Augmented Reality learning media on the material of the respiratory organs in humans with a percentage of 90.41%.

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