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IMPLEMENTATION OF AN GUIDED INQUIRY LEARNING MODEL IN THE REACTION RATE THEORY TO IMPROVE THE STUDENT CREATIVE THINKING SKILLS

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Abstract: This study aims to analyze the implementation of guided inquiry learning, student activities, students' creative thinking skills, and student responses after the guided inquiry model implementation on the reaction rate theory. The investigation uses a quantitative descriptive method with a one-group pretest-posttest design. The data collection method used the observation method, and the tests were tested using the normality test, Paired Sample T-Test, and n-gain. The subjects of this study were the eleventh-grade student at SMAN 7 Kediri, East Java, Indonesia. It shows that guided inquiry learning to improve creative thinking skills has been carried out well. Students use 16% of the time at meeting 1 and 15% at meeting 2 to practice fluency. 23% and 26% at meetings 1 and 2 to practice flexibility, and 11% of meeting time 1 and 8% of meeting 2 is used to practice elaboration. The students' creative thinking skills increased from before and after applying guided inquiry. There were 8 students categorized as quite creative and 24 others less creative before the learning was carried out. After learning, as many as 11 students were categorized as creative, and 21 others were very creative.

Keywords: *Guided Inquiry, Creative Thinking Skills, Reaction Rate Theory.*

INTRODUCTION

The world is developing very rapidly today regarding science and technology. It triggers the effort to improve the quality of higher-quality human resources in Indonesia by improving the quality of education. The development of human resources can be indicated by students' ability to think correlatively, innovatively, actively, and critically. The 2013 Indonesian curriculum is directed to today's world developments. In the 2013 curriculum, students are emphasized to have social, spiritual, knowledge, and skills attitudes. It is the foundation to be able to develop the potential of students to have the ability to think reflectively in solving problems that exist in the environment or socially [1].

Science material has several branches of science, one of which is chemistry. It is a subject that requires complex skills to solve the issues of chemical concepts, theories, laws, or facts. The ability to think creatively in chemistry learning is essential for students. Because chemistry lessons not only memorize a concept, fact, or principle from an existing theory but also apply and develop a product that has never existed (new) from the theories obtained.

In Indonesia, students' creative thinking skills are still relatively low. Trends in International Mathematical and Science Study (TIMSS) in 2011 showed that Indonesia was in the 3rd lowest level of 32 countries [2]. The ability to think creatively can be interpreted as a process that produces a wide variety of ideas and answers to find a solution to a problem [3]. There are several indicators of creative skills. The first is fluency, flexibility, originality, and elaboration [4][5]. These four factors are essential in supporting students to compete in the current global era. One of the primary skills that must be possessed to face today's global challenges is called the 4C (Critical Thinking, Communication, Collaboration, and Creativity). Therefore, the importance of training students' creative thinking skills from an early age [6][7].

Our observation of the student pre-research questionnaire indicates that 27 out of 32 students stated that chemistry lessons were difficult to understand and abstract. It is due to several factors, including the learning process that is still teacher-centered, the lack of learning resources, and the pandemic. The world is currently in the Covid-19 pandemic, so learning in the classroom is limited. They have never done face-to-face learning during the pandemic, and learning is online. Based on teacher interviews, during online learning, students tend to be passive in the process of coaching and getting to know activities. The learning resources are also reduced because they do not get chemistry textbooks from schools but get online modules from chemistry teachers. This research shows that the training step is still carried out using the lecture method so that students cannot develop their creativity optimally and the lack of learning resources makes it difficult for them to learn and understand chemistry.

In the pre-research questionnaire, students expected a two-way discussion between students and teachers, questions and answers, and practicum. Therefore, we need a new learning model which can generate students' creative thinking skills so they can take an active role in the study case and improve learning outcomes. One of the training models we can use is the guided inquiry learning model. Guided

inquiry learning is very influential in students' achievement, creativity, and learning motivation cognitively, affectively, and psychometrically [8].

A guided inquiry is a learning model that trains scholars to put up their concepts [9]. Guided inquiry is a model in which the teachers act as mentors and facilitators to students. In guided inquiry, learners formulate problems, formulate hypotheses, create experiments to obtain data, collect and evaluate results, and make conclusions to find concepts studied to train students' thinking skills [10]. Guided inquiry can boost students to actively explore their knowledge to solve problems based on the data and facts [11].

Teaching students creative thinking skills, relevant learning models are needed, one of which is guided inquiry [12]. Guided inquiry is one solution to support students' creative thinking skills with the learning process, from problem formulation, hypothesis proposition, data collection, hypothesis testing, and making opinions. The learning series is expected to train students to develop creative thinking skills [13].

Based on the information above, the study focuses on analyzing the Effectiveness of Implementing Guided Inquiry Learning Models to Improve Students' Creative Thinking Skills in the Reaction Rate concept.

RESEARCH METHODS

This type of research uses a quantitative descriptive method that aims to describe a change resulting from treatment on the research subject [14]. This study included one class XI science group (experimental class). The experimental class will be tested using a guided inquiry to improve students' creative thinking skills with the reaction rate material [15]. It investigation was controlled during the odd semester of the 2021-2022 academic year at SMA Negeri 7 Kediri with the target the grade eleventh students.

The research uses the one group pretest-posttest design, which is used to quantify the learning outcomes of creative thinking skills with a guided inquiry in the following format [16]:

O_1	**X**	**O_2**

Description: O_1 = students pretest score; X= operation of guided inquiry to increase creative thinking skills; O_2= students posttest score

Before implementing the guided inquiry, it is *pretest* first in the experiment class. The application of the guided inquiry is carried out to liven up students' creative thinking skills. During the training process, the teacher observes the activity of students to test the value of student enterprise. And after the experimental class was over, a posttest was conducted to check the students' progress.

This research uses a syllabus, lesson plan, and student worksheets. The research instruments used were observation sheets to implement guided inquiry, observation sheets for student activities, and pretest and posttest sheets of students' creative thinking skills. The data collection arrangement in this study is the observation method, which aims to observe learning activities relevant to the syntax of the guided inquiry and tests for measuring students' creative thinking skills.

The research was conducted for 2 meetings which were carried out in 2 weeks. During 2 meetings, students were trained in creative thinking skills accepting a guided inquiry. Data analysis was analyzed by the guided inquiry's implementation sheets, student performance analysis, creative thinking ability analysis, and student response analysis. Then the n-gain test was carried out to see the improvement of students' creative thinking ability [17].

Data analysis to measure the response of the guided inquiry to improving creative thinking skills was performed using a Paired t-test. Before testing with the Paired test, the sample t-test data was tested first with the normality test. The normality test is normal if the Shapiro-Wilk sig value is > 0.05 and will be abnormal if the Shapiro-Wilk value is < 0.05. Then the Paired Sample t-test, which has been done on the average pretest and posttest scores that had been carried out. Paired test Sample t-test is accepted if the price of sig (2-tailed) < 0.05. And is not approved if the value of sig (2-tailed) > 0.05 [10][18].

RESULTS AND DISCUSSION

Implementation of the Guided Inquiry Learning Model

Implementing the guided inquiry aims to resolve the cause of syntax of the utilization of learning models that have not been applied to previous learning to increase students' creative thinking ability. The implementation of learning in this exploration was carried out face-to-face, although in limited circumstances due to the Covid-19 pandemic with strict health protocols. In the first meeting, a guided inquiry learning model was carried out with creative thinking skills to teach the factors of reaction rate effect, namely surface area, and concentration. The second meeting carried out the implementation of guided inquiry to advance students' creative thinking skills with the next reaction rate factor, namely temperature, and catalyst.

During the learning process, three observers were joined as learning data collectors. The three observers observed and filled out the experience sheet on the employment of the guided inquiry, which obtained the average data as shown in Figure 1. Figure 1 shows that the learning process was performed twice over two weeks. Training is

performed according to the syntax of the guided inquiry.

Phase 1, presenting questions or problems to students, gets an average implementation at meeting 1 and 2 are 80% and 87.5, respectively. Phase 2, making hypotheses to get an average of 100% at meetings 1 and 2. Phase 3, design an experiment with a percentage value of 100% at meetings 1 and 2. Phase 4, experiments to obtain information, has an implementation value of 87.5% at meetings 1 and 2. Phase 5, collects and analyzes data obtaining a mean value of 100% at meeting 1 and 2. And phase 6 makes a conclusion worth 87.5% at meeting 1 and 100% at meeting 2.

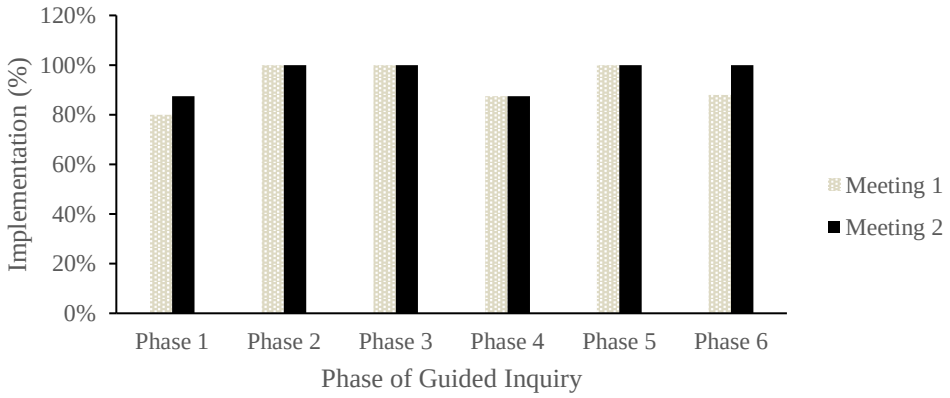

Figure 1. Implementation of the Guided Inquiry

The test of the application of the guided inquiry could be used regarding Table 1.

Table 1. Criteria for Limiting Guided Inqury Learning Management

Percentage	Relationship Level
0% - 20%	Not much
21% - 40%	Not enough
41% - 60%	Enough
61% - 80%	Good
81% - 100%	Very good

The guided inquiry syntax is said to be implemented if the percentage obtained is 61% of the total score of syntax implementation [19].
Since the values from phase 1 to phase 6 are more than 61%, we can complete that the guided inquiry learning syntax is carried out well and very well.

Student Activities

Student activities can be analyzed based on the student activity observation sheet observed by 3 observers. Observation of student activities aims to determine student activities related to creative thinking skills during the guided inquiry learning process.

According to the instructional request, figure 2 indicates that the student's creative thinking abilities were realized in the learning process. The activity results obtained in each component are 16% of the time for students to practice fluency at meeting 1 and 15% at meeting 2. In the flexibility component, 23% of the time for practicing at meeting 1 and 26% for meeting 2. 11% students practice elaboration at meeting 1 and 8% of meeting 2.

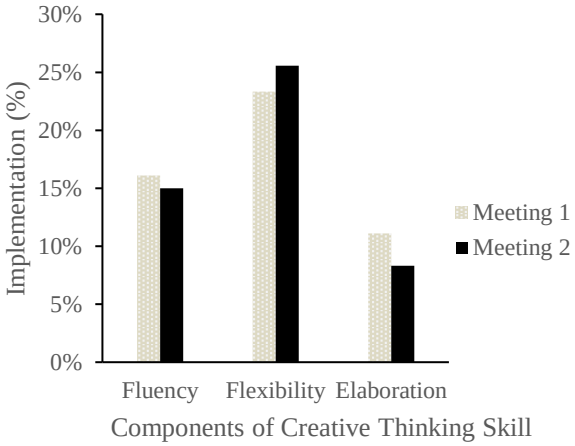

Figure 2. Percentage of Students' Creative Thinking Skills Activity

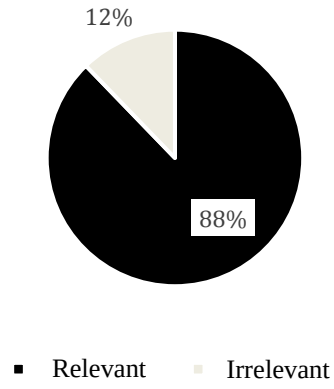

Figure 3. Student Activities

Student activities are categorized as good if the percentage of relevant activities reaches 61% [8]. Learning can be carried out well if the student-relevant activities are more significant than the student irrelevant activities. Figure 3 shows that the relevant activities of students are 88% higher than the irrelevant activities of students, which are only 12%.

Creative Thinking Skills

Learners' creative thinking ability in this study was trained using a guided inquiry learning model. In this study, the learning outcomes of students' creative thinking skills were measured by pretest and posttest sheets. The pretest and posttest sheets function to measure whether there is an increase in students' creative thinking skills before and after learning is finished. The evidence of the pretest and posttest will be compared and analyzed using the n-gain formula. Three aspects of students' creative thinking abilities are fluency, flexibility, and elaboration, as shown in Table 2.

Table 2. Pretest Details of Students' Creative Thinking Skills

Number of Students	Criteria
8	Pretty Creative
24	Less Creative

Table 2 shows that the eleventh-grade students at SMAN 7 Kediri City need to improve their creative thinking ability to adapt to the 2013 curriculum learning criteria. There are criteria for assessing creative thinking test results is depicted in Table 3.

Table 3. Criteria for Assessment of Creative Thinking Skills Test Results

Value Range	Criteria
0% - 20%	Not Creative
21% - 40%	Less Creative
41% - 60%	Pretty Creative
61% - 80%	Creative
81% - 100%	Very creative

Table 3 shows that students can be categorized as having the ability to think creatively if they have a minimum score of 61%. Table 2 indicates that many students still need to develop their creative thinking skills. A total of 8 students were categorized as quite creative, and 24 students were less creative. Learning is carried out by providing Student Worksheets to improve students' creative thinking have been adapted to the guided inquiry syntax and creative thinking skills. After they finished, they were asked to do a posttest to determine whether there was a development in creative thinking skills [20-22]. And the results of the posttest creative thinking skills are in view in Table 4.

Table 4. Posttest Results of Students' Creative Thinking Skills

Number of Students	Criteria
11	Creative
21	Very creative

Table 4 shows the student posttest results increasing after the model treatment was carried out. There are 11 students in the creative category and 21 students in the very creative category. It means that the creative thinking skills

of the eleventh-grade students have improved as a whole. It was tested through the n-gain test to obtain the data shown in Table 5.

Table 5. Results of the n-gain Pretest – Posttest Students

Number of Students	Category
4	Currently
28	Tall

From the result data in Table 5, students' creative thinking skills have improved well. The student's creative thinking ability is less than 4 at the intermediate level and 28 at the advanced level.

The difference in student learning performance before and after supervised learning with creative thinking ability can also be confirmed from the Paired Sample T-Test [23] in Table 6.

Table 6. Pretest Posttest Result Data for the eleventh-grade student

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	pretest	34.1563	32	10.48842	1.85411
	posttest	82.5000	32	3.01609	.53317

Table 6 shows that there is an improvement in the intermediate pretest and posttest. It means that before learning with the guided inquiry model, students' creative thinking skills have an average value of 34.1563. After learning with the guided inquiry model, the value of students has increased so that the average obtained is 82.5000.

Table 7 shows that it is familiar that the amount of sig (2-tailed) in the column is 0.000, which means that the value is less than 0.05. These data indicate that there are significant differences in learning outcomes between the pretest and posttest.

Another way to measure the effectiveness of the model to increase students' creative thinking skills can be done with the normality test contained in Table 8. If the sig value of Shapiro-Wilk > 0.05, then the data can be said to be normal, but if the sig value of Shapiro -Wilk < 0.05, then the data is not normal.

Table 7. Results of Calculation of Student Values with Paired Sample T-Test

Paired Samples Test									
		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	pretest - posttest	-48.34375	8.91758	1.57642	-51.55888	-45.12862	-30.667	31	.000

Table 8. Normality Test of Students' Pretest-Posttest

Tests of Normality							
		Kolmogorov-Smirnova			Shapiro-Wilk		
	class	Statistics	df	Sig.	Statistics	df	Sig.
student learning outcomes	pretest	.144	32	.090	.936	32	.057
	posttest	.140	32	.112	.958	32	.241
a. Lilliefors Significance Correction							

The data in the table is written if the sig value of Shapiro-Wilk > 0.05. In other words, it means that there is a significant difference in the students' results before and after a lesson with creative thinking abilities. The students' learning outcomes at the pretest had a sig value of 0.057 and the posttest 0.241. therefore, it can be concluded that these pre-and posttest values have a normal distribution.

Student Response Questionnaire

The student response questionnaire was done to know the student's response after the guided inquiry learning process was carried out. The student response questionnaire sheet was applied after being given learning. 96.88% of the 32 students felt that the learning model used was fun. 96.88% had been trained to formulate problems, 93.75% were trained to formulate hypotheses, collecting data, and draw conclusions. A total of 96.88% of students better understand reaction rate with the guided inquiry, are more active in learning and increase students' curiosity.

The results of observations based on students' questionnaire responses stated that they tend to be more active and enthusiastic about learning the material factors that affect the rate of reaction using a guided inquiry with creative thinking skills. They said that this was the first face-to-face meeting after several semesters of not doing face-to-face learning due to the Covid-19 pandemic. They said it was easier to understand the material when the lesson was done directly with the guided inquiry. During the learning process, they actively ask and argue. Their enthusiasm increased when they observed youtube videos about the practicum of reaction rate factors and then discussed analyzing the data obtained. Observations of youtube videos were conducted as a substitute for a practicum on reaction rate factors because it is currently still in a pandemic period, so learning hours in class are reduced and limited. The practicum of reaction rate factors was replaced by observing practicum videos from youtube to shorten the time. So it can be concluded that students prefer the guided inquiry and can understand the reaction rate concept well.

CONCLUSION

In conclusion, the implementation of guided inquiry to enhance students' creative thinking skills in the reaction rate concept for The eleventh-grade student at SMAN 7 Kediri City has been appropriately finished as the syntax of guided inquiry. The activities of students showed relevant activities by 88% and irrelevant by 12%. Students can demonstrate an active attitude in learning. They have a good attitude to improve their creative thinking skills. Fluency (16% for meeting 1 and 15% meeting 2), Flexibility (23% for meeting 1 and 26% meeting 2), and Elaboration (11% for meeting 1 and 8% meeting 2). Learning outcomes of students' creative thinking skills improved both before and after training. It can also be seen in the n-gain test result for students who got 4 students for the middle category and 28 others for the upper category. In the final evaluation test (posttest) of 32 students, there were 11 students in the creative category and 21 in the very creative category. These results are much better when compared to the results of the pretest of 8 students in the quite creative category while the other 24 are in the less creative category. When viewed based on the student response questionnaire,

they liked the guided inquiry. Students can take an active role in discussions to improve their creative thinking abilities and make it easier to understand the material on reaction rate.

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