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The Influence of Guided Inquiry Learning Models on Students' Creative Thinking Abilities on Reaction Rate Material

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Abstract: This research examines the effect of the guided inquiry learning model on students' creative thinking abilities, focusing on studying chemical reaction rate material in Class XI Science at SMAN 4 Praya. This research adopts a quantitative research design with a quasi-experimental research type. The population in this study were all class XI MIPA students at SMAN 4 Praya, consisting of 237 people spread across 7 classes. The sampling technique uses non-probability sampling, seeing a similarity in students' average daily test scores with students in classes XI IPA 3 as the control class and XI IPA 6 as the experimental class. The experimental group was given a guided inquiry learning model, while the control group used conventional teaching methods. This research assesses creative thinking abilities through a description test including three indicators: originality, fluency, and flexibility. In this research, the data analysis technique uses a series of statistical tests, including the Kolmogorov-Smirnov normality and homogeneity tests. Hypothesis testing uses the independent sample t-test. The hypothesis test showed that the t-test results prove that $t_{count} \geq t_{table}$, namely $4.31 \geq 2.03$, and a significant value of $0.00 > 0.05$, then H_0 is rejected, and H_1 is accepted. Thus, it can be concluded that the guided inquiry learning model positively affects students' creative thinking abilities in the reaction rate material for class XI Science at SMAN 4 Praya. This can also be seen from the results that the average value of the experimental group is higher than the control group's, with the experimental class's average value being 79.03% and the average value of the control class being 62.42%.

Keywords: Creative Thinking Skills; Guided Inquiry Learning; Learning Model; Reaction Rate.

Introduction

Chemistry is a science that studies the composition, structure, and properties of substances or materials, as well as the changes and interactions that form materials found every day [1]. In chemistry, there are several problems related to life phenomena. Phenomena in life, the object of chemical study, consists of the complex relationships between events, which ultimately become facts, theories, concepts, and chemistry principles [2].

Reaction rate is one of the chemistry subject matter studied by class XI SMA/MA students in the odd semester. This material has basic competency 3.6, explaining the factors influencing reaction rates using collision theory. Reaction rate is one of the chemistry materials that students often consider difficult. This difficulty usually arises because this material requires a deep understanding of abstract concepts and the ability to apply these concepts in analyzing facts or phenomena in real life. This is supported by research by Rhaska & Mawardi [3], which shows that the material on reaction rates is one of the materials whose concepts are not well understood by students because this material consists of factual, conceptual, and procedural knowledge. The above is also reinforced by research by Palajukan et al. [4], which states that reaction rate is a chemical material that students consider difficult because it requires students' ability to analyze facts or phenomena in real life.

Learning chemistry about phenomena in real life requires real teaching. It provides learning experiences to students so that abstract concepts can be proven and students do not have difficulty understanding the concepts. This follows research by Purnomo et al. [5], which states that the reaction rate contains several phenomena that require students' creativity in thinking, for example, fruit and vegetable rotting when placed in an open space and cutting meat when cooked. An understanding of chemical concepts is essential in the process of solving chemical problems. Students' low understanding of concepts will cause students to have difficulty solving problems and not be able to achieve cognitive abilities at a higher level, so students' creative thinking abilities will also be low [6].

The ability to think creatively is the skill of generating ideas or thoughts to solve problems in ways that are diverse and different from those that existed before [7]. Creative thinking can help someone see issues from various points of view and create more innovative solutions [8]. According to Rizal et al. [9], most schools do not encourage students to expand their thinking by developing new ideas, so students tend to listen without thinking about what to do to understand the information the teacher conveys.

SMAN 4 Praya is a school that applies the 2013 curriculum, but learning at this school still uses the lecture method, especially in chemistry lessons, so students' higher-level thinking abilities are rarely trained. Based on the results of observations in chemistry learning in class learning and problem-solving discussions, learning seems

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more natural because the teacher still uses conventional learning models [10]. Apart from that, the material juPurnomoga teaches is rarely related to applying concepts in everyday life and is more likely to provide practice questions that emphasize aspects of knowledge and understanding [11].

Based on the results of interviews conducted with chemistry teachers at SMAN 4 Praya, information was also obtained that chemistry learning activities were still teacher-centered (teacher-centered learning), which did not train students in creative thinking. Chemistry learning at SMAN 4 Praya is more dominant by providing material summaries and practice questions, so they are used to learning by rote and are less able to develop the concepts they already have. Learning activities like this tend to make students only obtain information from the teacher without reprocessing the information, so students' creative thinking abilities and learning outcomes are low.

The ability to think creatively has a significant influence on student learning outcomes because this helps students have the ability to see a problem from various points of view and be able to generate many ideas [12-13]. Therefore, students' creative thinking abilities can be seen from their learning results. Low learning outcomes indicate a tendency for students to have less creative thinking abilities.

The low level of students' creative thinking abilities can be seen from their attitudes, which tend to be passive, and their difficulty in answering questions containing analysis of chemical problems in life. Therefore, a guided inquiry learning model is needed because it can connect chemistry learning with everyday life and train students' creative thinking abilities. According to Qodratullah et al. [14], the guided inquiry model learning process emphasizes students' creative thinking abilities in solving problems independently using their knowledge.

The guided inquiry learning model is a model that requires students to be able to solve problems by utilizing the knowledge that students have to apply it in real life. This model is suitable for use in chemistry related to everyday life, such as reaction rates. The reaction rate contains several phenomena that require students' creativity in thinking, for example, rotting fruit and vegetables placed in the open or cutting meat when cooked [5]. Based on this, the guided inquiry model is needed to train students' creative thinking abilities in analyzing and concluding the results of their thinking related to the problems being studied. This model can train students directly to think creatively and analytically search for and find answers to a problem.

The model also allows the teacher to guide students in activities by asking initial questions and leading to discussion. Teachers are active in determining problems and the stages of solving them so students can carry out the inquiry process independently [15]. Thus, teachers are expected to guide students in learning according to their learning style so that students can develop their creative ideas. Based on this description, research needs to be carried out regarding the influence of the guided inquiry learning model to improve the creative thinking abilities of class XI Science students on reaction rate material at SMAN 4 Praya.

Research Methods

This research uses a quantitative approach with this type of design quasi-e x specimen tal. The research design used was a post-test-only control group design. In this design, the experimental class is given treatment using the guided inquiry learning model, while the control class uses conventional learning. After the treatment, both classes were given a post-test to measure students' creative thinking abilities.

The population in this study consisted of all students of class XI Science at SMAN 4 Praya, which consisted of 7 classes with 237 students. Sampling was carried out using a purposive sampling technique. Based on the similarity of students' average daily test scores, class XI IPA 3 was selected as the control class, and class XI IPA 6 as the experimental class, each with a total of 33 students.

The instrument used in this research was a description/essay test to measure students' creative thinking abilities. The test consists of 3 questions, which include indicators of fluent thinking, flexible thinking, and original thinking. Apart from that, observation sheets of teacher and student activities are also used during the learning process. This research instrument has been tested for construct validity, content validity, and reliability. Expert/construct validity test by 2 chemistry education lecturers at FKIP Unram and 1 teacher at SMAN 4 Peraya. The results of the construct validation test showed that the creative thinking ability test instrument and teacher and student activity observation sheets fall within the very valid criteria, with average scores of 89.78 and 93.33, respectively. The content validity test of the creative thinking ability test on 3 indicators is calculated using the product moment formula with r_{table} at a significance level of 5% and n = 35 is 0.33. Thus, 3 indicators were obtained and declared valid with $r_{count} > r_{table}$. The reliability test n Cronbach's Alpha value is 0.79 > 0.33 or within the range of reliability coefficient values between 0.60-0.80, so it can be concluded that the instrument regarding creative thinking abilities is declared reliable with a high classification.

Data on students' creative thinking abilities was obtained from the post-test results given to the experimental and control classes. Meanwhile, teacher and student activity data was obtained from observations during the learning process. Data from the post-test results on students' creative thinking abilities were analyzed using the t-test after fulfilling the prerequisite tests for normality and homogeneity. Hypothesis testing is carried out at a significance level of 5%. In addition, teacher and student activity data were analyzed quantitatively and descriptively.

Results and Discussion

Implementation of Learning

The learning was carried out in each class in 5 meetings, including post-test activities with a time allocation for each meeting of 90 minutes (2 lesson hours) where the MIPA 6 class was the experimental class. In the experimental class, treatment was given, namely applying the guided inquiry learning model in the learning process. The guided inquiry learning model is a learning model that has 6 learning stages (syntax), namely orientation, formulating problems, formulating hypotheses, collecting data, testing theories, and predicting. Students are divided into small groups, each comprising 5-6 students [16]. Group division follows the teacher's directions, meaning that each group formed cannot determine its own members.

At the first meeting, the learning process began by applying the guided inquiry learning model, introducing the learning model, and group division. The core activity begins with students reading the material and observing a simple, practical demonstration video of the effect of concentration on reaction rate. After observing a simple video demonstration, students are asked to formulate the problem, hypothesize, classify the appropriate tools and materials, and discuss it with their friends. On the first day in the experimental class, where the learning process adopted a guided inquiry model, some students still had difficulty adapting to this learning model. When working on Student Worksheets (LKPD) individually, some students had difficulty answering questions and were reluctant to join pre-determined groups. With inquiry learning, students' creative thinking must be developed by utilizing learning models, approaches, procedures, and learning links that can generate interest. So, it can be concluded that in inquiry learning, students can formulate problems correctly, create hypotheses, and classify tools and materials correctly.

The second meeting on applying the guided inquiry model was conducted with material on surface area factors. The learning stage is the same as the first meeting: reading the material and observing a simple practical demonstration video about surface area factors that can influence the reaction rate. After observing a simple practical demonstration video, students are asked to formulate problems, make hypotheses, classify the right tools and materials, and discuss with group friends. Compared to the previous day, several groups appeared to be more active in completing the practice questions contained in the Student Worksheet (LKPD) at this meeting. The aim of inquiry learning is that students can look for answers through creative thinking so that students can be more active in the learning process.

Therefore, the researcher controlled each group to encourage more active participation in learning and attempted to raise students' awareness to develop creative thinking abilities. In addition, researchers allowed random students to explain the results of their discussions, hoping that all students would be more motivated to understand the material and practice the questions discussed. This creative thinking ability must be developed because by thinking creatively, a person can put forward many ideas, has various ideas for solving a problem, and can provide satisfaction for himself, meaning that students are enthusiastic about participating in the learning process.

The third and fourth meetings on applying the guided inquiry model carried out material on temperature factors at the third meeting and material on catalyst factors at the fourth meeting. The learning stages are the same as the previous meeting, where students read the material and observe a simple practical demonstration video about surface area factors that can influence reaction rates. After observing a simple practical demonstration video, students are asked to formulate the problem, make a hypothesis, classify the appropriate tools and materials, and discuss it with their group friends.

At the fifth meeting, students were asked to study all the material given to answer the post-test. Next, a post-test was carried out to determine students' creative thinking abilities after learning using the guided inquiry model. The post-test questions given consisted of 3 essay questions. The post-test results obtained were used to test the hypotheses that had been created.

Implementing learning in the control class uses the conventional model, namely lectures and discussions. The learning process applied differs from the experimental class, but the material taught is the same at every meeting. At the first meeting, the learning process began with an explanation of the material by the researcher via PowerPoint, followed by providing example questions that the students answered together. Researchers offer opportunities to ask students questions and provide opportunities for students who want to take notes on the material that has been presented. Next, students are divided into groups of 5-6 people to discuss working on practice questions on the Student Worksheets that have been prepared. The results of the discussion of the practice questions were presented by one of the randomly selected students. The researcher clarified students' answers, allowed them to respond to other groups' presentations, and asked if there were still parts of the material they did not understand.

The researcher presented follow-up material from the previous meeting at the second meeting. When the researcher provided the opportunity to ask questions regarding the material offered, students stated that they understood, but no one asked. The researcher gave instructions to students to record all the explanations that had been given. Next, students are asked to do practice questions on the Student Worksheet with their group friends. While working on this question, several students asked about practice questions they did not understand, and the researcher immediately provided an explanation in front of the class regarding the meaning of the question. It can be seen that learning at this meeting went more smoothly and was more conducive than the previous meeting.

In the third and fourth meetings, the guided inquiry model was applied to explain the material on temperature and catalyst factors at the fourth meeting. The learning stages were the same as the previous meeting, where the researcher explained the material using PowerPoint and allowed students to ask questions and record the material. Students are asked to gather with their groups and work on the e-worksheet that has been prepared. One of the students is invited to present the group discussion results and conclude the overall results of the debate, which will be completed according to the teacher's directions.

At the fifth meeting, students were asked to study all the material given to answer the post-test. Next, a post-test was carried out to determine students' creative thinking abilities after learning using the guided inquiry model. The post-test questions given consisted of 3 essay questions. The post-test results obtained were used to test the hypotheses that had been created.

The analysis above shows that the creative thinking abilities of students who learn using the inquiry method are better than those who learn using conventional methods. This is because inquiry learning provides direct opportunities for students to think about solving problems during the learning process so that students can develop their thinking abilities through independent problem-solving activities [17,18]. Furthermore, through the inquiry learning model, Sulianti & Murdinono [19] will directly awaken students' critical thinking skills in solving problems individually and in groups [18]. Student activity in the learning process will give rise to intensive interaction between teachers, students, and subject matter. This will make learning conducive and provide opportunities for each student to explore their abilities optimally to improve their critical thinking abilities in learning [20,18].

This aligns with Anggraini and Syafitri [21], who said the inquiry learning model is better than conventional learning. Applying the inquiry learning model makes it easier to convey information to students so that the teaching and learning process becomes innovative and not dull. This learning pattern is more varied than the conventional learning model because students in the inquiry learning model class discuss and share to solve problems. In the learning process, there is openness between students and between students and teachers, and a question-and-answer process occurs. This is different from conventional learning, which prioritizes practice for students. In traditional learning, students also communicate less with their friends in the learning process in class. These passive activities impact students' weak knowledge absorption and low learning outcomes.

Hypothesis Test Results

Based on the results of the analysis prerequisite tests, namely the homogeneity test and data normality test, creative thinking ability, it is known that the creative thinking ability data from the two samples is homogeneous and normally distributed. Therefore, the hypothesis test used is the t-test using the SPSS program. The basis for independent sample t-test decision-making is as follows:

a) If the Sig value. (2- $_{\text{tailed}}$) < Research alpha (0.05), then H_0 is rejected, and H_1 is accepted.
b) If the Sig value. (2- $_{\text{tailed}}$) > Research alpha (0.05), then H_0 is accepted, and H_1 is rejected.

Table 1. Hypothesis Test Results Using T Test

		Levene's test for equality of variances		t-test for equality of means		
		F	Sig	Q	Df	S ig. (2-tailed)
Mark	Equal variances assumed	2.96	0.09	4.31	64	0.00
	Equal variances are not assumed.			4.31	60.80	0.00

Based on Table 1, the hypothesis results using SPSS version 24 obtained a t_{count} 4.31. It is known that the t_{table} with a sample size of 35 is 2.03, so the t test results prove that the $_{\text{calculated}}$ $_t \geq t_{table}$ is $4.31 \geq 2.03$ and the significant value is $0.00 < 0.05$, then H_0 is rejected and H_1 accepted. Thus, it can be concluded that the guided inquiry learning model positively affects students' creative thinking abilities in the reaction rate material for class XI Science at SMAN 4 Praya.

Students' Creative Thinking Ability

This research measures students' creative thinking abilities on reaction rate material. The creative thinking ability studied contained three indicators, namely, the ability to think fluently (fluency), think flexibly (flexibility), and think originality (originality). Before this creative thinking ability test instrument was given to the experimental and control classes, the researcher gave 3 validations. Essay items with instrument trials in class XI IPA 5 were completed by studying the reaction rate system material.

Researchers took data from 33 experimental and 33 control class students who took the post-test. From the experimental class, it was discovered that 14 students fell into the very creative category, 17 students into the creative category, and 2 students into the quite creative category. Furthermore, there were 5 students in the very creative category for the control class, 11 students in the creative category, 15 students in the quite creative category, and 2 students in the less creative category. A comparison of categories of students' creative thinking abilities in the experimental and control classes is shown in Figure 1.

Based on Figure 1, it can be seen that the majority of students in the experimental class fall into the creative (51.52%) and very creative (42.42%) categories, and only a small portion of students fall into the quite creative category (6.06%). Meanwhile, in the control class, most students fell into the quite creative category (45.45%), and 6.06% were in the less creative category. The rest fell into the creative (33.33%) and creative (15.15%) categories. This shows that the guided inquiry learning model can better train students' creative thinking abilities than conventional learning models. The results of this research are in line with the research results of Balga [22], Sulastri et al. [23], and Febrianti [24], where the guided inquiry learning model increases students' creative thinking abilities.

This study measured creative thinking ability using 3 indicators: the ability to think fluently, the ability to think flexibly, and the ability to think original. A comparison of student scores in 3 indicators of creative thinking ability is shown in Figure 2.

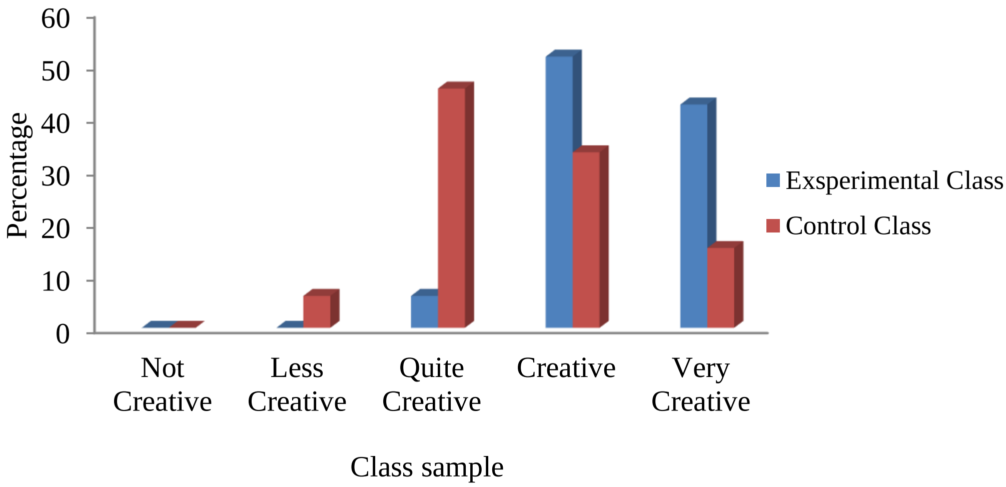

Figure 1. Categories of Students' Creative Thinking Ability

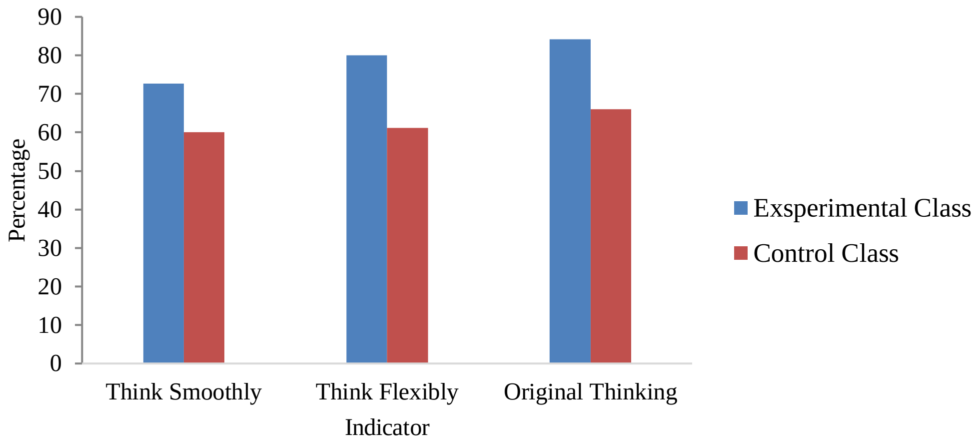

Figure 2. Comparison of Creative Thinking Ability Values for Each Creative Thinking Ability Indicator

Overall, it can be said that the three indicators of creative thinking abilities in the experimental class are better than those in the control class, with an average of the three indicators in the experimental class 79.03 and the control class 62.42.

The first indicator is the ability to think fluently. In this indicator, it is hoped that students will be able to answer with many relevant ideas. Based on the test results, there appears to be a difference in answers between the two classes with the experimental class 72.73 and the control class 60.00. This is because students in both classes could answer questions with many ideas. Fluency in creative thinking refers to the diverse (various) answers to problems that students make correctly. Learning in the experimental class uses a guided inquiry learning model with learning stages such as formulating a hypothesis, which can train students to provide various answers that are considered correct before determining the correct answer according to existing literature.

Indicators of fluency in creative thinking skills are related to the number of ideas or answers produced by students. Learning with this approach allows students to convey as many answers/ideas as possible. This aligns with context use, where students actively conduct context problem exploration activities to develop various problem-solving ideas. The fluency indicator is high, meaning the average student can generate many ideas/answers from the evaluation test [25].

Regarding flexible thinking ability indicators, it appears that there is quite a significant difference between the experimental and control classes. The experimental class had a very high level of creativity compared to the control class. This is because the guided inquiry learning model can provide an overview of students' thinking patterns. The learning process in the experimental class can foster students' creative thinking abilities on this indicator, and this is because learning in the experimental class with learning stages, such as collecting data, can train students to determine or classify the information or data needed according to the existing questions.

In line with Fajriah & Asiskawati [25], the number of ideas or answers produced by students is a measure of the flexibility of their creative thinking. The response should be diverse, not just large numbers. This can be shown in the way students answer problems in assessments. In reality, students can give multiple answers, but their answers may be the same or less diverse. Students have the opportunity to build their problem-solving skills, resulting in a variety of approaches. During learning, not all groups can provide more than one different method. However, group discussions can compensate for this weakness by offering opportunities for groups with various strategies to voice their viewpoints, resulting in new methods.

Weiss and Wilhelm [26] argue that one idea for understanding flexibility (think flexible) is to see it as a function of flexibility and persistence in a task. Both determinants are considered essential for creativity and can balance each other. Originality can then come from the number of categories generated in the task and from persisting in developing the ideas within the categories more deeply. Therefore, flexibility (and persistence) can be understood as concepts that promote the generation of a series of original ideas. Flexibility is considered a cognitive process that reflects the subject's ease of switching to different approaches or perspectives [26,27].

The third indicator is the ability to think original. In this indicator, it is hoped that students will be able to produce new/unique ways of thinking that already exist. The experimental class was more creative than the control class. This means that in the experimental class, students can better find a deeper meaning in the answers. The learning process in the experimental class can foster students' creative thinking abilities on this indicator because learning in the experimental class with learning stages, such as testing hypotheses, can train students to think differently from others.

In the aspect of originality, students participate in an active process to create innovative solutions to problems through their experiences [28]. Innovative means having the characteristics of novelty and renewal, meaning that the ideas expressed are entirely new or have not existed. Unique means different from other people; the idea expressed differs from most people's ideas and is not the same as other people's thoughts. Uniqueness is assessed based on the answers given by one student compared to other students' answers. Fajriah & Asiskawati [25] agree that some students have found new problem-solving approaches based on their learned principles. This shows that some students have been able to create new or unique answers for themselves based on other concepts or personal experiences.

As measured in this study, flexibility has no additional validity above and beyond broad assessments of fluency and originality. Therefore, flexibility appears largely as a twist to the more prominent task of fluency retrieval but as a twist with an increased price tag [26].

In this research, guided inquiry learning applied in chemistry subjects can have a better influence than conventional learning, namely through lecture and discussion methods on the creative thinking abilities of class XI IPA students at SMAN 4 Praya. This aligns with Dongoran's research [29], which found that inquiry learning improved students' creative thinking patterns. The guided inquiry learning model is one option that can be applied in the chemistry learning process. Inquiry learning places more emphasis on student-centered learning processes, making students tend to be more active in learning activities. Guided inquiry learning also has advantages, namely that it is related to students' self-concept, which increases with the discoveries they make and places emphasis on information processing. This can make the learning process more meaningful and absorbed into students' long-term memory. Apart from that, it can also improve students' understanding of concepts [30].

Based on observations during the research, students have experienced more meaningful learning using the guided inquiry model. This learning model can maximize student activity, where students play an active role as learning subjects in formulating problems, formulating hypotheses, finding answers, and providing clear theoretical conclusions by presenting supporting evidence for what they are asking. When linked to creative thinking skills, students are able to apply flexible, fluent, and original indicators related to the guided inquiry model learning system with chemistry material.

Researchers concluded that several main factors influenced the success of this research. One is the learning process that occurs in the two classes involved. Especially in experimental courses, students face questions related to reaction rate material. They then explore the answers through teacher-guided practicum. This practicum aims to enable students to discover theory independently based on practical experience with teacher guidance. This learning approach is very student-focused, encouraging them to use all their abilities to search for and understand concepts. This approach facilitates meaningful learning, where knowledge is not simply gained from memorizing facts, ideas, or theories but through the discovery and construction of one's knowledge, enriched by direct experience [31].

Student creativity is also required in the learning process [32]. Student creativity that is not given enough attention and appreciation in the learning process causes students not to want to do anything new. Creativity is not just creating a product but the ability to make a solution that is not fixated on one answer. From preschool education to college, creative thinking needs to be developed, trained and improved. Therefore, choosing media and learning methods when organizing learning activities is also very important.

In contrast to the experimental class, the control class uses conventional learning methods where material is taught through lectures. The teacher delivers material directly to students. This learning process focuses more on students accepting and memorizing concepts. This lecture method, which does not involve students' active thinking, can cause the knowledge gained by students not to remain in memory for long, thus having an impact on students' ability to develop their understanding of the lesson. As a result, student learning outcomes are low. This aligns with research by Ramdani & Artayasa [33], which states that learning based on memorization tends to be temporary and can result in misunderstandings. Students can experience difficulties in developing basic concepts that have been mastered to solve problems and various issues, which has the potential to cause misconceptions.

Overall, it can be concluded that the creative thinking ability in the experimental class is better than the control class. This is based on the scores obtained by each class from the 3 questions given. Creativity is related to cognitive and affective factors, which are reflected in creativity's aptitude and non-aptitude characteristics. Aptitude characteristics related to cognitive factors include the ability to think creatively, which involves the ability to think fluently, flexibly, and originally. This proves that inquiry learning can explore students' creative thinking abilities by guiding students independently and actively in learning. Improving students' creative thinking abilities does not always result in improvements in all aspects or indicators. Other factors may also influence the results.

Conclusion

This research shows that the guided inquiry learning model significantly improves the creative thinking abilities of class XI Science students at SMAN 4 Praya. This can be seen from the results of the t test, namely $t_{count} \geq t_{table}$, namely $4.31 \geq 2.03$ and a significant value of $0.00 > 0.05$, as well as from the results of the average value of the experimental group is higher than the control group, with a value the experimental class average was 79.03% and the control class average was 62.42%. Thus H_0 is rejected, and H_1 is accepted. This means that guided inquiry learning in chemistry lessons has a better influence than conventional learning (lectures and discussions) on the creative thinking abilities of class XI IPA students at SMAN 4 Praya.

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