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Analysis of Student's Learning Outcomes and Scientific Literacy Activities Using Guided Inquiry and Discovery Learning

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Abstract: *This research aims to find out whether the Guided Inquiry learning model is better than Discovery Learning in improving scientific literacy activities and student learning outcomes on reaction rate material. The research method used is quasi-experimental. The sample from this research consisted of two classes, namely experimental class I which was taught using the guided inquiry learning model and experimental class II which was taught using the Discovery Learning learning model. The results of data analysis show that the average learning outcomes and scientific literacy activities of students using the Guided Inquiry model are respectively (80.69) and (79.15) higher than the average learning outcomes and scientific literacy activities of students using the Discovery model. Learning respectively (74.63) and (73.72). Hypothesis results using the right-hand t test and* $\alpha = 0.05$ *obtained* $t_{count} > t_{table}$ *(2.34 > 1.675) for students' scientific literacy activities and* $t_{count} > t_{table}$ *(2.49 > 1.675) for student learning outcomes so that in this study the hypothesis the null (Ho) is rejected and the alternative hypothesis (*H_2*) is accepted. Thus, it was found that the Guided Inquiry learning model was better than Discovery Learning in improving scientific literacy activities and student learning outcomes on reaction rate material.*

Keywords **:** *Learning Outcomes, Scientific Literacy, Discovery Learning, Guided Inquiry, Reaction Rate*

INTRODUCTION

Education is one of the keys to advancing and educating humans. Quality education can create quality human resources (Cholifah & Novita, 2022). One of the efforts to change education is by making changes to the curriculum in stages by applying models and methods innovative learning. The emphasis on implementing the revised 2013 curriculum is student-centered *learning*. However, in reality, the teaching and learning process that is still often carried out in schools in chemistry subjects is teacher-centered learning, resulting in students tending to be passive in class so that' scientific literacy activities are lacking, which causes student learning outcomes. low education (Erlidawati & Habibati, 2020).

Sutiani, et al (2021) stated that one of the competencies that students must have after studying chemistry is being able to apply the topics they study to solve relevant problems and adapt chemical concepts, especially the concept of reaction rates, to real situations related to everyday life. Thus, students must master scientific literacy activities to improve their ability to analyze, evaluate, synthesize and determine information that is relevant to daily needs (Ginting et al., 2022). Students' scientific literacy activities are very important in the learning process, especially in chemistry, the subject of reaction rates. Reaction rate material is chemical material that can train scientific literacy skills, namely the factors that influence reaction rates. This material is quite difficult where students are required to be able to understand abstract concepts, prove theories through experiments and there is a focus on learning on students who are required to be active in discovering or solving scientific issues that are often found in everyday life through methods. scientific (Pamularsih, 2019) .

One of the causes of low student learning outcomes is low scientific literacy activities, where this occurs due to the inappropriate use of learning models so that they do not facilitate the development of students' scientific literacy (Fatmawati & Utari, 2015).

Based on the results of initial observations at SMA Negeri 2 Medan, students' scientific literacy activities in chemistry material are still less active in learning, and less able to connect one concept with other concepts so that students' interest in studying chemistry is reduced as indicated by poor student chemistry learning outcomes low .

The appropriate learning model for increasing students' scientific literacy activities is guided inquiry and discovery learning, where in these two models there is a focus on learning on students who are required to be active in finding or solving a scientific issue through scientific methods and stages of scientific literacy learning in line with syntax. of the two models. Apart from that, these two models can also be applied to all classes/levels and are more oriented towards students' active thinking, as well as providing opportunities for students to determine their own concepts by solving problems, with a problem-solving process through scientific methods so that they can support students' scientific literacy activities.

Syntax of the guided inquiry learning model according to Liewellyn (2013) namely: (1) orientation; (2) formulate the problem; (3) formulate a hypothesis; (4) formulate data; (5) testing hypotheses; (6) formulate conclusions (Llewellyn, 2013). Meanwhile, the syntax of the discovery learning model is: (1) providing stimulation; (2) problem identification; (3) data collection; (4) data processing; (5) proof and (6) draw conclusions. Judging from the syntax of the two models, the guided inquiry model emphasizes the formulation of a hypothesis first and then the hypothesis is tested, where with this, students will be trained in reading and gain new knowledge in order to be able to formulate their hypothesis . This is what will make students active in searching for and discovering their own knowledge or concepts.

Use of the Inquiry learning model Guided Inquiry is one solution to improve quality current chemistry learning at the school because of the model Guided Inquiry learning has the characteristics of conducting experiments will train students to improve science process skills and learning outcomes they (Juniar et al., 2019).

This learning has a better impact in practicing scientific literacy than conventional learning. This is also reinforced by research by Imansari, Sudarmin, & Sumarni (2018) that the application of the inquiry learning model can train students' chemical literacy activities (Ain & Mitarlis, 2020) . Apart from that, research by Ginting, et al (2022) states that the discovery learning model emphasizes the importance of students being scientific and playing an active role in discovering concepts or principles that they have not previously discovered independently (Ginting et al., 2022).

The advantage of this research is that it measures students' learning outcomes and scientific literacy activities using 2 models. The model used is the guided inquiry learning model and *discovery learning* . Meanwhile, previous research, namely research (Imansari et al., 2018) only used 1 model to measure students' scientific literacy activities. Apart from that, Nurfauziah's (2016) research used 2 models, namely the guided inquiry model and discovery learning , but only measured learning outcomes. Apart from that, Sitti Utami Medianty, Amrul Bahar, Elvinawati (2018) used 2 models but measured learning activities and student learning outcomes, not students' scientific literacy activities (Utami et al., 2017).

LITERATURE REVIEW

The learning model is strategies based on theories and research consisting of rationale, a set of steps and actions carried out by teachers and students, learning support systems and methods evaluation or learning progress assessment system students. Learning models describes essentially the whole what happens in learning from the start at the beginning, during, and at the end of learning for not only teachers but also students (Sunandari, 2015) .

One learning model that involves student activities finding the concept itself is by guided inquiry model. Inquiry models This guided guide is an application of constructivism based learning on scientific observation and study . So the inquiry model is guided suitable used for chemistry learning Students can play an active role and act like scientists in discovering chemical concepts (Malau & Juniar, 2020).

Discovery Learning Models is a model that directs students to determine something in learning activities. Students are directed to become accustomed to being scientists, playing an active role and even becoming actors who create knowledge. The principle of the Discovery Learning Model is that students are asked to identify things they want to know and then search for information themselves to form an understanding as an output (Yunsyahana et al., 2022). Discovery learning is a framework for creating active learning techniques through introspective selfreflection and exploration, ensuring that the outcomes are retained in memory (Agustina et al., 2023).

According to Dimyati and Mujiono (2002) "Learning outcomes are the result of something interaction of learning actions and teaching actions. From the teacher's side, the teaching act ends with the process of evaluating learning outcomes. From the side students, learning outcomes are the end experience and the culmination of the learning process" (Marpaung & Sutiani, 2020). Learning objectives for students generally include behavioral modifications in the cognitive, emotional, and psychomotor domains (Sudjana, 2014). 1) Internal factors, such as physical and psychological factors, and 2) External factors, such as family and school factors, are the factors that have an impact on learning outcomes (Panggabean et al., 2023).

In general scientific literacy has several components, components These are: (a) able to differentiate which are scientific contexts and which are not science context, (b) understand the parts from science and have a general understanding science applications, (c) have the ability to apply deep scientific knowledge problem solving, (d) understand characteristics of science and understanding relation to culture, (e) knowing benefits and risks posed by science (Komariah et al., 2017).

METHODS

This research was carried out at SMA Negeri 2 Medan, located at Jl. Karang Sari No. 435, Sari Rejo, District. Medan Polonia, Medan City, Prov. North Sumatra in the odd semester of the 2023/2024 academic year. The population in this study were all students in class XI Science at SMA Negeri 2 Medan for the 2023/2024 academic year, consisting of 9 classes. The samples in this study were 2 classes, namely class Where each class sample was given different treatment.

This type of research is quantitative research. Where quantitative research is a type of research to obtain data in the form of numbers (scores, values) or statements that are assessed and analyzed using statistical analysis. The data collection technique in this research was through multiple choice tests and observation sheets on students' scientific literacy activities.

RESULTS AND DISCUSSION

Descriptive Research Result Data

a. Student learning outcomes

Based on the calculation results, statistical data on student learning outcomes in experimental class I and experimental class II were obtained which are summarized in Table 1.

Table 1. Statistical Data on Student Learning Outcomes

Data	Statistics	Class	
		Experiment 1	Experiment 2
Pretest	Average	27.93	30.19
	Standard Deviation	8,713	9.95
	Variance	75,924	99
	Smallest value	10	10
	Greatest value	45	45
Posttest	Average	80.69	74.63
	Standard Deviation	8,422	10.28
	Variance	70,936	105.63
	Smallest value	60	50
	Greatest value	95	90

The average pretest and posttest scores for experimental class I and experimental class II can be seen in Figure 1

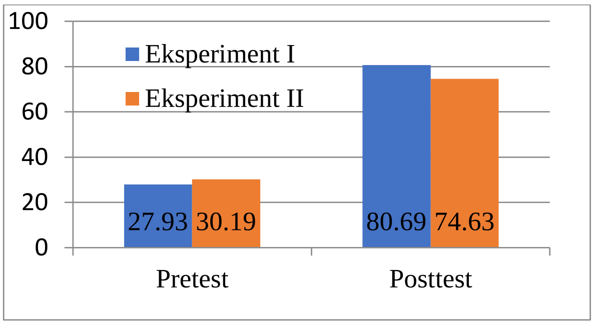


Figure 1. Pretest and Posttest Scores on Student Learning Results

Based on the calculation results obtained, it can be seen that the experimental class I which was taught using the Guided Inquiry model obtained an average learning outcome value (posttest) = 80.69, while the experimental class II which was studied using the Discovery Learning model obtained an average learning outcome value (posttest) = 74.63. So, from these results it can be concluded that student learning outcomes in experimental class I are higher than student learning outcomes in experimental class II.

b. Student Science Literacy Activities

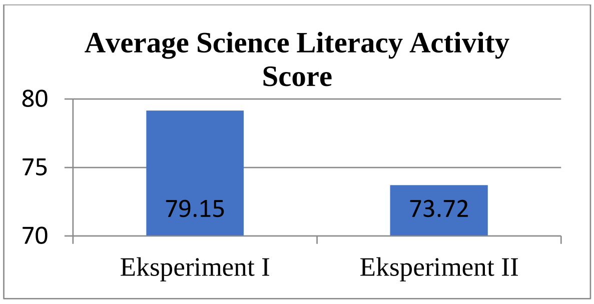
Based on the research results, after carrying out calculations, the average value of students' scientific literacy activities for experimental class I and experimental class II was obtained. A tabulation of the average students' scientific literacy activity scores can be seen in Table 2.

Table 2. Statistical Data on Students' Scientific Literacy Activity Values

Data	Statistics	Class	
		Experiment 1	Experiment 2
Value of Students' Scientific Literacy Activities	Average	79.15	73.72
	Standard Deviation	7,574	9,558
	Smallest value	62	52
	Greatest value	95	86

The average score of students' scientific literacy activities for experimental class I and experimental class II can be seen in Figure 2.

Figure 2. Data on Student Science Literacy Activity Values



Based on Figure 2, it can be seen that the experimental class I which was taught using the Guided Inquiry model obtained an average student scientific literacy activity score = 79.15, while the experimental class II which was taught using the Discovery Learning model obtained an average student scientific literacy activity score = 73.72. The scientific literacy activity scores of students in experimental class I were higher than the scientific literacy activity scores of students in experimental class II.

Research Data Analysis

a. Normality test

To find out whether the pretest and posttest data on learning outcomes and students' scientific literacy activity scores are normally distributed or not, a Chi-Square test is carried out at a significance level α= 0.05 with the Chi square criterion $(X^2)_{count} < (X^2)_{table}$ then it is stated data is normally distributed. The following are the normality values of pretest and posttest data on learning outcomes as well as the scientific literacy activity values of students in Experiment I and Experiment II classes.

Table 1. Results Data Normality Test

Class	Data	X^2_{count}	X^2_{tables}	α	Information
Experiment 1	*Pretest*	7.3	11.07	0.1	Normal Distribution
	Posttest	4	11.07	0.1	Normal Distribution
	Scientific literacy activities	10.4	11.07	0.1	Normal Distribution
Experiment 2	*Pretest*	5.4	11.07	0.1	Normal Distribution
	Posttest	6.69	11.07	0.1	Normal Distribution
	Scientific literacy activities	8.4	11.07	0.1	Normal Distribution

Based on Table 3 it is concluded that: Testing the normality of the pretest, posttest and scientific literacy activity data for experimental class I and experimental class II, it can be seen that the Chi Square value $(X_2) < (X^2)_{table}$, it can be concluded that the pretest, posttest and scientific literacy activity data for the class experiment I and the experimental class II has a Normal distribution.

b. Homogeneity Test

The homogeneity test is a parametric test carried out to determine whether student learning outcomes and students' scientific literacy activities in the two sample classes have homogeneous variance values. Data from the homogeneity test results can be seen in Table 4 below:

Table 4. Homogeneity Test Results Data

Class	Data	S^2	F_{count}	F_{table}	Information
Experiment I	Pretest	75.92	1.31	1.83	Homogeneous Data
Experiment II		99			Homogeneous Data
Experiment I	Posttest	70.94	1.49	1.84	Homogeneous Data
Experiment II		105.6			Homogeneous Data
Experiment I	Scientific literacy activities	57.36	1.59	1.85	Homogeneous Data
Experiment II		91.35			Homogeneous Data

Based on Table 4, it can be seen that in the learning outcomes data and students' scientific literacy activity data, the calculated F value $<$ F table with a significance level of α = 0.05 is consulted on the F distribution list with db = (29-1) (27-1) namely (28.26) is 1.83. Because the calculated $F_{value} < F_{table}$, it can be concluded that there is no difference in learning outcome data, namely pretest and posttest as well as student science literacy activity data for experimental class I and experimental class II or the data is homogeneous.

c. Hypothesis testing

Hypothesis testing is carried out to find out whether the alternative hypothesis (H_a) is accepted or rejected. The test criterion is if $t_{count} > t_{table}$ then the alternative hypothesis is accepted and the null hypothesis is rejected.

- **Hypothesis Test 1**

The hypothesis test that will be tested is a hypothesis test to see that the Guided Inquiry learning model is better than Discovery Learning in increasing students' scientific literacy activities on reaction rate material. Hypothesis 1 test results data can be seen in Table 5 below:

Table 5. Hypothesis Test Results 1

Class	Average	S^2	t_{count}	t_{table}
Experiment I	79.15	57.36	2.34	1,675
Experiment II	73.72	91.35		

Based on the hypothesis testing carried out, t_{count} = 2.34 and from the t distribution data it was obtained: t_{table} = 1.675, so the $t_{count\ value} > t_{table}$ (2.34 > 1.675). In the sense that Ho is rejected and Ha is accepted, the Guided Inquiry learning model is better than Discovery Learning in increasing students' scientific literacy activities on reaction rate material.

- **Hypothesis Test 2**

The hypothesis test that will be tested is a hypothesis test to see that the Guided Inquiry learning model is better than Discovery Learning in improving student learning outcomes in reaction rate material. Hypothesis 2 test results data can be seen in Table 6 below:

Table 2. Hypothesis Test Results 2

Class	Average	S^2	t_{count}	t_{table}
Experiment I	80.69	70.94	2.49	1,675
Experiment II	74.63	105.63		

Based on the hypothesis testing carried out, $t_{calculated}$ = 2.49 and from the t distribution data it was obtained: t_{table} = 1.675 so that the calculated t_{value} > t_{table} (2.49 > 1.675). Thus, the criteria for testing the hypothesis at $t_{count} > t_{table}$ are met, meaning that Ho is rejected and Ha is accepted, which means that the Guided Inquiry learning model is better than Discovery Learning in improving students' learning outcomes on reaction rate material .

- **Hypothesis Test 3**

The hypothesis test that will be tested is a hypothesis test to see whether there is a significant correlation between scientific literacy activities and student learning outcomes taught using the Guided Inquiry and Discovery Learning models. Hypothesis 3 test results data can be seen in Table 7 below:

Table 7. Hypothesis Test Results 2

Class	r_{xy}	r_{table}	Information
Experiment I	0.974	0.361	Positive Correlation
Experiment II	0.739	0.362	Positive Correlation

Calculated value of r = 0.974 obtained by consulting the product moment point value with N = 30 at the real significance level of α = 0.05 obtained r_{table} = 0.361. Because $r_{count} > r_{table}$ then Ho is rejected. So it can be concluded that there is a positive and significant correlation between learning outcomes and students' scientific literacy activities which are taught using the guided inquiry model on reaction rate material and the calculated r_{value} = 0.739 obtained is consulted to the product moment point price with N = 27 at the real significance level α = 0.05 obtained r_{table} = 0.381. Because $r_{count} > r_{table}$ then Ho is rejected. So it can be concluded that there is a positive and significant correlation between learning outcomes and students' scientific literacy activities taught using the discovery learning model on reaction rate material.

DISCUSSION

This research began by giving an initial test (pretest) to the two predetermined class samples. Then each class is taught with a different learning model. In experimental class I, namely (class in terms of validity, reliability, level of difficulty, and differentiation. The use of the pretest is to determine students' initial abilities and to determine the model that will be used in that class. After the pretest was carried out, treatment was given to each experimental class using a different model. The pretest results obtained in experimental class I (guided inquiry model) were 27.93, while the pretest results for experimental class II (Discovery Learning model) were 30.19. From these results it was found that the pretest results in experimental class I were lower than the pretest results in experimental class II, and these results showed that both classes had very low initial abilities. Based on these results, the guided inquiry model was used for lower pretest results, namely in experimental class I, while the discovery learning model was used in experimental class II. After the pretest was carried out, a learning process was carried out where in the experimental class I the reaction rate material was taught using the guided inquiry model and in the second experimental class the reaction rate material was taught using the discovery learning model.

At the third meeting, namely on the sub-topic of factors that influence reaction rates, each class was formed into 6 groups and then students were given worksheets that had been validated by the validator to carry out the practice that had been prepared by the researcher. During the practicum, students' scientific literacy activities were observed by observers. There were 3 observers in each experimental class, where each observer observed 2 groups totaling 12 students. Meanwhile, researchers supervise, guide and direct students in carrying out practicums.

At the end of the research, a final test (posttest) was given to measure student learning outcomes after treatment. Based on the results obtained, the posttest data and students' scientific literacy activities were processed and obtained an average of students' posttest and scientific literacy activities in experimental class I of 80.69 and 79.15 respectively. Meanwhile, the average posttest and scientific literacy activities of students in experimental class II were 74.63 and 73.72 respectively. Based on the average results, it can be seen that the average posttest and scientific literacy activities of students in classes taught using the guided inquiry learning model are higher than the discovery learning model. This is also in accordance with research conducted by (Rahmi et al., 2020) who said that the results of his research showed that class XI IPA 1 with guided inquiry treatment was superior to class research process. Apart from that, based on research (Permatasari et al., 2018), from the results of the N-Gain test, the learning outcomes in the guided inquiry model are higher than those in the discovery learning model, namely 0.71 for the guided inquiry model and 0.57 for the discovery learning model.

From the obtained values of student learning outcomes and students' scientific literacy activities, after being tested using the data analysis requirements test, the learning outcome value data and scientific literacy activity value data of experimental class I and experimental class II students were normally distributed and homogeneous . Testing the normality of pretest, posttest data and scientific literacy activities for experimental class I and experimental class II, it can be seen that the Chi Square value $(X^2)_{calculated} < (X^2)_{table}$, it can be concluded that the pretest, posttest data and student literacy activities for experimental class I and The experimental class II has a Normal distribution. For the homogeneity test, it is obtained that $F_{count} < F_{table}$, it can be concluded that there is no difference in the learning outcome data, namely pretest and posttest as well as student science literacy activity data for experimental class I and experimental class II or the data is homogeneous.

Next, the first hypothesis test was carried out, namely using the right-hand t-test to determine the higher value of scientific literacy activities between the guided inquiry learning model or the discovery learning model. The results of hypothesis testing I obtained $t_{count} > t_{table}$ (2.34 > 1.675) thus the hypothesis testing criteria a $t_{count} > t_{table}$ were met, which shows that Ho was rejected and Ha was accepted, namely the Guided Inquiry learning model is better than Discovery Learning in improving students' scientific literacy activities on reaction rate material. The results of the second hypothesis test were obtained, the value of $t_{count} > t_{table}$ (2.49 > 1.675) thus the hypothesis testing criteria at $t_{count} > t_{table}$ were met, which shows that Ho was rejected and Ha was accepted, namely the Guided Inquiry learning model is better than Discovery Learning in improving student learning outcomes in reaction rate material. This is also in accordance with research conducted by (Oktaviana et al., 2020). Based on the results of the research that has been carried out, it can be concluded that: (1) The guided inquiry learning model is effective in increasing student activities and learning outcomes. The magnitude of the influence of the effectiveness of the guided inquiry model on students' cognitive learning outcomes is 16% (Oktaviana et al., 2020) .

The results of hypothesis test III obtained that the calculated $r_{value} > r_{table}$ (0.974 > 0.036) which shows that Ho is rejected and Ha is accepted, namely that there is a positive and significant correlation between learning outcomes and students' scientific literacy activities which are taught using the guided inquiry model on the material of reaction rate and price. $r_{count} > r_{table}$ (0.739 > 0.381) which shows that Ho is rejected and Ha is accepted, namely that there is a positive and significant correlation between learning outcomes and students' scientific literacy activities which are taught using the discovery learning model on reaction rate material.

Even though this research was successful in improving students' learning outcomes and scientific literacy activities, individual completion cannot be said to be 100% complete because there were several students in both experimental class I and experimental class II whose posttest scores had not yet reached the KKM (Minimum Completion Criteria) score of 70 for studying chemistry at the school. In experimental class I there were 2 people who did not pass the KKM score while in experimental class II there were 7 students who did not pass the KKM, namely 70. This can be attributed to factors that cause students not to be able to meet the KKM namely the level of difficulty of the subject matter being tested is different for each student, the student's lack of attention during learning, the student's intellectual level is still lacking and less able to work together and less able to solve problems related to the learning material.

The roles of teachers and students in the two experimental classes are different, but both require students to be active. This is in accordance with research (Pratama & et al, 2015). Overall, guided inquiry learning has been quite effective. This can be seen from the enthusiasm of students in participating in learning. Many students who were originally passive in learning activities have become active. In experimental class I, which is taught using the guided inquiry model, the teacher's role is to guide and supervise students in investigating problems that have been provided previously and the stages of solving them. Meanwhile, in the experimental class II, namely those taught using the discovery learning model, the teacher's role is to give more attention to students in searching, discovering and formulating concepts in the learning material.

According to Khofiyah, et al (2019) that in the Discovery Learning model requires more time because in discovery activities students have to focus on processing data and carrying out verification and discussions. Meanwhile, the role of students who are taught using the guided inquiry model is to carry out real activities to solve problems and are required to investigate the problems presented. When they feel confused about the direction of the investigation, the teacher continues to direct the student. This is in accordance with research by Guritno, et al (2015) that when implementing the guided inquiry learning model, the teacher provides extensive instructions regarding topics and material as discussion material through questions. Students get more instructions from the teacher so that students do not use their own knowledge purely in solving problems. According to Anggraeni & Hidayah, (2019) the inquiry model is considered a form of learning model that is suitable for training students to solve problems that exist in everyday life.

CONCLUSION

Based on the results of the research that has been carried out, the following conclusions were obtained: The Guided Inquiry learning model is better than Discovery Learning in increasing students' scientific literacy activities on reaction rate material with $t_{count} > t_{table}$ (2.34 > 1.675). The Guided Inquiry learning model is better than Discovery Learning in improving student learning outcomes in reaction rate material with $t_{count} > t_{table}$ (2.49 > 1.675). There is a positive and significant correlation between learning outcomes and students' scientific literacy activities taught using the guided inquiry model on reaction rate material with $r_{count} > r_{table}$ (0.974 > 0.036) and there is a positive and significant correlation between learning outcomes and students 'scientific literacy activities. studied using the discovery learning model on reaction rate material with calculated $r_{count} > r_{table}$ (0.739 > 0.381).

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