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The Influence of Applying the Guided Inquiry Learning Model Assisted by the Olabs Website on the Physics Learning Outcomes of High School Students

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Abstract
Learning in the 21st century demands a change in the way of learning which used to only on the teacher centered learning, to become student centered learning. One of the innovative learning models suitable for training student learning independence is guided inquiry learning. The use of a virtual laboratory is very supportive if the facilities for carrying out practicums are lacking, and can save time. One of the virtual laboratories that can be accessed for free and is easily accessible, namely the Olabs website. The purpose of this study was to determine the effect of applying the guided inquiry learning model assisted by the Olabs website on physics learning outcomes for high school students. This type of research is true experiment and Research design pretest-posttest control group design. The data analysis technique used in this research is by conducting a prerequisite test (homogeneity and normality test), hypothesis testing (t-test). Based on the results obtained, the application of the guided inquiry learning model assisted by the Olabs website can have an impact on improving physics learning outcomes. This is evident from the results of the t-test sig. (2-tailed) 0,001 ≤ 0,05, H_0 is accepted and Ha is rejected or it can be said that there is a significant effect of the guided inquiry learning model assisted by the Olabs website on physics learning outcomes for high school students.

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1. Introduction

In the 21st century, the education system is required to always be more advanced and can be easily accessed by various groups. One of them is the emergence of the term "Industrial Revolution 4.0" or in this era, all systems are digital-based. Learning in the 21st century demands a change in the learning process, which previously teacher centered, to be more student centered [1]. Students are not only told to pay attention and memorize the material but are also required to be able to structure their knowledge and skills according to their qualifications. It aims to make students become interactive and involved in the learning process. Readiness to learn and student learning motivation are included in one of the factors that can influence student activity in the learning process, in other words, that activity has an impact on student learning outcomes [2].

Students are no longer required to only listen and memorize the material, but students are required to be able to structure knowledge and skills according to the qualifications of each student. In addition, the contribution of students in solving problems that occur in everyday life [3]. Low student learning outcomes can be seen when receiving material. This is shown when students work on questions, most of them are still waiting for answers from the teacher, so students are less able to ask questions and express opinions [4]. The presentation of material that is less interesting in learning activities such as, the lack of examples that can be applied in real life, and most students are more passive in learning. This causes student learning motivation to decrease so that the learning results obtained are less than optimal [5].

One of the innovative learning models that is suitable for training student learning independence and creating a new learning atmosphere, and can improve student learning achievement is the guided inquiry learning model. The inquiry learning model was originally created by Richard Suchman in 1962 [6]. The word inquiry comes from the English "Inquiry" which means question, examination, or investigation. Inquiry is a general process that will be carried out by humans to find and investigate information [7]. Through the guided inquiry learning model students can plan, observe, analyze, and conclude the results of practicum. As well as provides a more meaningful learning experience if students discover the concept themselves [8][9]10]. Practicum activities can be done in real or virtual, but with the development of technology, there are many virtual laboratory media that can be used easily and cost-effectively when compared to doing practicum in a real laboratory.

One of the virtual laboratories that can be accessed for free and are easily accessible, namely the Olabs website. Online Labs (Olabs) is a virtual laboratory software that has been developed and equipped with several experimental simulations in the field of science. Olabs can be accessed using a laptop or Android for free [11]. Olabs features consist of: a) theory, containing material and brief explanations; b) procedures, containing the purpose of practicum implementation, tools and materials, practicum procedures; c) animation, containing practicum demonstration videos; d) simulators, features for conducting practicum virtually; e) video, containing demonstrations; f) viva voce, contains a collection of several questions; g) resources, containing reference sources; h) feedback, containing questions related to Olabs [12]. Olabs was developed using sophisticated simulation technology to create a laboratory environment similar to a real laboratory [13]. The content of the experiment on the Olabs website has been aligned with the NCERT/CBSE syllabus and *State Board* [14].

The advantages of Olabs can be accessed online or offline, reducing time constraints, because Olabs can be accessed at any time without being limited by time. Whereas Olabs' weakness is limited knowledge about procedures for carrying out online practicum activities, the simulations contained in Olabs are still limited [15]. The use of guided inquiry models assisted by virtual laboratories has a significant impact on increasing physics learning outcomes [16]. Virtual laboratory media (Olabs) also has a positive effect in that the development of teaching materials with the help of Olabs is feasible and quite effective in improving students' abilities in sound wave material [11]. The Olabs virtual laboratory-based Activity Based Learning (ABL) model helps students understand and remember concepts better [14]. Olabs-assisted online learning is effective in measuring science process skills [17]. Based on the problems described above and several relevant studies. This study aims to determine the effect of applying the guided inquiry learning model assisted by the Olabs website on physics learning outcomes for high school students

2. Methods

This study aims to see an increase in physics learning outcomes for high school students by using a true experiment research type and a pretest-posttest control group research design, two groups or classes selected randomly. One class was used as the experimental class and the other class as the control class [18]. The pretest-posttest control group design can be seen in Figure 1.

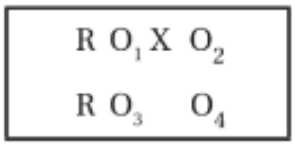

Figure 1. Prettest-Posttest Control Group Design

Information: R = random, O_1= *pretest* in control class, O_2= *posttest* in experiment class, O_3= *pretest* in control class, O_4= *posttest* in experiment class, X = treatment (applying of the guided inquiry model assisted by the Olabs website)

The research population was class XI MIPA and the research sample was class XI MIPA 1 as the experimental class and class XI MIPA 2 as the control class. To achieve this goal, 62 students from both classes were given a pre-test and post-test with 5 multiple-choice questions and 2 essay questions according to indicators. The learning outcomes indicators used in this study are applied) C3, (analyzing) C4, (evaluating) C5 and (creating) C6. The selection of these indicators is based on the objectives of learning using the guided inquiry model, namely, students can analyze a problem and find or understand the theory.

Data collection techniques in this study were 1) a homogeneity test to determine the research sample using cluster random sampling technique if the 3rd-semester student learning outcomes were homogeneous, 2) a normality test was carried out for pre-test and post-test results data, and 3) Independent Sample test T-test to find out the significant difference in scores from the pre-test post-test of the experimental class and the control class.

3. Results and Discussion

The results showed that the experimental class students were quite active in developing the ability to think systematically, logically, and critically to find a concept. The learning outcomes in this study focused more on cognitive aspects, namely C3 (applying), C4 (analyzing), C5 (evaluating), and C6 (creating). The results of the students' pre-test and post-test scores can be seen in Table 1.

Table 1 shows the descriptive statistics of the pre-test and post-test scores. The results showed that the students' physics learning outcomes in the experimental class experienced a significant increase compared to the control class. This can be seen from the average pre-test score of the control class of 22.61 and the post-test score of 67.09. While the average pre-test score of the experimental class was 12.22 and the post-test score was 80.32. The average score of the pre-test for both classes is still much below completeness, because the score was obtained before the treatment. Comparison of the average pre-test post-test scores for the experimental and control classes can be seen in Figure 2 below.

Table 1. Descriptive Statistics of Scores Pre-Test and Post-Test

	Experiment Class		Control Class	
	Pre-test	**Post-test**	**Pre-test**	**Post-test**
Minimum	4,00	59,00	6,00	29,00
Maximum	27,00	100,00	48,00	95,00
Mean	12,2258	80,3226	22,6129	67,0968
Std. Deviansi	5,97054	11,75411	11,70948	19,80631

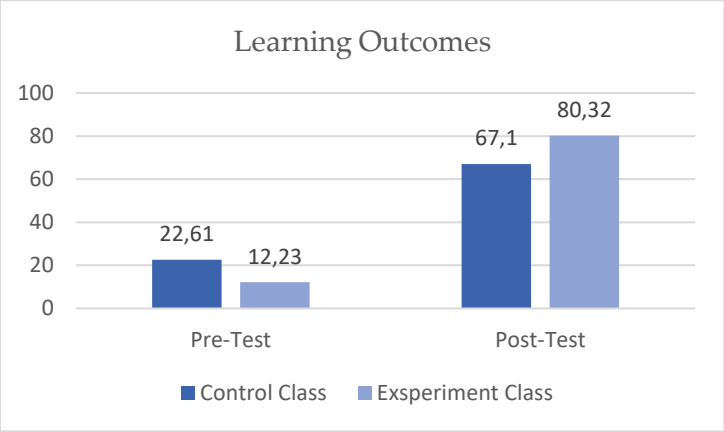

Figure 2. Average Score Comparison Pre-Test and Post-Test

Based on the research data that has been obtained, the next step is to analyze the data by going through several stages. The data to be analyzed in this study are learning outcomes. The normality test in this study was carried out to know whether the data obtained from the research were normally distributed or not. Ddata on learning outcomes will be tested for normality using the One-Sample Kolmogorov-Smirnov Test assisted by SPSS 24. As the results of the normality test are presented in Table 2, a significant pre-test value was obtained for the control class of 0.143 > 0.05 and for the experimental class 0.200 > 0.05. While the significant value of the post-test control class was 0.123 > 0.05 and the control class was 0.200 > 0.05. Based on the results of the normality test of the One Sample Kolmogorov-Smirnov Test that all data is normally distributed. This study will conduct a t-test for pre-test and post-test data. The results of the t-test can be seen in

Table 3 below.

Table 2. Normality Test Results

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Physics learning outcomes	Pre-test of controls	.137	31	.143	.927	31	.037
	Pre-test of experiments	.119	31	.200*	.950	31	.155
	Post-test of controls	.140	31	.123	.921	31	.025
	Post-test of experiments	.121	31	.200*	.933	31	.055

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Table 3. t-Test Results (Post-Test)

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Post-test	Equal variances assumed	10.106	.002	3.379	60	.001	13.77419	4.07671	5.61956	21.92883
	Equal variances not assumed			3.379	47.119	.001	13.77419	4.07671	5.57346	21.97493

The use of the guided inquiry learning model assisted by the Olabs website can improve student learning outcomes. This is evident from the results of the Independent Sample t-test, the post-test value obtained the sig. (2-tailed) 0.001 ≤ 0.05. This means that Ho is accepted and Ha is rejected or it can be said that there is a significant influence of the guided inquiry learning model assisted by the Olabs website on physics learning outcomes for high school students. In addition, the pretest results for most of the student's answers were not correct. This is because students' understanding is still lacking so the pretest scores in both the control class and the experimental results obtained are less than optimal. After using the Olabs website-assisted inquiry learning model in the experimental class, the posttest results were quite good compared to the posttest results in the control class.

This statement shows that the difference in learning outcomes between the control class and the experimental class is influenced by the learning model and the media used in learning. Learning activities in the control class implementation of learning using methods commonly used by physics teachers, namely the lecture method, and practice questions. Whereas in the experimental class using the guided inquiry learning model assisted by the Olabs website.

Learning that applies the guided inquiry model assisted by the Olabs website in the experimental class contains several thinking processes in the cognitive domain, namely C3, C4, C5, and C6. In the C3 cognitive domain (applying) according to stages 1, 2, and 3, namely students can identify a problem by discussing in groups to collect the data needed through experimental activities using the Olabs website media. The results showed that the students' ability to identify a problem through experimental activities was quite good, compared to before. This shows that students can solve a problem and produce effective, creative, and adaptive solutions to face some real-world challenges in the future.

Cognitive domain C4 (analyzing) corresponds to stage 4, namely, students can manage and analyze data that has been obtained from experimental activities. The results showed that the student's ability to manage and analyze data was quite good, as evidenced by the activeness of students in conducting experiments and looking for references to support the data that had been obtained. In addition, students can identify weaknesses or inconsistencies in making an argument based on the data that has been presented. The ability to analyze will help students to become more familiar with

problems, and be able to describe information and develop effective actions. In addition, the ability to analyze can also develop students' ability to think critically and logically.

Cognitive domain C5 (evaluating) corresponds to stage 5, namely, students can present results and make conclusions from the results of the experiment which will then be presented to other groups. The results of the study show that the student's ability to make inferences is good enough. This conclusion is obtained from some data that has been obtained and supported by information sources based on facts and strong reasons.

Students' ability to evaluate will encourage students to be able to think critically, analyze information and question whether these assumptions match the facts. In addition, students can distinguish and re-examine the arguments given by identifying these assumptions through reasoning activities and supported by accurate evidenc.

Cognitive domain C6(creating) in accordance with the objectives of implementing learning using the guided inquiry model, namely students can solve a problem to find the concept of material. The results showed that the student's ability to find the concept of progress was shown by the experimental results obtained in accordance with the theory, and students were active in expressing opinions and discussing together to provide mutual understanding. In addition, students can relate concepts or information to create creative solutions. This happens because before starting the lesson the teacher and researcher provide a stimulus in the form of a problem that must be solved by students, as well as giving freedom to students in finding several sources of supporting literature. These actions encourage students to be more creative and explore finding solutions to problems.

Learning activities using the inquiry learning model assisted by the Olabs website will provide many opportunities for students to be able to study independently. In addition, the enthusiasm of students to learn is also increasing with the emergence of curiosity through a few questions that have been asked by the teacher to students. Studying independently will increase students' knowledge and make learning more meaningful. So that the research results prove that the use of the guided inquiry learning model assisted by the Olabs website is an alternative to create a new learning atmosphere and the learning outcomes obtained by students have also increased.

The effect of applying the Olabs website-assisted guided inquiry learning model on learning outcomes is also in line with research [17].The application of *Olabs* as an online learning medium is quite effective in helping students easily understand a concept and can improve science process skills. [14] mentioned in the results of the *t-test* that the application of the Online Labs (Olabs)-based ABL (Active Based Learning) model makes students more active. Research conducted by [19] states that the use of *PhET* (virtual laboratory) media with a guided inquiry model has a significant influence on student learning outcomes. The guided inquiry model affects learning outcomes, this is evidenced by the learning outcomes of students who use the guided inquiry model higher than the learning outcomes of students who use conventional models [20].

Research of [21] shows the results that the application of guided inquiry models based on laboratory activities can improve learning outcomes significantly. Moreover, [22] suggests that the use of Olabs-based virtual lab practicum applications is quite significant in improving student learning outcomes. Based on the results of research and several relevant studies, it shows that the application of the guided inquiry model assisted by the Olabs website is quite significant in improving the physics learning outcomes of high school student

4. Conclusion

Based on research data that the application of the guided inquiry learning model assisted by the Olabs website can have a significant impact on improving student physics learning achievement. This

is evident from the results of the sig value t-test. (2-tailed) 0.001 0.05≤, meaning that it is accepted and Ha is rejected, meaning that there is a significant effect of the application of the Olabs website-assisted guided inquiry learning model H_0 on the physics learning outcomes of high school students. Further research may be possible to explore the potential impact of applying Olabs' learning model and media with different research objectives.

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