

THE INFLUENCE OF THE GUIDED DISCOVERY LEARNING MODEL ON CRITICAL THINKING ABILITY AND PROBLEM-SOLVING ABILITY

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Abstract

This study aims to determine the effect of the guided discovery learning (GDL) model on critical thinking skills and problem-solving skills, the extent of the influence of the model on each aspect of critical thinking skills and aspects of problem-solving skills and look for the effectiveness of the model on critical thinking skills and problem-solving skills. The population in this study were all students of class X Mathematics and Natural Sciences. The sampling technique was purposive sampling. Research instrument with description test. The results showed that there was an influence of the model on critical thinking skills and problem-solving skills, the influence of the model on aspects of critical thinking skills from high to low are advanced clarification, inference, elementary clarification, strategies and tactics, basic support and aspects of problem-solving skills from high to low are define the problem, planning solutions, implement solutions, evaluate and check problems. The GDL model is effective for improving critical thinking skills and problem-solving skills.

Keywords: guided discovery learning, critical thinking skills, problem-solving skills, biology learning

INTRODUCTION

Indonesia's ranking on the Program for International Student Assessment (PISA), which assesses students' skills and abilities, is still below average. Assessment by the PISA team in 2018, Indonesia was ranked 71st out of 79 countries. The low achievement of Indonesian students on PISA is due to their weak ability to solve high-level problems. The questions on PISA contain everyday contextual problems that require students to have critical thinking skills in solving problems. Based on the assessment by PISA, students' critical thinking abilities are low so it is a special concern for educators in improving students' thinking abilities through learning (Fariansyah et al., 2021). Critical thinking skills are important for students studying science because they can help students solve PISA science questions so that Indonesia's ranking can improve (Ayodele & Nasiru, 2021).

The ability to think critically in school is important to develop so that students can face problems that arise around them because this ability supports the search and discovery process (Kurniyasari et al., 2019) so that solutions to problems can be found by analyzing data. relevant data collected (Rahma & Windyariani, 2020: 282). In efforts to improve critical thinking skills, educators need to create an active learning atmosphere and be supported by appropriate learning models. Innovation through learning models is needed to improve students' thinking abilities (Rubiyanto et al., 2015). Students who are directly involved in the thinking process can influence the success of the learning model applied. One model that can facilitate the problems applied is the Guided Discovery Learning model. The GDL model is a learning model that is student-centered and involves students in the discovery process. Teachers provide problems and questions to train students' critical thinking so that students can make conclusions to solve problems (Nursidah et al., 2019).

The syntax of the Guided Discovery Learning Model according to the 2013 curriculum (Nofiana, 2020) is (1) Stimulation: the teacher asks students questions that lead to problem-solving so that students actively explore the material, (2) Problem Identification (Problem Statement): students identify problems and formulate hypotheses, (3) Data Collection: students carry out observations, experiments, and literature studies in collecting data to prove hypotheses, (4) Data Processing: processing and interpreting data (5) Verification (Verification): students check the results of data processing to prove the truth of the hypothesis, (6) Generalization: students conclude by considering the verification results. The GDL model helps students with low learning outcomes to improve their thinking abilities (Grobmann & Wilde, 2019) and allows students to develop their abilities to practice critical thinking skills and problem-solving abilities (Subuat et al., 2018), especially in ecosystem material which is applied to study.

METHODS

This research uses a Quasi-experimental method with Pretest-Posttest Nonequivalent Control Group Design. Sampling was carried out using a purposive sampling technique. The population used in this research was class X MIPA students. The selected sample was 36 students of class X MIPA 5 as the experimental

class and 36 students of class X MIPA 3 as the control class. The research instruments used were 10 items of critical thinking ability essay test data and 5 problem-solving ability essay questions. The test results were analyzed using prerequisite tests, namely the normality test and homogeneity test and to determine the influence of the GDL model on critical thinking abilities and problem-solving abilities using the MANOVA test. Parametric tests to determine the effect of the GDL model on each aspect of critical thinking abilities and problem-solving abilities using regression tests. The N-Gain test was carried out to measure the effectiveness of the GDL model. Statistical tests were carried out using SPSS version 25.

RESULTS AND DISCUSSION

The data obtained from the critical thinking ability test results using the GDL model are shown in Table 1.

Table 1. Recapitulation of Critical Thinking Ability Test Results

Variable	Pretest		Posttest	
	Experiment	Control	Experiment	Control
N	36	36	36	36
Average	62,19	59,17	84,17	78,89
Deviation standard	8,166	7,182	7,838	7,559
Varian	66,690	57,143	61,429	51,587

Table 1 shows that the application of the GDL model provides an increase in the average pretest and posttest scores for the experimental class by 35.34%, while an increase in the average pretest and posttest scores for the control class is 33.32%, which can be seen in Figure 1.

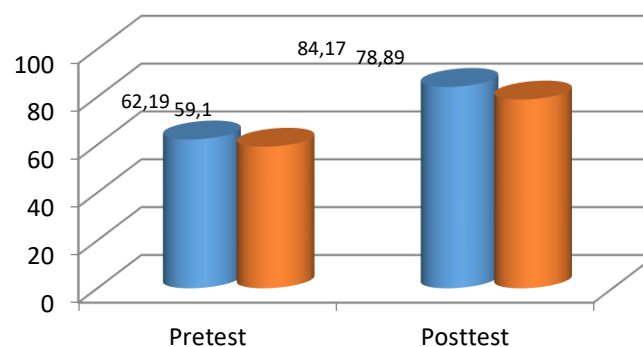


Figure 1. Comparison diagram of the increase in pretest and posttest scores (blue is experiment class and orange is control class)

The data obtained from the results of the problem-solving ability test using the GDL model are shown in Table 2.

Table 2. Recapitulation of Problem-Solving Ability Results

Variable	<i>Pretest</i>		<i>Posttest</i>	
	Experiment	Control	Experiment	Control
N	36	36	36	36
Average	60,96	59,29	83,58	79,15
Deviation Standard	9,242	7,130	5,704	4,306
Varian	85,405	50,834	32,536	18,540

Table 2 shows that the application of the GDL model provides an increase in the average pretest and posttest scores for the experimental class by 37.10%, while an increase in the average pretest and posttest scores for the control class is 33.49%, which can be seen in Figure 2.

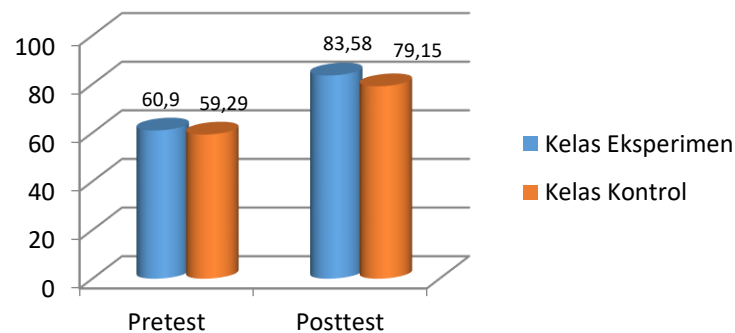


Figure 2. Comparison diagram of the increase in pretest and posttest scores (blue is experiment class and orange is control class)

The research results in Table 2 support the statement according to Widura, (2015) that the GDL model treatment in the experimental class has a higher average value than the control class because students carry out the process of discovering knowledge by developing their cognitive mastery through the scientific process (Yerizon et al., 2018). According to research by Sholihah & Prihatiningtyas (2021), the average score of the experimental class is superior because students actively ask questions during learning and work on questions in depth. The LKPD used is also by the model applied (Asy'ari et al., 2019). Students actively carry out experiments and discussions to solve problems (Rahma & Windyariani, 2020) so that students can solve problems and discover concepts (Septina et al., 2018). Students can improve and apply their knowledge and skills in various types of activities that can help students analyze and integrate concepts, choose problem-solving strategies, interpret, explain, evaluate, and reflect on learning (Murphy et al., 2021).

The normality test uses the Kolmogorov-Smirnov test and the homogeneity test uses Levene's test. The normality test and homogeneity test can be seen in Table 3.

Table 3. Results of Normality Test and Homogeneity Test

	Indicator	Sig.	Note	Decision
Normality test	Critical thinking	0,200	Sig. > 0,05	Normally distributed
	Solve the problem	0,200	Sig. > 0,05	
Homogeneity test	Critical thinking	0,857	Sig. > 0,05	Homogeneous Data
	Solve the problem	0,324	Sig. > 0,05	

Testing was carried out using the Manova test. The results of the hypothesis test are described in Table 4.

Table 4. Manova Test Results

Indicator	F	Sig.	Note	Decision
Critical thinking	5,325	0,024	Sig. < 0,05	H0 is rejected, H1 is accepted, there is a real difference
Solve the problem	10,320	0,002	Sig. < 0,05	

Table 4 shows that there is an influence of the GDL model on critical thinking abilities and problem-solving abilities. Based on teacher observations during learning and test results, the experimental class was more consistent in answering questions than the control class as evidenced by the pretest and posttest answers. The increase in scores in the experimental class was more significant than in the control class. Increasing critical thinking skills and problem-solving abilities is influenced by the positive impact of the GDL model which provides students with opportunities to be active during the learning process. Learning is not teacher-centered but student-centered. Students are encouraged to discover concepts and build new knowledge.

Supported by research by Aarsal (2017), the GDL model can improve students' critical thinking skills through discovering ideas and concepts during scientific method activities, thereby honing problem-solving abilities. Deepening concepts makes students have long-term retention (Yuni et al., 2019). The GDL model emphasizes the active learning process (Muhali et al., 2021) and group discussions (Kwan & Wong, 2015), and students are free to develop their abilities in the investigation process to the conclusion of the problem through teacher guidance (Arua, 2021). Teachers can reach students widely, making it easier to refine and deliver learning material. The GDL model can help students improve and enhance their thinking and cognitive abilities (Chusni et al., 2020).

According to Ennis (2011), there are 5 aspects of critical thinking, namely providing simple explanations (elementary clarification), building basic skills (basic support), making further explanations (advanced clarification), concluding (inference), strategies and tactics (strategies and tactics). The influence on each aspect is carried out using a regression test. The results of the regression test can be seen in Table 5.

Table 5. Regression Test Results

Critical Thinking Aspect	R ²	Sig.	Beta Value	Correlation	Effective Contribution (%)
Advance clarification	0,778	0,001	1,623	0,659	106,95
Inference		0,003	1,549	0,496	76,83
Elementary clarification		0,002	1,547	0,474	73,32
Strategies and tactics		0,000	1,677	0,355	59,53
Basic support		0,042	0,994	0,439	43,63

Table 5 shows the order of aspects influenced by the GDL model from high to low, namely aspects of advance clarification, inference, elementary clarification, strategies and tactics, and basic support. The advanced clarification aspect is the highest aspect that is influenced by the GDL model because students can define terms consider definitions and identify assumptions that are trained through questions correctly. This activity requires students' critical thinking skills to summarize the knowledge gained during learning to become a concept so that the inference aspect becomes the second highest aspect after the advanced clarification aspect. Students who can determine the main problem then create a hypothesis based on the concept found. Students who can find the main problem will be able to analyze the arguments to formulate the problem so that the elementary clarification aspect is in third place.

The strategies and tactics aspect and the basic support aspect rank fourth and fifth, which are the lowest aspects of the influence of the GDL model. The essay questions that practice these two aspects contain the components of the rice field ecosystem and the energy flow that occurs in it. The low results in these two aspects are because students are not optimal in making observations involving real objects so students have not been able to find and decide which solution is appropriate in solving problems. Observation activities that require a long time must be better prepared by teachers and students.

According to (Mourtos, Okamoto, and Rhee (2004), 5 aspects of the ability to solve problems, namely defining the problem, checking the problem, planning solutions, implementing solutions, and evaluating). The influence on each aspect is carried out using a regression test. The results of the regression test can be seen in Table 6.

Table 6. Regression Test Results

Problem-Solving Aspect	R ²	Sig.	Beta Value	Correlation	Effective Contribution (%)
Define the problem	1,000	0,000	1,000	0,471	47,10
Planning solutions		0,000	1,000	0,422	42,20
Implement solution		0,000	1,000	0,387	38,70
Evaluate		0,000	1,000	0,345	34,50
Check problem		0,000	1,000	0,130	13,00

Table 6 shows that the order of aspects influenced by the GDL model from high to low is defining the problem, planning solutions, implementing solutions, evaluating, and checking problem aspects. The define the problem aspect is the highest aspect that influence of the GDL model because students succeed in writing down the main problem and the reasons correctly which are used to plan solutions in solving problems. For this reason, the planning solutions aspect is in the second highest position influenced by the GDL model. Students first group sub-problems and sub-solutions to develop alternative solutions. The third order is the implementation solution aspect. At this stage, students create work steps from the selected solution to be used to prove the truth of the hypothesis. The solution is then checked again for its feasibility to estimate the final result that will be obtained which is the implementation of the evaluation aspect.

The lowest aspect in fifth place is the check problem aspect because students cannot determine the cause and effect of the problem that arises correctly. The teacher's role in improving students' abilities in the checking problem aspect can be done by providing students with a general overview of the problems that arise to stimulate students' thinking abilities.

The effectiveness of the GDL model is carried out using the N-Gain test. The N-Gain test results can be seen in Table 7.

Table 7. N-Gain Test Results

Indicator	Class	N-Gain Score	Category
Critical Thinking	Experiment	0,7820	High
	Control	0,5557	Medium
Problem-Solving	Experiment	0,7334	High
	Control	0,5389	Medium

Table 7 shows that the application of the GDL model is effective in improving critical thinking skills and problem-solving abilities. The main idea in the GDL model is that students play a major role in learning, thereby creating an active and interesting learning experience. Students can find and express their ideas regarding the topics they have studied (Rosidah & Fitrihidajati, 2020). The results of the research show that the use of the GDL model in the experimental class has increased critical thinking abilities and problem-solving abilities in the high category. Supported by research by Dahliana et al., (2018), the final N-gain score in the experimental class is higher than in the control class because students are free to build their knowledge in depth. Learning activities run systematically, critically, and logically in discovering knowledge, discovering attitudes, and building skills independently (Lee & Yeung, 2021). New knowledge that students build themselves during learning can last a long time in their minds. Students can strengthen concepts because they gain confidence when working together and discussing with their friends. The GDL model trains students' independence, including making

hypotheses. The final results concluded by students are purely from their thinking abilities during teaching and learning activities.

CONCLUSION

There is an influence of the Guided Discovery Learning model on critical thinking abilities and problem-solving abilities and the GDL model influences each aspect of critical thinking abilities and problem-solving abilities. The GDL model is effectively applied in learning to improve students' critical thinking and problem-solving abilities. For this reason, efforts need to be made to disseminate GDL learning, especially on ecosystem material. Efforts to apply this learning model need to be further developed to encourage teachers to create discovery learning that improves critical thinking skills and problem-solving abilities. Research related to the GDL model also needs to be applied to different variables.

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