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The Influence of Guided Inquiry Learning Strategies Assisted with Virtual Laboratories in Thematic Learning on The Critical Thinking Abilities of Primary School Students

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Abstract: Technological developments in the world of education are very rapid, requiring education to continue to have innovation and renewal in learning approaches to be able to produce generations or highly competitive human resources who are able to have critical thinking skills. The purpose of this research is to determine the differences in critical thinking abilities between students who are taught using a guided inquiry learning strategy assisted by a virtual laboratory and those who are taught using a guided inquiry strategy without the assistance of a virtual laboratory in thematic learning in class V elementary school. This type of research is quasi-experimental, while the research design used is nonequivalent control group design. The sampling technique uses nonprobability sampling with a saturated sampling technique. Meanwhile, the instrument in this research is a test. The results of the research through hypothesis testing using the t test with a significance level of 5%, show that the $t_{count} > t_{table}$ (3,283 > 2,712) and the significant value shows sig < 0.05 (0.002 < 0.05), then H_0 is rejected and H_a is accepted, so it can be concluded that there is differences in critical thinking abilities between students who were taught using guided inquiry learning strategies assisted by virtual laboratories and those taught using guided inquiry strategies without virtual laboratory assistance in thematic learning in class V of elementary schools.

Keywords: Critical Thinking; Guided Inquiry Learning Model; Virtual Laboratories

Introduction

Learning is a process activity and is a very fundamental element in the implementation of every type and every level of education. Meaningful learning will help students achieve national education goals. Education in the 21st century is very important to produce quality, superior and competitive human resources (Mardhiyah et al., 2021). A good learning system is a learning system that refers to 21st century learning and skills, which include communication, collaboration, critical thinking, and creative and innovative (Sari & Wardhani, 2020; Tohani & Aulia, 2022). This ability can be achieved through well-implemented learning activities. Important aspects required in learning include thinking rationally, formulating questions, and building arguments. These aspects create skills that can encourage students to be involved in providing appropriate facts, data and theories to support claims about a problem and as reasons for making decisions (Prameswari et al., 2018; Suciono, 2021).

In general, in learning activities students lack the ability and habits develop thinking skills. Directed

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thinking ability through learning in elementary school is the ability to think at a higher level. One of Higher order thinking ability is the ability to think critically (critical thinking) (Wijayanti et al., 2015). Critical thinking is a systematic process allows students to formulate and evaluate their beliefs and opinions himself (Sitorus, 2013).

Critical thinking skills are one of the higher level thinking skills that must be applied during learning. Critical thinking is an effort to deepen awareness and intelligence to compare several problems that are and will occur so as to produce conclusions and ideas that can solve these problems (Fitriyah, 2020). The learning process in class is more often an activity of giving assignments and stimulating students to memorize, this illustrates that the development of students' thinking competence is still at a low level (Mariyaningsih & Hidayati, 2018). In learning activities, students lack the ability and habit of developing critical thinking skills. Students are more directed to understand the information provided by the teacher without relating it to everyday life. The low critical thinking ability of students is also caused by deviations in the implementation of learning, namely that core activities are not optimal or do not fulfill the exploration, elaboration and confirmation processes (Ahmad, 2022; Febriatina, 2016).

Technological developments in the world of education are very fast, requiring education to continue to have innovation and renewal in learning approaches to be able to produce generations or highly competitive human resources who are able to have the ability to think critically, creatively, communicatively, collaboratively and are able to solve problems well (Fitriyah, 2020). The existence of technology is an effort to improve the quality of learning (Awaluddin et al., 2021). The laboratory is a very important supporting facility, because students can find their own concepts regarding a particular material. Students can only access laboratory functions while at school. Therefore, the existence of virtual laboratories is a form of educational acceleration (Husaini, 2017; Muhajarah & Sulthon, 2020).

According to Minister of Education and Culture Regulation no. 65 of 2013 concerning Educational Process Standards, learning characteristics in the realm of skills are obtained through observing, asking, trying, reasoning, presenting and creating activities (Pendidikan, 2013). Learning is oriented towards higher order thinking skills (HOTS) in order to realize students' critical thinking and argumentation abilities. Critical thinking is the ability to consider everything by using thinking methods consistently and reflecting on them as a basis for making valid conclusions (Sihotang, 2019) & (Jaenudin et al., 2020). The 2013 curriculum also implements research-based learning (discovery/inquiry learning), learning that encourages students' ability to produce contextual work, both individually and in groups, using a learning approach that produces work based on problem solving (project based learning) (Koesnandar, 2020).

One of the learning strategies used in the 2013 curriculum is discovery and inquiry learning. Siregar & Yunitasari (2018) argue that the inquiry learning strategy is one of the learning strategies that can encourage students to be active in learning. The inquiry strategy is a series of learning activities that emphasize the process of thinking critically and analytically to search for and find answers to a problem in question. The thinking process is carried out through question and answer between the teacher and students. The inquiry strategy places greater emphasis on students' activeness in seeking and discovering their own knowledge. In general, Wina formulates inquiry learning strategy steps which can follow the following steps: orientation; formulating the problem; formulating a hypothesis; collecting data; testing the hypothesis; and formulating conclusions (Siregar & Yunitasari, 2018).

The inquiry learning strategy aims to develop thinking abilities and learning outcomes but also the student's learning process (Sutiani, 2021). In Sitorus (2013) research, it was stated that after being treated using inquiry strategies, the average critical thinking ability of students increased by 19.5% in cycle I and 36% in cycle II. Khasanah & Ayu (2017) also stated in their research that students' critical thinking skills can be seen from students' responses by looking at indicators of critical thinking skills such as activeness in asking questions, as well as enthusiasm when they don't understand the teacher's explanation. Meanwhile, that overall students have a positive attitude towards learning using virtual laboratories.

Method

The type of research in this research is experimental. The type of experiment used is quasi experimental research (quasi experimental design). This study had two groups of subjects, namely the experimental group (treatment) and the control group (comparison). The control group or comparison group cannot function fully to control external variables that influence the implementation of the experiment. The quasi-experimental design used is nonequivalent control group design, in this design the control group and experimental group are not chosen randomly (Thyer, 2012).

The research subjects were taken from class V from two different schools in one sub-district. The reasons for choosing research subjects are as follows: in the area

around the research location there are no parallel groups; the characteristics of the two schools are similar in terms of the living environment and the school; the experience of the teachers who teach in the class has almost the same; the extracurriculars provided are the same; and the average student report card at the previous level is not much different.

The data collection instrument used in this research was a critical thinking ability test instrument. The indicators of critical thinking skills include: formulating the main points of the problem; uncovering the facts needed to solve a problem; choosing logical, relevant and accurate arguments; detecting prejudice based on different points of view; and determine the consequences of a statement taken as a decision (Suter, 2011).

The stages in preparing the test include: making a grid; making a draft of the questions; expert validation; trial; carrying out a validity test; carrying out a reliability test; and revising the instrument. The analysis technique used in this research is the t test, because the variables being compared are two variables. However, before carrying out the t test, the analysis prerequisite tests are carried out, namely the normalization and homogeneity tests

Result and Discussion

In this research, students were divided into two classes, each required to think critically through guided inquiry learning strategies with and without the help of a virtual laboratory. The results achieved show that there is a change in the results of critical thinking skills with different results between the pretest results and the posttest results after students were treated with different models. This shows that there are differences in critical thinking skills between students who were taught using guided inquiry learning strategies assisted by virtual laboratories. and who are taught using guided inquiry strategies without the help of virtual laboratories in thematic learning (Listiantomo, 2023; Simbolon, 2015). The analysis prerequisite tests in this research used the normality test and homogeneity test. The data tested were pre-test score data and post-test score data for grade 5 students (Sidiq et al., 2021).

It can be seen in table 4.8 that the significance of the data in the experimental class is 0.074, the sig value of 0.074 > 0.05 indicates that the posttest data from the experimental class is normally distributed and the significance of the control class data is 0.053, the sig value of 0.053 > 0.05 also indicates that the posttest control class data is normally distributed. The data from the experimental class and control class is greater than 0.05, then both posttest data from the control and experimental classes can be stated to be normally distributed.

Table 1. Pretest Normality Test Results

	1,2	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Experiment, Control	1	0.192	20	0.052	0.866	20	0.010
	2	0.175	19	0.127	0.921	19	0.117

a. Lilliefors Significance Correction

Based on the results of the normality test in table 4.7, it can be seen that in the Kolmogorov-Sminorv column the significant value in the experimental class is 0.052, which means 0.052 > 0.05, so the data distribution in the experimental class is declared normal. In the control class, the significant value obtained from the normality test was 0.127. The value is 0.127 > 0.05, so the data distribution in the control class is declared normal. The significance value of both classes is greater than 0.05, so the pretest data from both classes can be stated to be normally distributed.

Table 2. Posttest Normality Test Results

	1.2	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	Df	Sig.	Statistic	df	Sig.
Experiment, Control	1	0.184	20	0.074	0.942	20	0.261
	2	0.196	19	0.053	0.894	19	0.037

a. Lilliefors Significance Correction

Table 3. Pretest Homogeneity Test Results

Levene Statistic	df1	df2	Sig.
2.623	1	37	.114

Table 4. Posttest Homogeneity Test Results

Levene Statistic	df1	df2	Sig.
0.035	1	37	0.853

The analysis results in table 3 and table 4 show sig > α, α = 0.05. In testing the pre-test data, a significant result of 0.114 > 0.05 was obtained, so Ho was accepted, which shows that the data variance from the experimental class and control class is homogeneous. Meanwhile, in testing the homogeneity of the post-test data, a significant result of 0.853 was obtained, so Ho was accepted with a sig value of 0.853 > 0.05, so it can be said that the data variance is homogeneous.

After knowing that the data from classes VA and VB are normally distributed and homogeneous, proceed with hypothesis testing. Hypothesis testing to determine

the difference in treatment in the control class and experimental class uses a sample t-test using the SPSS program.

Table 5. Pretest Hypothesis Test Results

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Experiment, Control	Equal variances assumed	2.623	0.114	1.747	37	.089	8.163	4.672	-1.303	17.630
	Equal variances not assumed			1.763	34.116	.087	8.163	4.630	-1.246	17.572

From table 5, the tcount (Equal variances assumed) value is 1,147 and with df = n – k = 37, the t_{table} value is 2,026, so $t_{count} < t_{table}$ = 1,747 < 2,026, thus Ho is accepted, so in the difference test (t test) pretest scores show that there is no difference in critical thinking abilities between students who are taught using guided inquiry learning strategies assisted by a virtual laboratory and those taught using guided inquiry strategies without the assistance of a virtual laboratory in thematic learning in class V elementary school. Meanwhile, the significant value obtained was 0.089, the significance value was 0.089 > 0.05, then Ho was accepted, indicating that there was no difference in critical thinking abilities between students who were taught using guided inquiry learning strategies assisted by a virtual laboratory and those taught using guided inquiry strategies without the assistance of a virtual laboratory. thematic learning in class V elementary school. It can be concluded that there is no difference in critical thinking abilities between students who were taught using guided inquiry learning strategies assisted by a virtual laboratory and those taught using guided inquiry strategies without the assistance of a virtual laboratory in thematic learning in class V in the pretest conducted in the experimental class and control class.

Table 6. Pretest Hypothesis Test Results

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Experiment, Control	Equal variances assumed	0.035	0.853	3.283	37.000	0.002	11.205	3.413	4.290	18.121
	Equal variances not assumed			3.281	36.772	0.002	11.205	3.415	4.284	18.127

From the table above, the tcount (Equal variances assumed) value is 3,283 and with df = n – k = 37 the ttable value is 2,712, so tcount > ttable = 3,283 > 2,026, thus Ha is accepted, so in the difference test (t test) post-test scores show that there is a difference in critical thinking abilities between students who were taught using guided inquiry learning strategies assisted by a virtual laboratory and those taught using guided inquiry strategies without the assistance of a virtual laboratory in thematic learning in class V elementary school. Meanwhile, the significant value obtained is 0.002, because the significant value is 0.002 < 0.05, then Ha is accepted and Ho is rejected, meaning that there is a difference in critical thinking abilities between students who are taught using guided inquiry learning strategies assisted by a virtual laboratory and those taught using guided inquiry strategies without laboratory assistance. virtual on thematic learning in class V Elementary School. Judging from the calculated t value and significance value in hypothesis testing using the t test,

both show that there are differences in critical thinking abilities between students who are taught using guided inquiry learning strategies assisted by virtual laboratories and those taught using guided inquiry strategies without the assistance of virtual laboratories in thematic learning in class V.

The pretest showed that there was no difference in the application of guided inquiry strategies with and without virtual laboratory assistance to students' critical thinking skills, this was because the pretest data was obtained before the two classes were given treatment, so students answered based on students' experiences gained in everyday life. Posttest data shows that there are differences between the two classes that were given different treatments. After being treated using a guided inquiry strategy with and without the help of a virtual laboratory, the average post-test results increased compared to the average pre-test class results, both in the control and experimental classes. This shows that critical thinking skills between class V at SD Negeri 1 Sidorenggo as an experimental class that was treated with the Guided Inquiry strategy assisted by a virtual laboratory and class V at SD Negeri 2 Sidorenggo as a control class that were treated with the Guided Inquiry strategy without the assistance of a virtual laboratory have different results, namely the experimental class had a higher difference in posttest and pretest average scores compared to the control (Solikah & Novita, 2022) & (Husnain et al., 2019).

At the stage of implementing guided inquiry learning, namely by following the stages of orientation, exploration, concept formation, application, and closure, students can design investigations, analyze results, and draw conclusions (Auliyah & Iryani, 2019). Conclusions are in accordance with the teacher's directions for thematic learning. The advantage of the inquiry learning strategy is that students can develop self-concept, encourage students to think and work on their own initiative, formulate hypothesis, develop individual skills, and avoid traditional ways of learning as well can be proven in this research, namely that students work in groups to exchange things opinions to carry out tasks given by the teacher, so that individual skills can develop and through this activity student-centered learning (Sari et al., 2019). This is also supported by the higher average change in critical thinking results from pretest to posttest.

Conclusion

Based on research conducted, the results of analysis testing using the t test on pretest scores show that there is no difference in students' critical thinking results between learning using the Guided Inquiry learning model and the Project Based Learning learning model with a significant value of 0.089 which is greater than 0.05 (sig > 0.05) and tcount < ttable (1,747 < 2,026). Meanwhile, the posttest results show that there is a difference between the Guided Inquiry learning model and the Project Based Learning learning model on students' critical thinking skills with a significant value of 0.02 which is smaller than 0.05 (sig < 0.05) and $t_{count} > t_{table}$ (3.283 > 2.026).

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In this short study, the researcher stated that the writer and supervisor played an active role in the research and writing that had been carried out. The author designed and completed the research with direction and guidance from the supervisor, so that he could provide good research results.

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