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THE EFFECT OF LEARNING MODELS DISCOVERY HELPFUL LAB VIRTUAL AGAINST THE ABILITY TO UNDERSTAND PHYSICS CONCEPTS

Joel Pebrian Sihombing[1], Juniar Hutahaean[2]
[1,2] Universitas Negeri Medan, Medan, Indonesia
Email: Jsihombing635@gmail.com

Abstract

This study aims to (1) determine student activity during the learning process using the Virtual Lab-assisted Discovery learning model on the subject matter of work and energy, (2) determine the effect of the Virtual Lab-assisted Discovery learning model on students' ability to understand physics concepts on the subject matter of effort and energy in class X semester II SMA Sw. Dharma Bhakti Siborongborong Academic Year 2022/2023. This type of research is quasi-experimental. The population in this study were all students of class X SMA Sw. Dharma Bhakti Siborongborong in even semester T.A. 2022/2023. The sample for this research was taken from two classes, namely class X IPA 1 (as the experimental class) and class X IPA 2 (as the control class), each of which consisted of 22 students and 20 students who were determined by the Cluster Random Sampling technique. Then given a different treatment, the experimental class used the Discovery Learning model assisted by the Virtual Lab and the control class with conventional learning. The data used in this study used a description test, the number of questions was 21 items which had been validated by the validator. From the research results, it was obtained that the average pretest value for the experimental class was 45.54, and for the control class was 43.81. After learning was completed, the posttest was given with the average result for the experimental class being 78.14 and the control class being 72.62. The data analysis technique used is the t-test after the data is normally distributed and homogeneous. Based on data analysis and hypothesis testing, it was found that there was a significant influence of the Virtual Lab-assisted Discovery learning model on students' ability to understand physics concepts on the subject matter of work and energy.

Keywords: Discovery Learning, Virtual Laboratory, Mastery of Concepts

Education is a conscious effort carried out by families, communities, and the government through guidance, teaching, and training activities that take place at school and outside of school to prepare students to play roles in various living environments permanently for the future. One of these conscious efforts is the existence of quality education. The quality of education is one of the solutions to increase the dignity of the Indonesian people. One indicator of the quality of education is determined by the quality of the teacher (Muzhoffar, A., 2003: 36). If teachers are always creative in improving the quality of their learning, it will also give birth to quality children of the nation. Based on this opinion, the teacher's ability to improve the quality of learning is intended to direct changes in students in a planned manner in the aspects of knowledge, skills, and attitudes. And also the teacher must be able to create learning that can stimulate students to learn actively as needed.

Using the right learning model can create interesting teaching and learning activities so that the material delivered by the teacher is easily understood by students. The use of learning models

must be following the conditions and developmental levels of students. The implementation of Physics learning should be done with various simulations so that students will easily understand the material and optimal learning results can be achieved.

Based on the results of observations made by researchers at SMA Sw. Dharma Bhakti Siborongborong, by distributing a questionnaire to class X-IPA students on January 6, 2022, only 31.6% liked physics and thought that physics was fun, other than that as many as 65% were mediocre and thought physics was a difficult subject to understand, less interesting, lots of formulas, and there were only 3.4% of students who did not like physics and even thought that physics was a boring subject. The results of the questionnaire also showed that teaching and learning activities in the classroom were still teacher-centered. The teacher only explains on the blackboard, and students record material and work on problems. In learning, learning media is rarely used and the use of laboratory equipment is less than optimal in schools.

In addition to distributing questionnaires, the authors also interviewed physics teachers at SMA Sw. Dharma Bhakti Siborongborong, namely Mrs. R. Nababan, S.Pd, by reviewing the learning process in one of the X-MIPA classes, information was obtained that when learning took place students' interest and level of understanding of the material was only 25% of students were able to quickly understand the concepts of Physics material, other than as many as 70% of students can understand the concept of Physics but in the teaching process which is repeated and there are 5% of students who find it difficult to understand the concept of Physics material. This is because the use of less varied learning models, and the use of practicum and media which is very rare results in students being less active in learning physics.

Efforts to overcome these problems require an innovative student-centered learning model that involves the active role of students and can provide opportunities to build knowledge in their minds. One of them is by applying a constructivism-based learning model, namely the model discovery learning. Learning discovery is discovery-based learning. Learning discovery is a series of learning activities in which the teacher presents teaching materials not in the final form, but provides opportunities to seek and find the concepts of the material being studied. Through this learning, students can learn more independently and construct knowledge obtained from the results of thinking and are trained in solving the problems they face (Sari et al: 2016).

The application of the Discovery learning model can be more effective by using media in its learning activities. Teachers who are effective in using media can increase students' interest in the teaching and learning process and students will more quickly and easily understand and understand

the subject matter delivered by the teacher (Sabri, 2010). The media used is a simulation virtual namely Physics Education Technology (PhET) simulation. According to Mubarrok (2014), laboratory virtual is a set of software that provides facilities and infrastructure to carry out experimental activities consisting of simulations, animations, and videos and provides experimental tools. Through this media, we can carry out experimental activities without the need for real laboratory equipment.

Model Discovery Learning has been researched before by Adelia Kartika concluded that through the learning model Discovery Learning using Macro Flash Media the physics learning outcomes increased where for the experimental class with an average score of 36.1 higher than the conventional class with an average score of 26 (Kartika, 17). This phenomenon is in line with the findings obtained from Sari's research, namely application discovery learning laboratory assistance virtual effect on students' mastery of physics concepts (Sari, et al, 2016). This is indicated by an increase in the average value of mastery of the concept of students who are taught with discovery learning laboratory assistance virtual higher than students taught using conventional learning (Sari, et al., 2016). Researcher Putrayasa, et al also proved that the application of the model Discovery Learning can improve students' understanding of science concepts and learning outcomes (Putrayasa, et al., 2014). The difference between this study and the previous research is the material, the characteristics of the students, and the place of research, namely the material to be used in effort and energy, and the characteristics of the students, where the characteristics of each student are different, while the research location will be held in class X-MIPA SMA Sw. Dharma Bhakti Siborongborong.

This study aims to determine the effect of the learning model Discovery Help Lab Virtual on students' understanding of physics concepts on the subject matter of work and energy in class X semester II SMA Sw. Dharma Bhakti Siborongborong T.A. 2022/2023. Using the right learning model can create interesting teaching and learning activities so that the material delivered by the teacher is easily understood by students. The use of learning models must be following the conditions and developmental levels of students. The implementation of Physics learning should be done with various simulations so that students will easily understand the material and optimal learning results can be achieved.

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Efforts to overcome these problems require an innovative student-centered learning model that involves the active role of students and can provide opportunities to build knowledge in their minds. One of them is by applying a constructivism-based learning model, namely the model *discovery learning*. Learning d*iscovery* is discovery-based learning. Learning *discovery* is a series of learning activities in which the teacher presents teaching materials not in the final form, but provides opportunities to seek and find the concepts of the material being studied. Through this learning, students can learn more independently and construct knowledge obtained from the results of thinking and are trained in solving the problems they face (Sari et al: 2016).

The application of the Discovery learning model can be more effective by using media in its learning activities. Teachers who are effective in using media can increase students' interest in the teaching and learning process and students will more quickly and easily understand and understand the subject matter delivered by the teacher (Sabri, 2010). The media used is a simulation *virtual* namely Physics Education Technology (PhET) simulation. According to Mubarrok (2014), laboratory *virtual* is a set of *software* that provides facilities and infrastructure to carry out experimental activities consisting of simulations, animations, and videos and provides experimental tools. Through this media, we can carry out experimental activities without the need for real laboratory equipment.

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This study aims to determine the effect of the learning model *Discovery* Help *Lab Virtual* on students' understanding of physics concepts on the subject matter of work and energy in class X semester II SMA Sw. Dharma Bhakti Siborongborong T.A. 2022/2023.

RESEARCH METHODS

This research was conducted at SMA Sw. Dharma Bhakti Siborongborong in semester II T.A. 2022/2023. Class sampling technique randomly (Cluster Random Sampling), a sample of 2 classes. One class is used as an experimental class, namely a class that applies a learning model Discovery Help Lab Virtual, and one more class is used as a control class, a class that applies conventional learning. The design of this research can be seen in Table 1.

Table 1. Two Group pretest and posttest design

Group	Pre-test	Treatment	Post-test
Experiment	T1	X	T2
Control	T1	AND	T2

Information :

T1 = Pretest given to experimental class and control class

T2 = Posttest is given to the experimental class and the control class

X = Learning with a learning model Discovery help Lab Virtual

Y = Learning using conventional learning methods

Researchers will provide Pre-test to the experimental class and control class. After the pretest data was obtained, data analysis was carried out using the t-test to determine the student's initial abilities in the two sample groups, in this case, the initial ability to the knowledge of physics concepts in the two samples must be the same. Furthermore, the researcher taught the subject matter by using a learning model Discovery help Lab Virtual in the experimental class and conventional learning in the control class. Researchers will give a posttest to the experimental class and control class. After the data was obtained, a t-test was carried out to determine the effect of the learning model treatment Discovery help Lab Virtual on students' understanding of physics concepts. Statistical analysis shows that students' ability to understand physics concepts in the experimental class is better than students' understanding of physics concepts in the control class, so it can be said to be a learning model Discovery help Lab Virtual can affect the ability to understand students' physics concepts.

The Lilliefors test is used to find out data on sample populations that are theoretically infinite, and normally distributed. The homogeneity test is used to determine whether the theoretically infinite sample population data comes from a homogeneous population. The homogeneity test uses the variance similarity test (Sudjana, 2005: 249).

RESULT AND DISCUSSION

Research result

The research conducted is research like an experiment, which involved two classes that were given different learning models, namely class X IPA1 with a total of 22 students as an experimental class taught using a learning model Discovery Help Lab Virtual and class X IPA2 with a total of 20 students as a control class taught using conventional learning.

The initial test (pretest) was tested on each class before applying different learning with a total of 21 items in the form of a description test (Essay Test) in both sample classes to determine students' initial abilities towards students' ability to understand physics concepts on the subject matter of work and energy. The average result of the pretest score of the experimental class students was 45.45 while for the group of students who were selected in the control class, the pretest average was 43.81. After being given treatment, the average posttest score for the experimental class was 78.14 while the posttest average score for the control class was 72.62.

Based on the results of the normality test and the results of the data homogeneity test, it was found that the two samples were normally distributed and had a homogeneous variance. The data

for the two samples were declared normal and homogeneous so that it was feasible to test the hypothesis and the results are shown in Table 2 and Table 3.

Table 2 Initial Ability Hypothesis Test

Class	Rate-rate	T_{count}	T_{table}	Conclusion
Experiment	45,45	0,88	2,02	H_0 accepted
Control	43,81			

Based on Table 2 above, the calculation of the average pretest value of the experimental class and control class, obtained t-count = 0,88< t-table = 2,02 eyes H0 accepted and Ha rejected. So it was concluded that the initial abilities of the experimental class students were the same as the initial abilities of the control students.

Table 3 Calculation of Hypothesis Test (Pos-test) Student

Class	Rate-Rata	T_{count}	T_{table}	Conclusion
Experiment	77,6	2,44	1,66	There is a significant difference
Control	71,46			

Based on data from the post-test results of the experimental class and control class, the value of t is obtained count = 2.44 and t-table = 1,66. Nilai t-count > t-table or 2.44 > 1.66 then H0 rejected and Ha accepted so that there is the influence of the learning model Discovery help Lab Virtual on the ability to understand students' physics concepts on work and energy material in the second-semester class of SMA Sw. Dharma Bhakti Siborongborong T.A. 2022/2023.

Discussion

Based on the data from the research results that there is a significant influence on the learning model Discovery helps Lab Virtual students understand physics concepts in the matter of work and energy.

From hypothesis testing, model application discovery learning helps Lab Virtual affect students' understanding of physics concepts. Evidenced by the learning outcomes of students in the experimental class increased better than the control class, where previously a pretest was carried out in both classes to find out whether the two classes had the same ability before treatment. From the test data, it was obtained that the experimental class pretest value was 45.45 and the control class pretest value was 43.81 with t-count<t-table (0.889 <2.02) at the intensity level $\alpha = 0.05$. Next,

a posttest was carried out in class to find out whether there was a significant effect on students' abilities after treatment. From the test data, the experimental class posttest value was 78.13 and the control class posttest value was 72.61 with t-count>t-table (1.905 > 1.684) at the intensity level α = 0.05. This is because, in the experimental class, students learn to prove and find relationships between concepts and physics equations through experiments, discussions, and questions and answers so that students better remember and understand the concepts being studied. Strengthened by the results of research conducted by Putrayasa: 2014) discovery learning allows students to better understand the subject matter through the process of observing, asking, trying, associating, and communicating the material being studied during the process. In addition, (Sihombing: 2015), (Sari: 2016), and (Sari: 2017) also state that by discovery learning, students learn to solve problems, learn by doing so that the learning process is more effective and makes students better remember what they have learned. So it was concluded that for the learning process to prove and find relationships between concepts and physics equations, models can be used in discovery learning.

From using Lab Virtual in the experimental class, students became motivated and interested in learning. Students were initially ignorant and not enthusiastic about participating in learning but after the simulation Lab Virtual displayed, students show their curiosity by asking questions and formulating hypotheses about the phenomena contained in Lab Virtual. (Wardhani et al, 2014) explained that the spurred curiosity of students causes students to be more eager to learn and know their knowledge. Evidenced by the results of observations obtained an increase in student learning activity each meeting on the aspect of asking and expressing opinions (Appendix 25). This is because when learning with lectures students only hear theory so they are bored and not interested in later using Lab Virtual which displays real phenomena in the form of a simulation makes students no longer just hear and imagine but can see how the theory is applied so that students more easily understand the subject matter. This statement is in line with the results of research (Derlina: 2015) and (Syaifulloh: 2014) using simulation media Lab Virtual makes learning easy to understand because Lab Virtual makes abstract learning look more concrete. (Sari: 2016), (Marlinda et al, 2016) Simulation Lab Virtual presents pictures or interactive images that are made like a game to create an interesting learning atmosphere and can increase students' learning motivation. So it was concluded that learning is more interesting and can generate curiosity in students who can use simulation media Lab Virtual.

On learning discovery, students are involved in groups to do practicum and prove the truth of the hypothesis. During practicum students first assemble the tool with a group of friends

according to the instructions in the LKPD. (Fitriani et al, 2016) explains that this LKPD can assist students in carrying out practicum activities to prove hypotheses. In the first meeting, the value of student activity at this stage is still low because they are not familiar with practicum so students do not understand what to do, so the researcher needs guidance so that there are no mistakes in assembling the experiment. And for the next meeting students' understanding of assembling tools and materials, following student worksheets to conduct experiments is better so that the activity value increases as evidenced by the results of observing learning activities in the experimental class. After completing data collection, students hold discussions about the results of the practicum. By collaborating and discussing, students are required to provide input to other students so that students who have low abilities are more motivated in learning material that is poorly understood. The result is that students' cognitive abilities get better because students are directly involved in the process of finding. (Makmur: 2016) explains that with group discussions students share information, and learn a symptom so that they better remember what was discussed rather than receiving explanations from the teacher. (Salwan & Rahmatan, 2017) the use of discovery learning-based LKPD makes it easier for students to understand the material than using the lecture method. That discovery-based LKPD can improve student learning outcomes in science material.

Stages 5 and 6 are students doing proof and drawing conclusions from the results of the experiment. This activity increases students' self-confidence because they are trained to present their results in front of the class. In addition, students' critical thinking skills arise because of the interaction of mutual questions and answers, refuting and comparing results between groups of students so that students gain a better understanding of the concepts being studied. By what was conveyed by Slameto (2010) that studying together with other students increases knowledge and sharpness of thinking. This is also evidenced by the results of activity observations obtained, there was an increase from meeting I to III in the aspect of concluding. At the first meeting, the activity results were still low because some students were still shy about presenting so only smart students were involved. However, with the encouragement given by the researcher and seeing the activeness of other students, passive and shy students became more confident so in the second and third meetings, students competed to present the results of the experiment. In addition, the conclusions obtained were also as expected.

Based on the description above, it can be concluded that the application of the discovery learning model assisted Lab Virtual can improve learning outcomes and student's understanding of physics concepts. This is following the results of previous studies (Sari: 2016), (Sri: 2012), explaining

the use of the model discovery learning helped Lab Virtual can improve learning outcomes and student activity in his research obtained an average learning outcome using conventional learning is 62.40 whereas applying the discovery Learning assisted virtual laboratory average learning outcomes is 75.05 means there is a significant difference due to the influence of the application of the learning model discovery learning. That the physics learning achievement of the group of students who studied through discovery learning helped Lab Virtual higher than the group of students who studied through discovery learning. (Devi: 2016), (Rizal: 2014) The application of learning with the discovery learning model with the PhET virtual lab can be implemented well and there is an increase in better learning outcomes, activities in the learning process are more active seen from an increase in the average value of activity by 85,42%.

However, in carrying out this research there were several obstacles that the researchers experienced, such as the implementation of the practicum in non-laboratory classes while the classrooms were small so that the preparation of group tables sometimes required quite a long time. To overcome this for future researchers, if learning there is a practicum implementation, it is better if the observation is confirmed to the school that the laboratory is in good condition and can be used for practicum. Another obstacle is that Lab Virtual is still quite foreign to students, some students are confused by the media presented because the teacher has never used Lab Virtual. For this reason, if the next researcher experiences the same problems, it is better if every implementation of learning for learning media is better to explain in advance the simulation that will be displayed in Lab Virtual, such as how to change the angle of the inclined plane, determine the amount of mass used in the media so that students understand what is seen in the simulation Lab Virtual and can relate it to the topic being studied and researchers should be able to use their time properly according to class hours so that each phase in the model can be carried out optimally.

Thus based on the results of research conducted at SMA Sw. Dharma Bhakti Siborongborong on Business and Energy material in class X even semester TA 2022/2023 it is proven that learning using the discovery learning model help Lab Virtual influence on student physics learning outcomes.

CONCLUSION

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