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The Effectiveness of Videos and Animations in Learning Physics in Junior High School Heat Materials

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ABSTRACT

At the junior high school level, it is expected that learning Physics will provide students with knowledge and skills so that they can develop competency and hone science skills. Heat material is one of the junior high school physics materials which is dominated by concepts and principles so that it is considered difficult by students. The use of effective media can be one of the solution, namely the use of videos and animations in learning Physics. The type of this research is Research and Development which aims to develop videos and animations in learning physics of heat material. The effectiveness in using of videos and animations was carried out in a limited field test, namely in class VII³ SMP N 1 Pariaman even semester 2019/2020 using before and after experiments. The data collection instrument for the effectiveness test was in the form of tests of students' cognitive learning outcomes before and after using videos and animations. Furthermore, the data were analyzed using a correlated t-test. Based on the results of the analysis, the value of $t_{count} = 6.91$ and $t_{table} = 2.04$ ($t_{count} > t_{table}$). This shows that there is a significant difference between learning outcomes before using videos and animations in learning Physics and learning outcomes after using videos and animations in learning Physics. Thus, it can be said that videos and animations in physics learning are effective heat materials used in physics learning in class VII SMP Negeri 1 Pariaman.

INTRODUCTION

The main purpose of education is to make changes and educate students to improve their quality of life [1]. The quality of education can be formed through quality, innovation, and fun learning [2]. Improving the quality of learning is important to do starting from primary and secondary education to higher education [3]. To achieve this, science activities must be relevant to students' lives with a focus on sources of knowledge, strategies, and contexts that students will encounter in real life after

graduation. Therefore, a transition is needed where students learn to participate in science activities that require deeper involvement on their part. This transition is a process that relies on teachers' acceptance of what is expected of them to replace outdated classroom models of science teaching and learning with student-centered models [4].

Physics education in the conventional learning era is still teacher-centered; a short question and answer session at the end of the lesson by giving homework, and face the final exam with the same problem pattern in each semester. Such a learning system then causes almost all students in the field of Physics to have the same mindset and characteristics. Educators in the field of science are expected to be able to develop physics learning to be more effective and relevant in accordance with the demands of global needs [5].

The technology used in learning activities is growing along with the times, ranging from learning to use print media to computer-based learning [6]. Therefore, various educational applications are emerging as cognitively active, highly engaging, meaningful, interactive, and socially engaging digital experience drivers in the context of learning objectives, rather than simply replicating and extending old media such as books, worksheets, television, or even video games. The main purpose of using technology in learning is to solve problems that arise from the lack of facilities in learning activities [7].

The use of media in learning is to assist the teaching and learning process so that teaching objectives can be achieved effectively and efficiently [8]. The purpose of using media is to provide variations in the learning process, provide more reality in learning so that it is more realized, more directed to achieve learning objectives [9]. In addition, conceptual understanding refers to students' ability to relate new knowledge to existing knowledge in various ways of conveying it without changing its true meaning. Therefore, the media is needed to explain the material in more detail, visualize abstracts, understand concepts correctly, train students to think, and be able to solve problems. Based on this, the use of technology as a learning medium becomes an inseparable part [10].

Science subjects in junior high school include studies on biology and physics. Science subjects are an extension and deepening of science in elementary school and as a basis for studying the behavior of matter and energy and the relationship between concepts and their application in real life [11]. Physics is a branch of science that has certain characteristics in life and has values that are always evolving. In an effort to develop physics, it can be done through education and teaching. The function of science (science) subjects in junior high schools is basically to provide knowledge about the natural environment, develop skills, awareness insights, technology related to using in everyday life, and as a prerequisite for continuing to secondary education. This is in accordance with what is stated in the Ministry of National Education, namely: a). Instilling belief in God Almighty, b) Developing skills, attitudes, and scientific values, c). Preparing students to become citizens who are literate in science and technology, d) Mastering the concept of science for the provision of life in society and continuing education to a higher level [12].

The purpose of learning science in junior high school is basically to provide knowledge to understand physics concepts and their interrelationships and be able to apply scientific methods that involve process skills to solve problems in everyday life. In the Ministry of National Education, it is stated that the objectives of learning science are as follows: a). Instilling belief in the greatness of God Almighty based on the existence, beauty, and orderliness of His natural creation, b). Provide an understanding of various kinds of natural phenomena, principles, and concepts of science and their relationship to the environment, technology, and society. c). Provide experience to students in planning and doing scientific work to form scientific attitudes, d). Raise awareness to maintain and preserve the environment and natural resources. e). Provide provision of basic knowledge to continue education to the next level [12]. At the junior high school level, it is expected that learning Physics will provide students with knowledge and skills so that they can develop competencies and hone science skills. One of them is by utilizing videos and animations in learning Physics.

Video is a useful technology for capturing, recording, processing, transmitting, and rearranging moving images using celluloid film, electronic signals, or digital media. Digital video is a type of video recording system that works using a digital system compared to analog in terms of a video representation. And usually, digital video is recorded on tape, then distributed via optical discs, such as VCD and DVD. The benefits of using video media in learning are as follows, 1) can train students to develop abstract imagination power, 2) can stimulate active participation of students, 3) present messages and information simultaneously for all students, 4) generate learning motivation, 5) overcomes the limitations of space and time, 6) can present difficult and original reports using other media, and 7) control the direction and speed of student learning [13].

Animation is the art of bringing to life an illustration of an inanimate object or character. Animations are created by sorting a collection of images, then quickly displaying them one by one. The image will look alive and moving. In fact, the human eye can only store one image for 1/16th of a second, so when several images appear in quick succession, the brain combines them into a moving image. To create the impression of smooth motion, every animator must consider the frame rate or the number of consecutive images displayed each second. Animation is one of the computer-based learning media that aims to maximize visual effects and provide continuous interaction so that student's understanding of learning material can increase [14].

Here are the advantages of animation when used in learning: 1) animation is able to convey a complex concept visually and dynamically. Relationships or links regarding a complex concept or process are easier to map into students' minds and so help in the understanding process. 2). Digital animation is able to attract students' attention easily. Animation is able to convey a message better than the use of other media. Students' memory is longer for dynamic media than static media. 3). Digital animation can also be used to help provide virtual learning. This is especially important for situations where actual estimates are difficult or unavailable, dangerous, or may involve high costs. 4). animation is able to offer a more enjoyable learning medium. Animation is able to attract attention, increase motivation and stimulate students' thinking more memorable. Everything will help in the process of reducing the cognitive load of students in receiving a subject matter or message that the teacher wants to convey. 5). Visual and dynamic presentations provided by animation technology are able to facilitate the process of implementing concepts or demonstrations [15].

Previous research conducted by Yulisa et al. (2020) showed that physics learning videos had an effect on understanding the concepts of junior high school students as indicated by $t_{count} > t_{table}$, namely $8.112 > 1.671$ [16]. In addition Hafizah (2020) also conducted research and revealed the use of video in physics learning to effectively improve student learning outcomes and encourage students to be active in learning [17]. Furthermore, research conducted by Paramita et al. (2017) shows that the use of animation can support learning Physics in junior high school and is worthy of being used as a medium in learning process [18].

Learning Physics at SMPN 1 Pariaman still has problems. For this reason, observations were made using a questionnaire in the form of a student needs questionnaire as an analysis of student needs (needs assessment). The need assessment activity is an activity that must first be carried out in every instructional model and design. This shows the importance of tracking information about expectations and reality, namely the abilities that must be possessed with the abilities that have been possessed [19]. Based on the results of the analysis of student needs, it can be understood that the problems in learning Physics are closely related to learning media that are not developed in schools. In addition, based on the results of interviews with several physics teachers at the school, the heated material is considered quite difficult for students to understand. This is because heat matter is dominated by concepts and principles. Therefore, it takes skills in understanding the practicum and understanding the concept. One of the efforts that can be done to support the learning of Physics on heat material is by using effective learning media. Thus the solution chosen for this problem is learning media in the form of videos and animations on heat material.

METHOD

This type of research is research and development (R&D). The procedures carried out in developing videos and animations in Physics learning are: defining, designing, developing, and disseminating. Research R&D is a process used to develop and validate educational products. The output or result of development research is not only the development of existing products but also to find knowledge or answers to practical problems/problems [20]. In this paper, only the development section will be explained regarding the implementation of video and animation in physics learning on heat material because the other sections have been explained in the previous published paper. Videos and animations are made using software, namely Adobe Flash CS4, CyberLink Power Director, Audacity, and Format Factory. Each software has a different function and supports each other so that by combining its use it can produce good video and animation products.

The effectiveness of physics learning videos and animations on heat material was carried out in a limited field test, namely in class VII³ N 1 Pariaman even semester 2019/2020. Testing the effectiveness of videos and animations in learning physics is done by testing using the Before and After the experiment, which compares student learning outcomes before using videos and animations in learning physics with after using videos and animations in learning physics. The before and after experimental design can be seen in Figure 1 below.

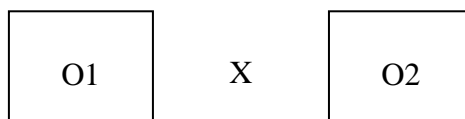


Fig 1. Before-After Experiment Design [20]

Here O1 is the value before treatment, while O2 is the value after treatment. Experiments were carried out by comparing the results of O1 and O2 observations. The effectiveness of the treatment can be measured by comparing the value of O2 with O1. If the value of O2 is greater than O1, it can be said that the treatment is effective [20]. Thus the initial test is intended to determine the initial ability of students before being given treatment. The treatment given is learning Physics using videos and animations on heat material. After that, students were given a final test to determine the effectiveness of using videos and animations for learning Physics on heat material. Videos and animations in learning physics are said to be effective if there is an increase in student learning outcomes after the use of videos and animations in learning physics. Improved learning outcomes can be analyzed using statistical tests, namely the correlated t-test.

The data collection instrument for the effectiveness test was in the form of tests of students' cognitive learning outcomes before and after using videos and animations. The learning outcomes test is made in the form of questions. The items used for the initial and final tests were analyzed first to find out which questions were appropriate or not used as testing instruments. Furthermore, the data obtained were analyzed using a correlated t-test. A correlation t-test was used to compare the average score of students before using video and animation with after using video and animation in learning Physics.

RESULTS AND DISCUSSIONS

Video and animation products in physics learning on heat materials are produced using software such as Adobe Flash CS4, CyberLink Power Director, Audacity, and Format Factory. The process of making images for animation is done with the help of a device in the form of a tablet. The image is painted using a tablet that is connected to a computer and saved in a file in Adobe Flash CS4 software. Coloring images that have been imported using the tools found on the Adobe Flash CS4 menu. The movement of the animation can be done by adding bones into each curve of the image you want to

move. To incorporate videos into animation software, you must first edit the video using Cyberlink Power Director. The video editing process is done to cut parts of the video that are not displayed and to improve the appearance of the video after it is imported. The video that will be imported into Adobe Flash CS4 is first converted into FLV form using Format Factory software. Video can be placed in the frames contained in Adobe Flash CS4. Audacity is used to record sounds used for character conversations in videos and animations. Animation in Adobe Flash CS4 can be created by adding action scripts at each desired frame. Video formats can be arranged according to the needs of learning physics. The menu display on the animation that has been created can be seen in Figure 2 below.



Fig 2. Menu Display

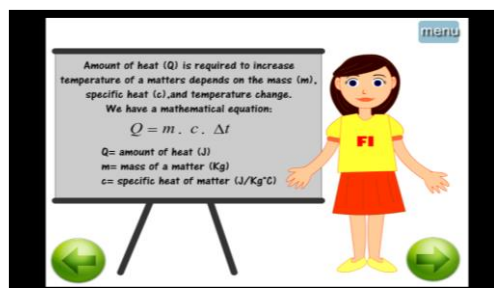


Fig 3. Display of formula writing

The material section is also equipped with formulas. For example, the formula for determining the heat required by an object/substance can be seen in Figure 3. In order for students to better understand the material, the animation is equipped with a practicum video. The video that has been created is then imported into the animation. Video and animation products in Physics learning use experimental videos that have clear work stages/procedures so that students can easily understand and can use the video as a companion in carrying out experiments. The tools and materials used were also explained well by the experimental guide. Each stage and procedure of the experimental work is well explained in videos and animations. The experimental video display can be seen in Figure 4 below.



Fig 4. Video display of heat experiment

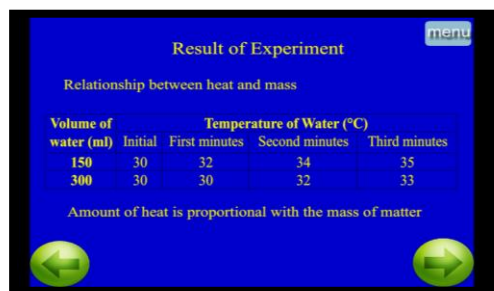


Fig 5. Display of experimental results

In the material menu, there are experiments followed by data presentation at the end of the experiment. The data is presented in tabular form as a guide for students in conducting experiments or as a reference in drawing conclusions. For example, for experimental data, the relationship between heat and mass is followed by a conclusion display in the next frame, the relationship between heat and the specific heat of an object is followed by a conclusion display in the next frame. The conclusion menu display can be seen in Figure 6 below.

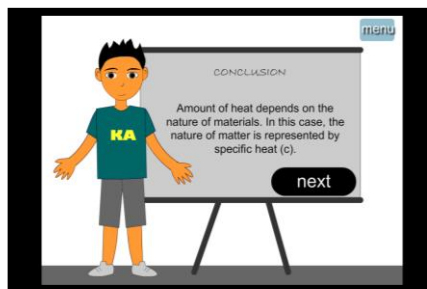


Fig 6. Conclusion menu display

Before the effectiveness test was conducted, the questions were first tested in other schools. The school chosen for the test test was SMP N 1 2X11 Enam Lingkungan. The selection of schools for the test questions is carried out by looking at the equivalence of the schools to be studied with the schools where the test questions will be conducted. The questions tested were 25 pieces and adjusted to the indicators and objectives of the learning. After analyzing the items and differentiating power, it was found that the questions were worthy of being tested as an effectiveness test.

The effectiveness test was conducted on students of class VII³ SMP N 1 Pariaman by giving a pre-test and a post-test. The initial test and the final test are in the form of 20 equivalent objective questions with 4 answer choices. To see the quality of the test, an analysis of the validity of the test and the reliability of the test was carried out. The validity of the test aims to see the validity and validity of the tests given to students. From the calculation obtained 0.68 test validity and 0.68 test reliability. Based on the results obtained, it can be stated that the validity and reliability of the tests used to test the effectiveness are high. Furthermore, an analysis of the results of the initial and final tests was carried out. The results of the analysis of the pre-test and post-test are presented in Table 1 below.

Table 1. Analysis of pre-test and post-test

| Pre-test | | | | Post-test | | | |
|------------------------|--------------|-------------------|---------------|------------------------|--------------|-------------------|---------------|
| Number of students (n) | Lowest Score | The Highest Score | Average Score | Number of students (n) | Lowest Score | The Highest Score | Average Score |
| 30 | 40 | 75 | 61,33 | 30 | 60 | 90 | 76,33 |

Based on the initial test scores, the lowest score was 40 and the highest score was 75. The average value obtained for the initial test was 61.33. The lowest score obtained for the final test was 60 and the highest score was 90. The average score for the final test was 76.33. Based on the data on the average value of the initial test with the final test, it can be seen that there was an increase in the average score of students after using videos and animations in learning Physics. To determine a significant increase in the students' mean scores, the correlated t-test was used. The t-correlation test is a comparison of the values between t_{count} and t_{table} . The results of the correlation t-test analysis can be seen in Table 2 below.

Table 2. Results of correlated t-test analysis

| N | α | t_{table} | t_{count} | description |
|----|----------|-------------|-------------|-------------------------|
| 30 | 0,05 | 2,04 | 6,91 | $t_{count} > t_{table}$ |

The t_{table} value is obtained by first finding the degrees of freedom. The value of degrees of freedom is obtained by using the equation, $dk = (n-1)$. The number of students who became the object of this study was 30 people, so the degrees of freedom were: $(30-1)$, so the value of the degrees of freedom (dk) used was 29. The t-value for the real level $\alpha = 0.05$ with the number of students (n) = 30 people

and degrees of freedom (dk) = 29, are: $t_{table} = t_{(1-\frac{1}{2}\alpha), (n-1)} = t_{(0.975, 29)}$, of 2.04. This means the value obtained from $t_{count} > t_{table}$.

The value of $t_{count} > t_{table}$ indicates that there is a significant difference between learning outcomes before using video and animation in learning Physics and learning outcomes after using videos and animations in learning Physics. This means that there is a significant effect on learning outcomes using videos and animations in learning physics and it can be said that videos and animations in learning physics are effectively used in learning physics in class VII SMP Negeri 1 Pariaman.

The use of videos and animations in learning Physics makes it easier for students to understand the concept of heat so that students become more motivated in learning. Learning motivation is very influential on learning achievement as measured by student learning outcomes [21]. This shows that the learning process can be balanced with the scientific process. This is believed to be a path for the development of attitudes, skills, and knowledge of learners [22]. Media provides variety in learning activities. In the context of the teaching and learning interaction process, variations are intended to overcome student boredom. With variations, it is expected that students will always show perseverance, enthusiasm, and full participation [23].

This is in line with the opinion of Ikwuka and Samuel that learning media functions as 1) clarify and enrich/complete the information provided verbally. 2) increase motivation, effectiveness, and efficiency of information delivery. 3) add variety to the presentation of the material. 4) can generate enthusiasm, passion, and prevent boredom of students to learn. 5) make it easier for the material to be digested and make more impressions, so it is not easily forgotten by students. 6) provide a more concrete experience for things that may be abstract. 7) provide stimulus and encourage student responses [24].

The obstacle found when learning to use videos and animations in class is the lack of supporting facilities such as computers, so students have to bring laptops from home. Constraints of the lack of supporting facilities such as computers in the implementation of learning can be overcome by properly distributing computer labor time in schools. The use of computer labor can be arranged with good management so that each student can use a computer. Thus, it is hoped that in the future the application of learning using videos and animations in physics learning will be maximized.

CONCLUSION

Based on the results of the study, it can be concluded that the use of video and animation on heat material has a significant effect. We can see this from student learning outcomes. Student learning outcomes after the use of videos and animations are higher than before. Thus, it can be said that videos and animations in physics learning material heat are effectively used in learning physics.

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