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The Effect of The Use of Guided Inquiry-Based E-LKPD on Cognitive Learning Results and Students' Learning Motivation in Vibration and Wave Materials

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Abstract

The learning method using inquiry-based e-LKPD is expected to affect students' cognitive learning outcomes and the learning motivation. The research method used was a nonequivalent control group design. The research sample was taken by using the cluster random sampling technique. The results of the analysis of significant improvement in cognitive learning outcomes using N-gain showed that the experimental class was 0.40. The control class was 0.32 with the same moderate criteria. Learning outcomes related to students' motivation have also increased, which is known from the table analysis of learning outcomes for each indicator between the control and experimental classes. It can be seen that the control and experimental classes at the beginning of learning have equally low learning motivation, as evidenced by the results of the average proportion of motivation learners learning indicator by 43% in the control class and 45% in the experimental class. While the results of the final learning motivation questionnaire in the control and experimental classes both experienced an increase, but for the control class, it was still in the low category by 48% and for the experimental class experienced a significant increase of 78% with the high category.

INTRODUCTION

In the 21st century, education's role is very important in preparing the next generation who have learning skills, innovation, using technology and information media, and skills to survive (Mayasari *et al.,* 2016). Technology has an important role in building 21st-century skills so that the skills of students in using technology are very important (Erdem, 2014). Science and technology have progressed rapidly, affecting the preparation and implementation of learning methods or models. The 21st century is marked by the era of the industrial revolution 4.0 as a century of openness or the century of globalization, meaning that human life in the 21st century has undergone very fundamental changes that are different from the order of life in previous centuries (Sukartono, 2018). According to Zubaidah (2014), learning science is learning about a collection of knowledge in the form of facts, concepts, or principles and a process of discovery. The discovery process can be carried out in various ways, including observing, exploring, and experimenting so that active learners and educators act as facilitators. Fauziyah (2015) states that the inquiry learning model is a learning model in which all students' abilities in finding and investigating something systematically, critically, logically, and analytically are maximally involved so that the formulation of their findings is obtained. The teacher's role in learning with the guided inquiry model is as a guide and facilitator. According to Rachman *et al.,* (2017) one alternative that can encourage students to improve learning outcomes and scientific attitudes of students is LKPD teaching materials, where the presentation of LKPD is developed by using electronic media as a learning medium that supports a learning process. Based on the results of observations and interviews at SMP Negeri 33 Semarang with one of the science teachers, it shows that learning innovation in the classroom is still lacking. This can be seen from the less interesting learning because many students pay less attention to learning and tasks that are not maximally complete due to the low motivation of students. It can be seen from the results of the assessment of science subjects, especially vibration and wave material, which are still below the Minimum Completeness Criteria (KKM). The minimum completeness criteria for the subject is 75. Only 55% of all VIII grade students who achieved learning completeness criteria supported by a direct statement from the science teacher at SMP Negeri 33 Semarang that the material of vibrations and waves was difficult to understand formulas. Based on these results, it is needed that can improve cognitive learning outcomes and student motivation. The guided inquiry learning model by integrating electronic student worksheet technology is a solution in learning because it is supported by research by Rachman *et al.,* (2017). One alternative that can encourage students to improve learning outcomes and scientific attitudes of students is LKPD teaching materials, where the presentation of LKPD is developed with one of them utilizing electronic media as a learning medium that supports a learning process.

METHOD

The research subjects were students of SMP Negeri 33 Semarang class VIII H and VIII I. Class VIII H was the control class, and class VIII I was the experimental class. This study's sampling technique is the cluster random sampling technique or included in Probability Sampling, which is a sampling technique that provides equal opportunities for each element (member) of the population to be selected as a sample. The type of research used is experimental research. The data collection methods in this study are as follows: (1) The interview method is used to determine the learning process in the classroom, (2) The questionnaire method is used to determine the learning motivation of students and to support the test method, (3) The test method is used to determine the influence of the application of guided inquiry-based e-LKPD learning. Data analysis in this study was (1) homogeneity test, (2) normality test, (3) N-gain, (4) related t-test.

RESULT AND DISCUSSION

Research results obtained from research that has been carried out include (1) research documentation, (2) posttest data, and pretest (3) questionnaire data on students' learning motivation. The homogeneity test analysis of

the initial data (daily test data on the previous material) in each class will be used to determine the research sample. The results of the experimental class and control class students' initial data test are the same or homogeneous, which can be used for initial research data. The results of the homogeneity test were also carried out on the pretest data. This shows that the pretest results of the experimental and control class students are the same or homogeneous. The results of the homogeneity test were also carried out at the posttest. shows that the posttest data of the experimental and control classes are the same or homogeneous.

Table 1. Homogeneity Test Results

Data	Class	Variance	F_{count}	F_{table}	Criteria
Early	Experiment	136,996	0,65	1,89	Homogen
	Control	90,125			
Pre Test	Experiment	136,996	0,65	1,89	Homogen
	Control	90,125			
Post Test	Experiment	85,78	0,45	1,89	Homogen
	Control	39,09			

The normality test is used to determine whether the test score data of students in the experimental and control classes are normal or not. The results of the analysis of the final data normality test (pretest and posttest data) in each class will be used to determine the data obtained after normal research or not and used to determine further tests.

Table 2. Results of the Pretest and Posttest Normality Test

Data	Class	χ^2count	χ^2table	Criteria
Pretest	Experiment	0,128	0,241	Normal distribution
	Control	0,111		
Post test	Experiment	0,140		
	Control	0,111		

Data on cognitive learning outcomes were obtained from pretest and posttest results. This increase in cognitive learning outcomes can be analyzed with the n-gain formula. This test of increasing learning outcomes aims to determine the magnitude of the increase in learning outcomes before being treated and after being given treatment. Students' cognitive learning outcomes are said to increase if at least they reach the moderate criteria with an interval of $0.3 \leq g \geq 0.7$.

The pretest and posttest that are normally distributed can be used for further tests with parametric statistics, namely the comparative t-test related test. The t-test or two different tests on average were used to determine the significant effect of learning using guided inquiry-based e-LKPD on cognitive learning outcomes and student learning motivation on vibration and wave material. Significant differences can be seen by determining t and t table and rejection of H0 if t> t table.

Table 3. T-Test Results Related to Pretest and Posttest Data

Data	Class	Average	df	T_{count}	Information
Pretest	Experiment	67,06	31	0,22	There are significant differences
	Control	59,69	31		
Posttest	Experiment	67,06	32	0,13	
	Control	59,69	32		

Based on Table 3 shows that the t-test pretest and posttest data there is a significant difference in the cognitive learning outcomes of students in the experimental class and control class because the results of $t_{count} < t_{table}$ and H_0 are accepted. The improvement of students' cognitive learning outcomes can be analyzed using N-gain. N-gain analysis aims to determine the increase in cognitive learning outcomes of students at the first meeting or pretest to the last meeting, namely the 6th posttest.

Table 4. N-Gain Cognitive Learning Outcomes

Data	Experiment		N-Gain	Control		N-Gain
	Pretest	*Post test*		*Pretest*	*Post test*	
Lowest score	40	67		37	50	
Highest score	85	94	**0,40 Moderate**	77	90	**0,32 Moderate**
Averange	67,06	81,53		59,69	72,78	

The N-gain value in the analysis of students' cognitive learning outcomes shows that the experimental class is higher than the control class even though it is still in the moderate category. The experimental class got an N-gain value of 0.40 in the moderate category, while the control class was 0.32 in the moderate category. This category is in accordance with Meltzer (2002) showing that N-gain $0.3 < g < 0.7$ is moderate category.

Table 5. Percentage Difference in Increasing Cognitive Learning Outcomes

Class	Averange score		Enchancement (*Pretest-Posttest*)	N-Gain	Criteria
	Pretest	*Post test*			
Experiment	67,06	81,53	14,47	0,40	Moderate
Control	59,69	72,78	13,09	0,32	Moderate

Based on table 5 shows that the percentage of increase in the experimental class with learning using guided inquiry-based e-LKPD is 14.47, better than the control class using unassisted LKPD is 13.09. The percentage difference analysis between these two classes was assessed from the pretest and posttest, as seen in Figure 1

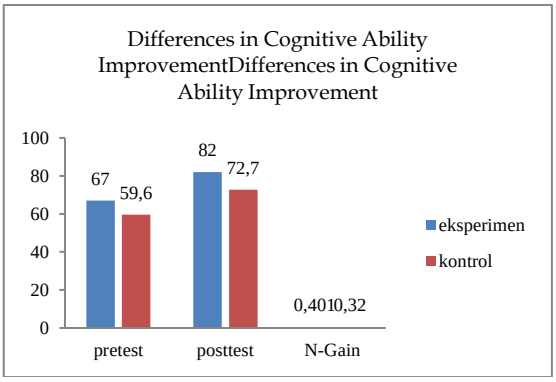

Figure 1. Differences in Cognitive Ability Improvement

Analysis of Students' Learning Motivation Questionnaire.

The Student Learning Motivation Questionnaire was used to determine the effect of increasing students' learning motivation after implementing learning using guided inquiry-based e-LKPD on the experimental class and learning using printed LKPD in students' textbooks in the control class.

Learning motivation data were obtained from observation sheets in the experimental class and control class. The observation sheet consists of eight indicators of learning motivation, namely as follows: (1) persevering in facing tasks, (2) persistence in facing difficulties, (3) showing interest in various problems, (4) preferring to work independently, (5) not fast bored with routine tasks, (6) Can defend his opinion, (7) Not easy to let go of what he believes, and (8) Enjoy looking for and solving problems.

Based on the research results carried out at SMP Negeri 33 Semarang with 32 students in each class divided into the control class VIII H and the experimental class VIII I. The results of learning motivation in the experiment class after learning using inquiry-based e-LKPD guided by 0.4 and the control class only 0.17 seen from N-Gain. The T-test final learning motivation in the experimental class is 133.97, and the control class final learning motivation is 117.75. The percentage of the control and experimental classes' initial motivation is the same, namely in the low category where the control class is 43.41% and the experimental class is 47.25%. After carrying out learning in the control class using LKPD in the textbook assisted by Quipper media, it has increased but is still in the low category, namely by 48.08%. Whereas in the experimental class, after implementing learning using guided inquiry-based e-LKPD, it has increased by being in the high category by 78%.

Analysis of the observation sheet data is testing the normality of the observation sheet data. The normality test is used to determine whether the data is normally distributed, to determine the next analysis. Observation normality test can be seen in table 6

Table 6. Results of Normality Test for Early Learning Motivation Questionnaire

Data	Class	p Value	Criteria
Early	Experiment	0.468	Normal distribution
	Control	0.475	Normal distribution

Based on table 6 Early Learning Motivation between the experimental and control classes are both normally distributed which is used as a condition for conducting the T-test. This is because the p value <0.05. The final learning motivation

normality test was also carried out to determine the posttest T-test with the results shown in Table 7

Table 7. Results of the Normality Test for the Final Learning Motivation Questionnaire

Data	Class	p Value	Criteria
Final	Experiment	0.092	Normal distribution
	Control	0.230	Normal distribution

Based on table 7 Final Learning Motivation between the experimental and control classes is normally distributed, which is used as a condition for conducting the T-test. This is because the p value <0.05.
The data is then followed by parametric analysis. The analysis used in the questionnaire data was the difference test. Test the difference between the control class and the experimental class using the right-hand one-sided t test. One-party t test can be seen in table 8

Table 8. Different Test Results on Learning Motivation Questionnaire Data

Class	Averange	df	T_{count}	Information
Experiment	133,97	31	7,45	There are significant differences
Kontrol	117,75	31		

Table 9. Comparison Results of Initial Learning Motivation for Each Indicator

No	Indicator	Control Class		Experiment Class	
		Result (%)	Category	Result (%)	Category
1.	Diligent in facing the task	43%	Low	44%	Low
2.	Resilient to adversity	42%	Low	47%	Low
3.	Shows interest in various problems	43%	Low	50%	Low
4.	Prefer to work independently	40%	Low	49%	Low
5.	Do not get bored quickly on routine tasks	46%	Low	46%	Low
6.	Can defend his opinion	41%	Low	47%	Low
7.	It's not easy to let go of what is believed	45%	Low	49%	Low
8.	Enjoy finding and solving problems	49%	Low	45%	Low

The difference test result with a significant level of 5% df price is 31 while the tcount is 7.45. Based on these data tcount> ttable so that Ho is rejected. Guided inquiry-based e-LKPD learning affects students' learning motivation in the experimental and control class and in the experimental class higher than the control class. Based on the recap of the initial and final learning motivation questionnaire results, it can be seen that the comparison of the initial and final learning motivation questionnaire in the control class and the experimental class per indicator. The following is the comparison of the learning motivation of early students in table 9. Based on table 9, it can be seen that in the control class and experiment, students' initial learning motivation is in the low category because they have not experienced learning using guided inquiry-based e-LKPD in the experimental class. The following table shows a comparison of students' final learning motivation between the control and experimental classes per indicator.

Table 10 Comparison Results of Final Learning Motivation for Each Indicator

No	Indicator	Class Control Result (%)	Experiment Class Result (%)
1.	Diligent in facing the task	16,2%	88,6%
2.	Resilient to adversity	19%	65,9%
3.	Shows interest in various problems	6,9%	50%
4.	Prefer to work independently	15%	65,3%
5.	Do not get bored quickly on routine tasks	8,6%	63%
6.	Can defend his opinion	17%	59,5%
7.	It's not easy to let go of what is believed	0%	57,1%
8.	Enjoy finding and solving problems	2%	80%

Based on table 10 it can be seen that there was an increase in the experimental and control class. However, in the control class the increase was only slightly so that it was still in the low category by implementing learning using LKPD in the textbook of each student assisted by applications from schools in the form of the Quipper platform. Whereas in the experimental class there was also an increase with the average being in the high category with learning using guided inquiry-based e-LKPD. After that, look for the difference in comparing the increase in early and late learning motivation between the control and experimental classes below in table 11.

The following table shows the difference between the comparison of the increase in early and late learning motivation for each indicator between the control and experimental classes in Figure 2.

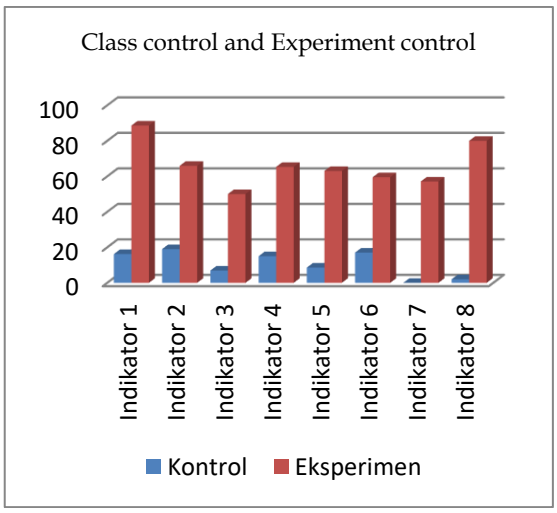

Figure 2. Class control and Experiment control

Based on the data, it is known that between the control and experimental classes, each has an increase in each indicator and the experimental class data is higher than the control class. It shows that learning using guided inquiry-based e-LKPD affects students' learning motivation supported by the T-test analysis. Test that the experimental class with the control class is different, although not significant, indicated by the experimental class's learning motivation is higher than the control class.

Table 11 Results of the Difference in Comparison of the Increase in Early & Late Learning Motivation for Each Indicator

No	Indicator	Control class		Experiment class	
		Result (%)	Category	Result (%)	Category
1.	Diligent in facing the task	50%	Low	83%	High
2.	Resilient to adversity	50%	Low	78%	High
3.	Shows interest in various problems	46%	Low	75%	High
4.	Prefer to work independently	46%	Low	81%	High
5.	Do not get bored quickly on routine tasks	50%	Low	75%	High
6.	Can defend his opinion	48%	Low	75%	High
7.	It's not easy to let go of what is believed	45%	Low	77%	High
8.	Enjoy finding and solving problems	49%	Low	81%	High

Student Response Questionnaire Analysis

Student response questionnaires can be used to determine students' responses related to the learning model used in the form of guided inquiry-based e-LKPD in improving cognitive learning outcomes and student learning motivation on vibration and wave material. Based on the results of research conducted at SMP Negeri 33 Semarang with 32 students who applied the learning model using guided inquiry-based e-LKPD, it was obtained an average of 78% with good criteria which can be seen in table 12

Table 12. Results of Students' Responses to E-LKPD Learning Based on Guided Inquiry

No	Statement	Percentage (%)	Criteria
Positive statement			
2.	When I took the multiple-choice test, I didn't feel pressured	76%	Good
3.	The time for taking multiple-choice tests is in accordance with the number and type of questions..	80%	Good
4.	The images in the multiple-choice test are clear and easy to understand	80%	Good
5.	The use of language in multiple-choice tests is easy to understand.	85%	Very Good
6.	The guidelines for taking multiple-choice tests are clearly stated.	82%	Very Good
7.	The material in the multiple-choice test corresponds to the vibration, wave and sound material.	81%	Good
8.	Multiple-choice tests help determine abilities and weaknesses in mastery of the material.	81%	Good
9.	Mastery after the test helped me straighten and reinforce the concepts I wasn't good at.	78%	Good
11.	In order to master the material of vibration, waves and sound I have to study harder in order to understand the concept correctly	74%	Good
14.	My curiosity is often moved by the teacher's questions and problems in the subject of vibrations, waves, and sounds.	75%	Good
16.	My family always accompanies me when I'm studying at home.	77%	Good
18.	The atmosphere in my classroom is very comfortable, making me focus more on understanding the	75%	Good

	material concepts of vibration, waves, and sound.		
19.	Success or failure in this study is up to me.	80%	Good
Negative statement			
1.	I studied vibrations, waves, and sounds, just memorizing it.	73%	Good
10.	The concepts that I learned in the material of vibration, waves, and sound cannot benefit me in my daily life.	76%	Good
12.	Vibration, wave and sound matter is very difficult for me.	71%	Good
13.	Mathematical equations or formulas for vibration, wave and sound are difficult to understand	75%	Good
15.	When learning was boring, it was difficult for me to understand concepts.	75%	Good
17.	My parents never asked about my learning progress.	77%	Good
	Average	78%	Good

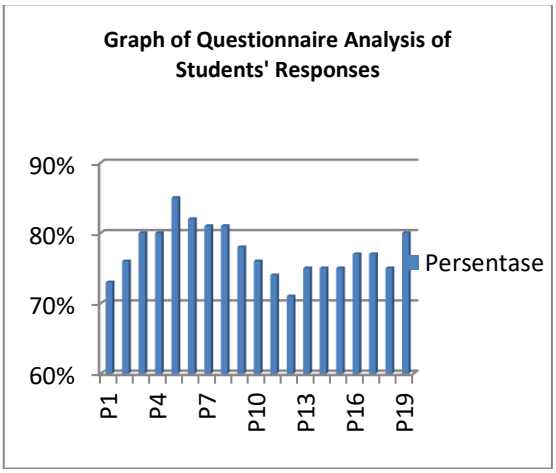

Figure 3. Graph of Questionnaire Analysis of Students' Responses to Learning Using E-LKPD Based on Guided Inquiry

Table 12 shows that the student response questionnaire results related to the implementation of guided inquiry-based e-LKPD learning get a good response. This analysis indicates that the applied learning model has a positive impact and is accepted by students.

CONCLUSION

Learning using guided inquiry-based e-LKPD has an effect on improving cognitive learning outcomes in the moderate category and affects the learning motivation of students with good categories seen from the analysis per indicator and students' responses to the use of guided inquiry-based e-LKPD learning at SMP N 33 Semarang is good.

REFERENCES

Erdem, M., & Kibar, P. N. (2014). Student's opinion Facebook supported Blended Learning Environment. *Turkish Online Journal Educational Technology*, 13(1): 199-206

Fauziyah, D. (2015). Penerapan strategi Pembelajaran Inkuri Pada Mata Pelajaran ekonomi Pokok Bahasan Pasar. *Prosiding Seminar Nasional Pendidikan Ekonomi FE*. Yogyakarta: Universitas Negeri Yogyakarta.

Mayasari, T., A. Kadarohman, D. Rusdiana, & I. Kaniawati. (2016). Apakah Model Pembelajaran Problem Based Learning Dan Project Based Learning Mampu Melatih Keterampilan Abad 21. *Journal of Physics and Scientific Education (JPFK)*, 2(1): 48-55.

Rachman, Abd, F., Ahsanunnisa, R., & Nawawi, E. (2017). Pengembangan LKPD Berbasis Berpikir Kritis Materi Kelarutan dan hasil Kali Kelarutan pada Mata Pelajaran Kimia di SMA. *Alkimia. Jurnal Kimia*, 1(1): 16-25.

Sukartono. (2018). Revolusi Industri 4.0 Dan Dampaknya Terhadap Pendidikan Di Indonesia. *Journal FIP PGSD Universitas Muhammadiyah Surakarta*.

Zubaidah, S., S. Mahan, L. Yuliati & D. Sigit. (2014). *Buku Guru Ilmu Pengetahuan Alam.* Jakarta: Kementrian Pendidikan dan Kebudayaan.