The Effect of Virtual Experiment Media in Direct Learning on Students' Cognitive Learning Outcomes on GLB-GLBB Material

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Abstract *- The use of appropriate media to facilitate student activities in learning physics is still very minimal at this time. This has an impact on the lack of enthusiasm of students in learning physics which will indirectly affect their learning outcomes. The integration of interactive multimedia in direct learning is an alternative solution in carrying out activities in physics learning. This quasi-experimental research aims to determine the effect of using interactive multimedia in direct learning on students' cognitive learning outcomes for GLB-GLBB material. The research design used was a pretest-posttest control group design with purposive sampling as sampling technique. The respondents for this research were 45 students of Class X MIA in one of the senior high schools in Sumbawa Regency, which were divided into 2 groups, experimental and control. Data analysis used the ANOVA test to determine the significance of the difference in the mean of the two groups. The question instrument used to collect data on students' cognitive learning outcomes is in the form of descriptions with a total of 5 items. The ANOVA test results obtained a significance of 0.175, where the significance value is greater than 0.05. Based on these results, it can be concluded that the use of interactive multimedia that is integrated in direct learning does not significantly affect students' cognitive learning outcomes for GLB-GLBB material.*

Keywords*: Media; virtual experiments; hands-on learning; cognitive learning outcomes; GLB-GLBB.*

INTRODUCTION

The development of information technology (IT) provides an opportunity to build and conduct practicums or experiments in virtual form, in order to overcome the limitations of real laboratory facilities. Virtual experiments are experiments that use learning simulations (software) and computers to perform important experimental functions like experiments in general (actual experiments) (Zaus & Krismadinata, 2018).

Some of the benefits of using virtual experiments in physics learning are: First, it makes it easier for students to collect information and for teachers to communicate contextual problems to students. Second, you can build students' confidence, skills and knowledge to solve problems and become independent thinkers and learners. Third, it is an informative mental model that looks visually and dynamically, which makes it easier for students to understand concepts, especially concepts (Abdjul, 2019).

Nowadays, virtual media is used in physics learning to make the teaching and learning process more interactive. This media is an alternative solution to overcoming the limitations or absence of laboratory equipment and to increasing students' interest in physics. These can be done through a functional multimedia laboratory (practicum place) that is able to facilitate practicum activities with Information and Communications Technology (ICT). The activities in question are activities that cannot be facilitated by a conventional laboratory, but can be facilitated by a multimedia laboratory and computer simulation (virtual laboratory) (Rasyidah et al., 2018). By using a virtual laboratory, students can freely explore their knowledge by replacing various parameters in the simulation practice and hence, the

analysis can be conducted without having to use dangerous and expensive teaching props (Maryani, 2010).

Practicum activities can actively involve the students in the learning process and develop students' scientific attitudes in the matter of cognitive, emotional and psychomotor aspects. In addition, by applying practice method, it is possible to improve students' understanding and problem-solving abilities. Moreover, the material can be associated with students' lives through experiments, so that the basic concepts that the students understand are not easily lost (Martanti et al., 2021).

By using a virtual laboratory, students are free to explore knowledge by replacing different parameters that are included in the simulation practice. Therefore, you can obtain the analysis without using dangerous and expensive props (Rasyidah et al., 2018).

The results of Yuliani et al.'s research (2017) found that poor physics learning outcomes are influenced by many factors, one of which is the selection of learning strategies. In addition, the low student learning outcome score is reflected in students' activity, whereby the students are less active in participating in the teaching and learning activities, especially in Physics subjects. Students feel less motivated during educational and learning activities. This problem is expected to be solved by using or utilizing virtual media in conducting experiments in physics learning.

RESEARCH METHODS

This study aims to examine the effect of the use of interactive multimedia that is integrated in direct learning on students' cognitive learning outcomes for Uniform Motion (hereinafter GLB) and Uniform Accelerated Motion (hereinafter GLBB) material. This research is quasi-experimental research with a pretest-posttest control group research design. The research was conducted in one of the senior high schools (hereinafter SMAN) in Sumbawa Regency. The SMAN was chosen as research site because based on initial observations, said SMAN experienced some of the obstacles mentioned in the introduction. The population of the study was all students of Class X MIA (Math and Natural Science) at the SMAN totaling 45 students. The sampling technique used a saturated sample whereby all X MIA students were sampled. The sample was divided into 2 groups, namely X MIA 1 totaling 23 students who were used as the control group and X MIA 2 totaling 22 students as the experimental group. The two groups were given different treatment in terms of learning media provision. The control group was given direct learning treatment combined with the use of simple learning media available at the research site and the experimental group was treated with direct learning combined with virtual experiment media. Data collection used test technique in the form of 5 (five) long answer questions given at the pretest and posttest. The test is used to measure students' cognitive learning outcomes. To determine the average increase from pretest to posttest, students' cognitive physics learning outcomes were calculated using N-Gain analysis. The ANOVA test was used to test the difference in students' cognitive learning outcome average.

RESULTS AND DISCUSSION

The pre-test was given before treatment using interactive multimedia in direct learning was given. Post-test was conducted after the treatment was given. The treatment given to the experimental group was virtual experiment media in direct learning and in the control group, direct learning was applied with the help of conventional media such as simple teaching props that haven't been perfected. In general, the recapitulation of the results of the pre-test and post-test data calculations for the two groups can be seen in Figure 1.

From Figure 1, one can notice that the average pre-test score of the experimental

group students was 0.20 higher than the control group. The average post-test score of the experimental group was 7.50 higher than the control group. The average N-gain score of the experimental group was 8.30 higher than the control group. These data indicate that the use of virtual experiment media in direct learning can improve students' cognitive learning outcomes better than direct learning with conventional media. These results are in line with the research of Yahya et al (2019), Hermansyah et al (2019), & Yulianci et al (2017) which stated that the use of virtual media in physics experiments can improve students' understanding of concepts which is the result of their cognitive learning.

The increase in cognitive learning outcomes of the experimental group was higher than those of the control group because the virtual media used contained animations that were displayed and Husein et al (2017) stated that interactive simulations contained in virtual media were able to train students' logical thinking in solving physics problems related to the concepts learned.

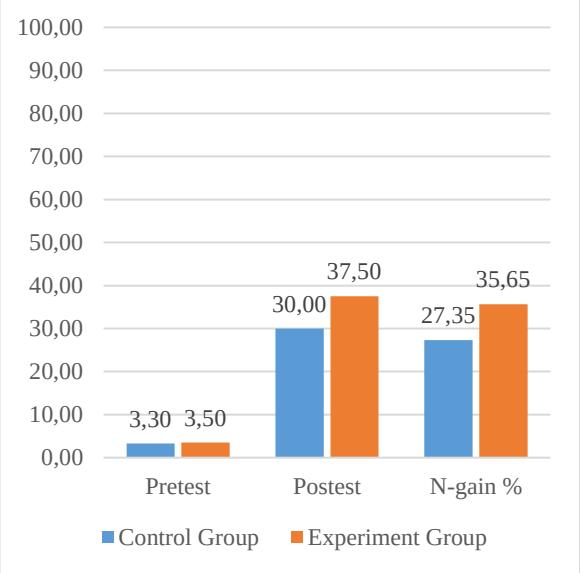

Figure 1. Comparison of the Students' Cognitive Learning Outcome Average Score and N-Gain score

Table 1. Test of Homogeneity

Levene Statistic	df1	df2	Sig.
15.740	1	43	.000

To discover the difference in the data average, hypothesis testing was conducted using ANOVA test. Prior to the test, a prerequisite test was first conducted by testing the homogeneity and normality of the data as seen in Table 1 and Table 2. The results of the two tests showed that the two groups were not homogeneous because the calculated significance value was less than 0.05 and the data were normally distributed because the calculated significance value is greater than 0.05. From the two tests, it could be determined that the test used to test the data hypothesis is parametric test with ANOVA test.

Table 2. Test of Data Normality

Cognitive Learning Outcome		
Most Extreme Differences	Absolute	.318
	Positive	.318
	Negative	-.184
Kolmogorov-Smirnov Z		1.067
Asymp. Sig. (2-tailed)		.205
a. Grouping Variable: Group		

Table 3. Hypothesis

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	774.969	1	774.969	1.906	.175
Within Groups	17485.737	43	406.645		
Total	18260.706	44			

Based on the results of hypothesis testing as shown in Table 3, the groups' mean difference test is not significant because the data's statistical significance value of 0.175 is greater than 0.05. The test results show that the use of virtual experiment media in direct learning has no effect on the cognitive learning outcomes of Class X MIA students.

Based on the results of the pre-test and post test data analysis, there are some things that are quite interesting, that is: in Figure 1, the experimental group has a higher increase in cognitive learning outcomes than the

control group, but in Table 3, hypothesis testing discovered that the use of virtual experiment media has no effect on students' cognitive learning outcomes on GLB-GLBB material. This result is not in line with the research conducted by Hermansyah et al (2017) & Hermansyah et al (2021) in which the use of virtual media in the conduct of physics experiments can affect students' mastery of physics concepts.

The questions used in the implementation of this research are categorized as quite complicated. Hence, the students find it difficult to answer the questions posed. The problem which occurred is that students experienced difficulty in solving the questions because students are confused about starting calculations or the solving (of the problem). Students tend to think that the equations used in solving problems are equations or formulas that were recently taught. They are not used to recalling equations or formulas that they learned a long time ago, so they have difficulty finding the quantities whose value is unknown (Afryanto, 2021). This results in students not being able to work on the questions given.

There are several other things which can also affect student learning outcomes, such as motivation, learning opportunities, and a learning that is student-centered in nature. In line with this statement, Zubaidah (2016) states that learning outcomes can be influenced by many things, including motivation, infrastructure, cooperation & communication, learning models, learning opportunities, and innovation in learning.

The use of virtual experiment media in physics learning on GLB-GLBB material combined with direct learning has no effect on learning outcomes and only affects students' learning motivation. Different research results are shown by Sarini (2015), who states that the use of virtual experiment media is able to influence student learning outcomes and motivation. The use of this media has no effect on cognitive learning outcomes because the number of lesson hours for each meeting is so insufficient that discussions or interactions with students are still lacking. Contrary to this research, Raupu (2018) states that lesson hours greatly affect student learning outcomes. This research was conducted during the Covid-19 pandemic when the number of lesson hours per meeting was reduced from usual.

In addition to these problems, the absence of devices such as students' smartphones becomes an obstacle for them in studying or using virtual experiment media for independent study at home or anywhere. Students only conduct lessons at school using the computers in the multimedia laboratory provided, and in such a short time due to conditions. Today's smartphone is no longer used as merely a means of communication, but has also functioned as a medium to obtain information in the form of audio, visual, video, or multimedia. Android-based learning media which are accessed through smartphones are found anywhere nowadays (Ismanto et al., 2017).

CONCLUSION

Increase in students' cognitive learning outcomes occurred in both research group and the experimental group experienced a higher increase. Based on the results of the study, it can be concluded that the use of virtual experiment media in direct learning has no significant effect on improving students' cognitive physics learning outcomes, especially on GLB-GLBB material. The limitation of this study is that the research sample is not equipped with devices such as smartphones that can be used to conduct independent learning at home or anywhere as the purpose of using virtual

media in physics learning is as an alternative solution to the limitations of real media.

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