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The Effectiveness of Animated Videos on High-Level Thinking Skills of SMA Negeri 1 Silat Hulu Students

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ABSTRACT

Higher-order thinking skills are 21st-century competencies that must be mastered by students. Higher-order thinking skills can be seen in student learning outcomes. Students' higher-order thinking skills can be improved by choosing the right learning media, one of which is by using animated video media. The purpose of this study was to measure the effectiveness of animated videos to improve the high-order thinking skills of SMA Negeri 1 Silat Hulu students. The method used in this research is the experimental method. The form of study used a quasi-experimental design with a nonequivalent control group design. The research subjects were all students of class XI IPA. The instrument used is a question of pretest-posttest. Data analysis used a t-test and *N-Gain Score*. Based on the results of the research, the results of video animation media are effective for improving students' higher-order thinking skills because they have fulfilled two criteria, namely the high-level thinking skills of students in the experimental class are significantly different from the control class (proven by the sample t-test 0.000 < 0,05) and the results of the *N-Gain Score* in the experimental class 0.61 with a moderate interpretation.

Keywords: *higher order thinking skills*, learning media, PISA, animated videos

INTRODUCTION

Biology learning emphasizes on providing direct observations to develop competence so that students explore and understand the natural surroundings scientifically. Skills in learning biology aim to increase students' understanding of the surrounding environment. The skills developed are observing using the senses, making hypotheses, making questions, grouping and communicating the findings, and selecting relevant facts to solve everyday problems. Biology learning aims to train students' potential to be able to think critically, creatively and innovatively (Karmana, 2013:57; Yulianis, et al., 2019:106).

21st century learning not only requires students to understand the content of the material, but also leads to higher-order thinking skills. Higher order thinking skills include cognitive abilities in the realm of analyzing (C4), evaluating (C5), and creating (C6). Higher

order thinking skills are very important for students. This is in line with the competency standards for high school graduates (SKL-SM), namely students are able to develop skills in logical, critical, creative, and innovative thinking, as well as develop skills in solving problems (Kemendikbud, 2020; Kivunja, 2014:2 ; Fayakun, 2015:50).

In fact, higher order thinking skills in Indonesia are still relatively low. This can be seen in the TIMSS 2019 International Results in Mathematics and Science report on thinking skills in the 8th Grade Science category, where Indonesia was ranked 44th out of 49 countries. Meanwhile, in the 2018 PISA (program for international student assessment) report on scientific literacy achievements, Indonesia was ranked 70th out of 78 countries (OECD, 2019).

Based on the results of interviews with biology teachers at SMA Negeri 1 Silat Hulu, it said that learning in class was carried out using media in the form of power points and pictures. Learning with these media has not optimized students' ability to master the learning material. Therefore, it is necessary to improve the learning process, one of which is by choosing learning media that can foster enthusiasm and make students think actively and creatively. Learning using the right media will provide optimal results for students' understanding of the material being studied, and is expected to improve students' higher-order thinking skills (Mardhinah, 2018: 50).

The cell is material that studies the chemical components that make up the cell, the structure and function of the cell parts, and the processes that take place in the cell as the smallest unit of life that cannot be observed directly. In cell biology material, students who usually only listen to explanations and only see pictures, by using animated videos can see how the structure of cells and the processes that occur in them with a more attractive appearance and look more real. Animation media can describe objects that cannot be seen by the eye, for example the structure of cell organelles. With animated videos, complex events that require detailed explanations can be conveyed clearly and easily understood. Examples of processes that occur in cells, such as metabolic processes and so forth. Also with animated videos, material that is difficult to explain verbally will be represented in a straightforward and easy to understand manner (Raida, 2018: 210).

One of the learning media that is considered appropriate to increase students' understanding of the material presented and to improve higher order thinking skills is to use animated video media. Animation is the most interesting form of pictorial presentation, in the form of a moving image simulation that describes the displacement or movement of an object. The advantage of animated video media is that it visualizes abstract concepts that cannot be directly observed by the sense of sight. Animation has the ability to be able to describe something complicated, complex and difficult to explain with just pictures or words. Animation can be used to explain a material that cannot be seen by the eye, by visualizing the material described can be described (Daryanto, 2010 : 53). Animation is one form of the most interesting pictorial presentations, which is a moving image simulation describe

displacement or movement an object. Use of in-progress animation learning is very helpful in increasing the effectiveness and efficiency of the teaching process, as well as increased learning outcomes. In addition, the use of learning media especially animation can increase power attractiveness, as well as student motivation in following learning process (Mayer & Moreno, 2018). Learning with multimedia more effective and efficient of learning conventional (Kadiyala & Cryners, 2019). The use of animated media in learning can reduce the learning process time and test results increase by 15% (Balazinski & Przybylo, 2020). The animation method is more effective than traditional teaching methods in improving student learning outcomes (Aksoy, 2020). Animation can increase student understanding when used consistently according to cognitive theory in multimedia learning (Mayer & Moreno, 2020).

The purpose of the study was to measure the effectiveness of animated videos on improving high-level thinking skills of students in class XI IPA at SMA Negeri 1 Silat Hulu. This research is expected to improve students' higher order thinking skills, especially in biology subjects at SMA N 1 Silat Hulu.

METHOD

This research used quasi-experimental method with nonequivalent control group design.

Table 1. Nonequivalent control group design

Class	Pretest	Treatment	Posttest
E	O_1	X_1	O_2
K	O_3	X_2	O_4

Information: O_1= Pretest of Experiment Group, O_2= Posttest of Experimental Group, O_3= Pretest of Control Group, O_4= Posttest of Control Group, X_1= Experimental class treatment, X_2= Control class treatment.

The research was conducted to determine the effectiveness of animated video media on students' higher order thinking skills. The method is to compare students' higher order thinking skills between the experimental group and the control group. In the experimental group, learning using video animation media. While in the control group, learning using power point media.

This research consisted of two independent variables and one dependent variable. The independent variables are animated videos and power points, and for the dependent variable is higher order thinking skills. The research was conducted at SMA Negeri 1 Silat Hulu in the odd semester of the 2020/2021 academic year. The population in this study included all

students of class XI IPA totaling 36 students. The sampling technique in this study used saturated sampling technic.

Data collection used test techniques and observation techniques. Measurements were carried out twice, pretest and posttest. Observations were carried out by the researcher asking the observer for help to fill out the observation sheet that contained the stages of learning implementation.

The data collection instrument is in the form of a test with a multiple-choice test instrument for measuring students' higher order thinking skills, and observation sheets to see the RPP has been designed. Before the test questions were used as data collection instruments, the test questions were first tested and analyzed by using product moment correlation for validity, reliability test, difference and difficulty level. Validity test results obtained 10 invalid questionnaires. For the reliability results, the reliability coefficient values for the pretest questions were 17.15 and 20.40 posttest with very high question criteria. While for the results of the level of difficulty of the questions obtained 3 questions that are classified as difficult.

The data analysis technique uses gain to determine the difference in students' higher order thinking skills and n-gain scores to calculate the effectiveness of learning media. Differences in students' higher order thinking skills were done by calculating the pretest and posttest gain values of the two groups. Then the prerequisite test is performed, normality and homogeneity tests, and hypothesis testing using independent sample t-test. Calculate the n-gain score to determine the effectiveness of the media calculated using the following equation:

Equation 2. Formula for N-Gain Score

$$<g> = \frac{Tf - Ti}{SI - Ti}$$

Information: <g> = Normalized gain, Tf= Posttest Score, Ti= Pretest score, SI= Ideal Score (maximum score)

The category of the size of the N-gain score can be seen in the following table:

Table 2. Classification of N-Gain score

N-Gain Value	Interpretation
0.7 <g<1	Height
0.3 ≤ g ≤ 0.7	Medium
0 <g< 0.3	Low

(Hake, 1999)

RESULT AND DISCUSSION

Based on the data collected, the research results have been recapitulated and then analyzed to determine the effectiveness of animated videos on high-level thinking skills of SMA Negeri 1 Silat Hulu students. Here are the results of the research data:

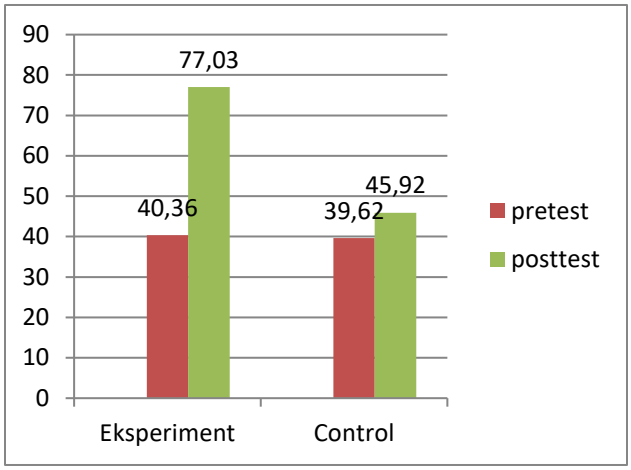

Figure 1. Bar chart of the average pretest and posttest of the experimental-control class

Based on Figure 1 above, it can be seen that the posttest mean for the experimental class is 77.03 and the posttest mean for the control class is 45.92. Meanwhile, the gain value for the experimental class is 36.66 and the gain value for the control class is 6.29.

Prerequisite Test

Normality test

The normality test aims to test whether the independent variable data has a normal distribution or not.

Table 3. Recapitulation of normality test results of gain values for experimental groups and control groups

Class	**Significance**	**Criteria significance**	**Description**
Eksperiment	0,427	0,05	Normal
Control	0,404	0,05	Normal

Based on table 3, the results of the normality test using the Shapiro Wilk method, it can be seen that the value of Sig. > = 0.05, then the data meet the assumption of normality. Thus, it can be stated that the data is normally distributed.

Homogeneity Test

The homogeneity test was used to determine whether the data obtained from the two groups had homogeneous variants or not. The homogeneity test was carried out using the homogeneity of variances test. The results of the homogeneity test can be seen in the following table:

Table 4. Results of homogeneity of gain values for experimental groups and control groups

	Significance	**Criteria significance**	**Description**
Based on mean	0,298	0,05	Homogen

Based on the table 4, the result of homogeneity is 0,289 > α=0,05, so it can be stated that the result data has the same variance (homogenous).

Hypothesis test

Test Independent Sample T-test

After knowing that the posttest data is normally distributed and homogeneous, a decision can be made to carry out a further test, namely the independent sample t-test. This follow-up test is useful to find out whether the data in the experimental class and the control class differ significantly or not. The basis of the independent sample t-test test is seen in the equal variance assumed. The results of the t-test can be seen in the following table.

Table 5. Recapitulation of T-test

	Sig. (2-tailed)	**Criteria significance**	**Description**
Equal variance assumed	0,000	0,05	significantly different

Based on table 5 recapitulation of the results of the t-test on equal variance assumed, the value of Sig. (2-tailed) of 0.000 < =0.05. These results indicate that there is a significant difference between the group of students who are taught using animated videos (class XI IPA 1) and the group of students who are taught using PPT media (grade XI IPA 2).

Test N-Gain Score

The effectiveness of using animated video media on higher order thinking skills was analyzed using the N-gain score test. The N-gain score is a data analysis test used to determine the difference between the average pretest and posttest for each experimental and control group.

After testing the N-gain score with the help of SPSS 26, the results of data analysis can be seen in the table below:

Table 6. Calculation results of N-gain score

Group	Score		Average	Category
	Pretest	Posttest		
Eksperiment	40.36	77.03	0,61	Medium
Control	39.62	45.92	0.07	Low

Based on table 6 the results of the N-gain score calculation above show that the average value for the experimental group (learning using animated video media) is 0.61 which is included in the medium category. Meanwhile, the average value of the control group (learning using ppt media) is 0.07 which is included in the low category.

Discussion

From the results of the data analysis above, it can be concluded that the students' higher order thinking skills in the experimental group were higher than the students' higher order thinking skills in the control group. It illustrates that the material presented clearly and close to reality can increase student understanding. Students more easily accept and understand the material presented. Easy-to-understand subject matter certainly provides better learning outcomes. Therefore, animated video media makes a positive contribution in improving students' higher-order thinking skills. The difference in the posttest average scores in the two groups shows that animated video media is more effective in increasing students' higher-order thinking skills. By using animated videos in learning process, it makes it easier for students to accept lessons that are abstract in nature.

The results of research conducted by Fauzi, *et al.,* (2014 : 63) stated that the increase in learning outcomes in posttest data and the average N-gain value in the experimental class using animation media was better than the learning process using handouts.

Furthermore, in the research conducted by A, Nurhayati. S. *et al* (2014: 9) stated that there was 8.25% difference in student learning outcomes for class XI between students who were taught using animated video media and students who were taught without using animated video media on chemical equilibrium material.

Based on the opinions of students in the experimental class, the use of animated video media in learning process makes it easy for students to accept or understand the material being taught, especially on abstract biological material, one of which is cell biology material. It is different with students in the control class who are taught using power point media which only displays an explanation of the material along with pictures, making it difficult for students to accept and understand the material presented.

The improvement of higher order thinking skills in the experimental class cannot be separated from explanations using animated video media which are more concrete and realistic than power point media. The more concrete and realistic the explanation of a learning media in a learning process, the more experience for students. The use of more concrete learning media will result in better higher order thinking skills. Animation media was more effective in improving student learning outcomes compared to image media. animated media accompanied by audio-visual will have an impact by providing a lot of motivation from the moving images and writing. Basically, interesting animated media will make it easier for students to understand learning material and have a positive impact on student learning outcomes (Susilo, 2021: 34).

Biology material is often seen by students as difficult material because it has complex concepts and problems that students must learn. In addition, many biological objects cannot be observed directly, are abstract, and often use Latin/foreign terms (Raida, 2018: 210). One of them is cell material. Cells are material that teaches about the chemical components that make up cells, the structure and function of cell parts, and the processes that take place in cells as the smallest unit of life that cannot be observed directly. In cell biology material, students who usually only listen to explanations and only see pictures, by using animated videos can see how the structure of cells and the processes that occur in them with a more attractive appearance and look more real. Animated media can describe objects that cannot be seen by the eye, for example the structure of cell organelles.

With animated videos, complex events and the need for detailed explanations can be delivered clearly and easily understood. For example the processes that occur in cells, such as metabolic processes and so on. With animated videos too, material that is difficult to explain verbally will be represented in a straightforward and easy-to-understand manner. Learning animation videos can be played at any time according to the students' wishes, even at home. As we know, the time allocation of students in school is less than outside of school. With animated videos, students can repeat subject matter that they do not understand.

Animation is the most interesting form of pictorial presentation, in the form of a moving image simulation that describes the displacement or movement of an object. Animated media is also equipped with audio so that it has a lively impression and forms the same character as the original. In addition to movement, objects can also experience changes in shape and color. The use of animated media in learning serves to attract students' attention to learning, so that it can provide a faster understanding. Lesson material that is easy to understand will certainly provide better learning outcomes. The use of animation media in learning activities is able to provide a stimulus to students to be more enthusiastic and motivated in learning and their attention is focused on the material described (Cahyani, 2020: 5).

In addition, animated media can make it easier for students to understand or study very broad subject matter, where in animated media contains various concepts, real facts and

certain principles related to the subject matter being taught. Animated media can increase the satisfaction and success of student learning in accordance with the expectations or wishes of the teacher. By using animated videos, the teacher does not spend extra energy in explaining the subject matter, so the teacher can focus more on helping students if there are students who have learning difficulties, building positive characters, and motivating students.

The use of animated videos can also improve student learning outcomes (Wardoyo, 2015: 6). Research conducted by Ridho, et al., (2017: 144) states that students who learn to use animation media have higher learning outcomes than students who learn to use torso and image media. Animated media can be developed by presenting the characters of historical figures or characteristics that will be discussed in the material. The presence of animated media in various learning materials will have an impact on the development of students' thinking.

Animated media accompanied by audio visuals will have an impact by providing a lot of motivation from the moving images and writings. Basically, attractive animated media will make it easier for students to understand learning materials and have a positive impact on student learning outcomes (Susilo & Widya, 2021: 34). Animated learning media describes moving objects to make them look alive. With the learning process using animated videos, students not only imagine, but students can see directly the concepts explained by the teacher. The use of animated videos in learning can help teachers explain the subject matter and is expected to make it easier for students to remember the material being taught, answer practice questions as a strengthening of understanding of the material and provide new experiences to make students motivated. So that students can develop higher order thinking skills.

The effectiveness of the use of animated media related to understanding the material can also be seen from the learning outcomes. The test results of the experimental class students on the indicator of analyzing questions (C4) which consisted of seven questions, it was found that 73% of students answered the questions with the correct answers. The evaluating indicator (C5) consists of five questions, where almost 99% of students are able to answer all four questions correctly. While on the creative indicator (C6) which consists of four questions, 99% of students answered 2 questions with correct answers, and 22% of students answered two questions correctly. The results of research conducted by Thahroni (2018:12) regarding the effect of audio-visual-based media on the achievement of higher order thinking skills (HOTS) in students, stated that audio-visual-based media were able to increase students' higher order thinking skills HOTS so that students had the ability to analyze, evaluate, and create.

Higher order thinking skills have a very important role in the realm of educational evaluation because they can affect students' ability, speed, and effectiveness in learning (Ramdiah et.al., 2019: 21). The application of higher order thinking skills in learning aims to minimize students in terms of remembering and understanding, but examining ideas and

materials critically. Higher order thinking skills are abilities in the 21st century, these abilities are (a) critical thinking and the skill of problem solving (critical thinking and problem solving), namely the skills of students who use their logical thinking skills in understanding the material and making or making choices as answers. or solutions to problems. That way students can independently solve problems. (b) Communication skills (communication), namely students' communication skills are required to be able to understand, manage, and create effective communication both orally, in writing and in multimedia. (c) Collaboration skills (collaboration), namely skills that teach students to use their ability to work together and their leadership abilities in groups, be able to adapt and carry out various roles and responsibilities, work that can produce, use empathy, respect opinions that differ from their thoughts. (d) Creativity and innovation skills, namely skills that help students to use their thinking abilities to come up with new and original ideas. When students are faced with problems, students are able to provide several ways or solutions to solve problems and create a product (Cahyawati, et al., 2020: 105).

However, the implementation of higher-order thinking-oriented learning in Indonesia has not been maximized and there are still many shortcomings, so that students' thinking skills are still at the lower level or Low Order Thinking Skill (LOTS). Based on the results of the Program for International Student Assessment (PISA) and Trends in International Match and Science Survey (TIMSS) surveys, since their participation in 1999, the ranking of Indonesian students has not been able to occupy the top position. These two surveys show that Indonesia is still at the LOTS level (Nugroho, 2018: 11). This situation is caused by several factors, including students who are not ready to take part in the learning process (Prasetyani, et al., 2016: 37). Students' low initiative in learning, less persistent when solving a problem, playing around in the learning process, and chatting about something that is not part of the learning process among friends (Mufit, 2020: 413).

The second factor is the influence of literacy culture carried out by students. Literacy culture is not only a culture of reading and writing, but also thinking skills through a source of information that can be in the form of auditory, printed, digital and visual. Information literacy is needed by students because information literacy is an expertise in tracking, knowing, assessing carefully and being able to manage it in the form of knowledge that is beneficial to oneself and the surrounding environment. According to Kurniawan & Maryani (2015: 213), the cause of students' thinking skills in the low category is also caused by environmental factors. Environmental factors from family and school significantly influence students' high-level skills. For example, a supportive environment can improve students' higher-order thinking skills. On the other hand, a less supportive environment can affect students' higher-order thinking skills to lower levels.

There are several factors that affect students' higher order thinking skills, namely (1) students are not ready to face the learning process, lack initiative and are persistent in solving problems. (2) many student activities in the learning process are playing around and chatting

outside of the discussion of learning. (3) student literacy culture, where literacy culture is not only reading and writing, but also the skills of searching, understanding, critically evaluating information. (4) school family environmental factors. As well as (5) from the students' point of view, they do not know the indicators of the skills that must be possessed. Meanwhile, from the teacher's perspective, the majority of teachers do not know how to create effective learning to achieve learning objectives by training students' higher-order thinking skills (Mufit, 2020).

CONCLUSION

Based on the results of research that has been carried out on "the effectiveness of animated videos on high-level thinking skills of SMA Negeri 1 Silat Hulu students", it can be concluded 1) There is a significant difference between the higher order thinking skills of students who are taught using animated video media and students who are taught using power point media, this is evidenced by the independent sample t-test test, which has a significance level of Sig. (2-tailed) of 0.000 < 0.05, and 2) animated video media is effective in improving students' higher order thinking skills, this can be seen from the results of the calculation of the *N-Gain Score,* obtained a value of 0.61> 0.3 with a moderate interpretation.

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