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Implementation of Guided Inquiry Based on Contextual Approach to Improve Students Critical Thinking Skills on Reaction Rate Material

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ABSTRACT

The purpose of this study is to describe the improvement of students' critical thinking skills on the reaction rate material by implementing a guided inquiry based on a contextual approach. The subjects were students of class XI MIA 7 SMA Negeri 1 Gedangan with a one-group pretest-posttest research design. The methods used to collect data are observations, tests, and response questionnaires. The research instruments used were critical thinking skills test sheets, observation sheet of learning model implementation, students activity observation sheets, and students response questionnaires. Data analysis was carried out using quantitative techniques assisted by SPSS 23. The results showed that (1) The percentage of the implementation of the guided inquiry with a contextual-based approach at I and II meetings is 98.66% (very good) and 99.48% (very good). (2) The relevant activities of students at I meeting is 98.06% and at II meeting is 97.78%. (3) Students' critical thinking skills are successfully improved with an average gain score on the interpretation indicator is 0.85 (high), the inference indicator is 0.82 (high), the analysis indicator is 0.77 (high), and explanation indicator is 0.75 (high). (4) Students' positive response to the learning model implementation is 96.35% (very good). The results showed that students' critical thinking skills on the reaction rate material were successfully improved by implementing a guided inquiry learning model based on a contextual approach.

INTRODUCTION

In the 21st century, technology and science have developed very rapidly. The 21st century is a century of globalization that is full of challenges and causes competition in various fields of life, including technology and education. The demands and challenges that exist in the 21st century have an impact on changes in learning patterns that exist in Indonesian education. The learning system in the 21st century requires schools to implement a student-centered learning system. The teacher's role is also needed in preparing collaborative learning models and media to prepare competent students (Prayogi & Estetika, 2019).

The learning process in the 21st century requires human resources to master various forms of skills known as the 4C (collaborative, creative, critical thinking, and communicative) (Direktorat Pembinaan SMA, 2017). One of the primary skill priorities to be improved in this century is critical thinking skills (Frima et al., 2020). Several attempts have been carried out by the Indonesian government, one of which is designing the 2013 curriculum. The 2013 curriculum emphasizes learning that gives the opportunities for students to construct knowledge in their cognitive processes. In the education system that implements the 2013 curriculum as the basis for the learning process, students are guided and required to solve problems around them through the implementation of information learned both at school and in everyday life by emphasizing cognitive, attitude, and skill aspects (Munandar & Amiruddin, 2020)

Indonesia has participated in several international-scale evaluations to determine the quality of its education, including PISA and TIMSS. The Programme for International Student Assessment (PISA) 2018 report published in March 2019 shows that in science, math skills, and reading, Indonesia's score is low because it ranks 74th out of 79 countries (OECD, 2019). According to the Trends in Internatioal Mathematics and Science Study (TIMSS) survey, Indonesia is ranked 45th out of 48 countries (TIMSS, 2015). Based on these two survey results, the quality of education in Indonesia, especially in the science field, is in a low category.

Natural Sciences (IPA) is a branch of education that has an essential role in realizing the quality of education (Indahyana & Nasrudin, 2021). Chemistry is a branch of natural science that becomes a compulsory subject in high school (Kemendikbud, 2018b). Chemistry contains abstract concepts, so it is difficult for students to understand (Hidayat, 2017). The pre-research survey results conducted at SMAN 1 Gedangan show that as many as 81.3% of students said that chemistry is a complicated subject, and 53.1% of students stated that the most challenging chemical material to learn was reaction rate. In addition, as many as 75% of students choose to learn with practicum activities as the learning method they like the most and want to apply in learning activities. According to the results of the pre-research survey, the large number of theories to be learned, memorization, and calculations to be performed make chemistry and reaction rates challenging to study. This fact is reinforced by the result of the previous research, which states that the sub material of factors affecting the reaction rate is prone to misunderstandings because the material is abstract, which causes students to have difficulty understanding concepts. So experimental activities are needed to improve students' understanding (Titari & Nasrudin, 2017).

Students' critical thinking skills in chemistry subjects are in a low category. It is because the learning methods used so far still focus on the teacher as a learning resource (teacher-centered). This reduces the opportunity for students to participate in the learning process actively. So it will affect the students' critical thinking skills (Oktaviana et al., 2016). The outcomes of the pre-research survey conducted in class XI MIA 7 and XI MIA 8 SMAN 1 Gedangan shows that students' critical thinking skills were still low, with an average score on the interpretation indicator is 32.14, on the inference indicator is 35.00, the analysis indicator is 25.00, and the explanation indicator is 16.67. Based on these results, students' critical thinking skills need to be trained and improved.

One of the essential skills for students is critical thinking skills. There are six primary indicators in critical thinking skills: interpretation, inference, analysis, explanation, evaluation, and self-regulation (Facione, 2020). Students with high critical thinking skills usually tend to think broadly, giving opinions by providing comparisons, giving logical analysis, providing suggestions and criticisms, and having problem-solving skills (Amri, 2015). Critical thinking skills can be improved by applying appropriate learning models and approaches. Guided inquiry is one of the learning models that can improve students' critical thinking skills.

The guided inquiry can change the way students learn to be more skilled, active, and directly involved in the learning process so students' critical thinking skills could be trained and improved. This fact is reinforced by Qureshi's research, which states that implementing an inquiry can increase students' self-confidence and grades in chemistry subjects such as the reaction rate material (Qureshi et al., 2017). Critical thinking skills could be trained and improved through several approaches, one of which is the contextual approach. According to the previous research conducted by Muchlis (2015), concluded that a contextual approach could improve students' motivation and critical thinking skills.

The learning process-oriented to the contextual approach is a learning strategy that focuses on the student's full involvement to find the core of the matter and relate it to real-life situations that encourage students to apply it in their lives. So by implementing this approach, it will make students easier to understand the matter being taught. It is relevant to the research results of Darling-Hammond et al. (2020), which states that providing opportunities for students to find a learning experience will further assist students in the control concept

Based on the facts described above, the researchers hope that implementing the guided inquiry based on the contextual approach in sub material of factors that affect the reaction rate can be implemented very well, so students' critical thinking skills can be improved, resulting in many relevant activities, and receive a positive response from the students of SMAN 1 Gedangan.

METHOD

This study type is pre-experimental. This study was conducted in the odd semester in the 2021/2022 academic year, with the face-to-face implementation of 2 meetings, namely on 23 and 25 November 2021, with the subjects of class XI MIA 7 SMAN 1 Gedangan. This study used a quantitative method with one group pretest-posttest design that could be described as follows

$$O_1 \ X \ O_2$$

Information:

O_1 : Pretest results (initial test)
X : The treatment of guided inquiry learning model with a contextual-based approach
O_2 : Posttest results (final test)

The research instrument used was the observation sheet on implementation of the learning model, the students' activity observation sheet, the critical thinking skills test sheet, and the student response questionnaire. The learning tools used in this research are the lesson plans, syllabus, and worksheets. Data collection methods used include observation, test, and questionnaire.

The purpose of observation is to observe and determine the learning model implementation in each phase and monitor students' activities during the learning model implementation. The purpose of the test is to measure the students' critical thinking skills improvement. Furthermore, the purpose of the questionnaire is to determine students' responses to the learning model implementation that has been done.

Before being used to collect data, research tools and instruments must be validated first. The following formula is used to assess or validate the research tools and instruments used, namely:

$$\%\ \text{Validation} = \frac{\sum \text{Overall Score}}{\sum \text{Criteria Score}} \text{ x } 100\%$$

The validity percentage is then described in the criteria in Table 1.

Table 1. Validity Criteria

Percentage (%)	Criteria
0% - 20%	Very less valid
21% - 40%	Less Valid
41% - 60%	Enough valid
61% - 80%	Valid
81% - 100%	Very valid

Source: Riduwan (2015).

The implementation of learning can be determined based on the implementation of learning activities in each phase using the scoring criteria, and it was observed by three observers. Furthermore, the calculation percentage of learning model implementation can use the following formula:

$$\%\ \text{Implementation} = \frac{\text{Score obtain}}{\text{Maximum score}} \text{ x } 100\%$$

The percentage of the learning model implementation results is then divided by the number of observers to find out the average percentage of this learning model implementation using the following formula:

$$\%\ Average = \frac{\%\ Implementation}{Number\ of\ Observer}$$

The results of the average percentage obtained are described as criteria for each phase according to Table 2.

Table 2. Learning Model Implementation Criteria

Percentage (%)	Criteria
0% - 20%	Very Bad
21% - 40%	Bad
41% - 60%	Enough
61% - 80%	Good
81% - 100%	Very Good

Source: Riduwan (2015).

Observations of students' activities were carried out by three observers and observed every 2 minutes for 90 minutes. The percentage of student's activity is analyzed by calculating the frequencies of students activity that occurred during the learning process, with the following formula:

$$\%\text{Act.} = \frac{\sum Freq\ of\ activity\ that\ appears}{\sum Freq\ of\ overall\ activity} \text{ x } 100\%$$

The student's activities are declared good if relevant activities are more significant than irrelevant activities during the learning process.

Critical thinking skills could be analyzed based on students' pretest and posttest scores on each critical thinking indicator, with the following assessment formula:

$$Critical\ Thinking\ Score = \frac{Score\ obtain}{Maximum\ score}\ x\ 100$$

Data on students' pretest and posttest scores on each indicator were tested using the normality test and paired sample t-tests using the SPSS 23 program. The normality test using the Kolmogorov-Smirnov method was carried out to determine whether the data on students' pretest and posttest scores on each critical thinking skill indicator was normally distributed.

The following is the basis for making the decision of the normality test:

a. If the significance value (Sig.) > 0.05, then the research data on students' critical thinking skills are normally distributed.
b. If the significance value (Sig.) < 0.05, then the research data on students' critical thinking skills are not normally distributed.

The effectiveness of the learning model implementation can be analyzed by conducting paired sample t-tests on students' pretest and posttest scores on each critical thinking skill indicators. The following is the basis for decision making for the paired T-test:

a. If the Sig. (2-tailed) < 0.05, there is a significant difference between the pretest and posttest results on critical thinking skills indicators.
b. If the Sig. (2-tailed) > 0.05, there is no significant difference between the pretest and posttest results on critical thinking skills indicators.

The improvement of students' critical thinking skills on each indicator can be analyzed by calculating the N-gain score with the following formula:

$$< g > = \frac{Posttest\ Score\ -\ Pretest\ Score}{Maximum\ Score\ -\ Pretest\ Score}$$

The N-gain score obtained then interpreted according to the category in Table 3.

Table 3. Gain Score Criteria

(<g> Score)	Category
<g> 0.7	High
0.7 > <g> 0.3	Medium
<g> < 0.3	Low

Source: Riduwan (2015).

Analysis of student response data is carried out by calculating the percentage of positive responses with the following formula:

$$\%\ Response\ = \frac{Positive\ Response}{Respondent}\ x\ 100\%$$

The results of the percentage of student responses then divided by the number of statements given on the response questionnaire sheet to determine the average percentage of student responses, with the following formula:

$$\%\ Average\ = \frac{\%\ Response}{Number\ of\ Statements}$$

The results of the average percentage of students' responses towards the implementation of the guided inquiry learning model with a contextual-based approach obtained are described in the same criteria according to Table 2.

RESULTS AND DISCUSSION

The guided inquiry with a contextual-based approach is a process to obtain information by conducting experiments and or observations to find answers or solve problems, by linking the learning context to the real world and motivating students to connect the knowledge they have learned and its application in life. According to Arends (2012), the guided inquiry learning model consists of 6 syntaxes, namely focusing the attention of students' and explaining the inquiry process, presenting an inquiry problems or phenomena, asking students to formulate hypotheses to explain problems or phenomena, encouraging students to collect data to test hypotheses, formulating explanations and conclusions, reflecting on the problems and thinking processes used during the investigation.

According to Muhan (2021), the students' critical thinking skills can be trained and improved by implementing a guided inquiry learning model. Critical thinking skills analyzed in this study are the interpretation, inference, analysis, and explanation skills. In learning activities by applying this learning model, the teacher functions only as a facilitator, mediator, and mentor, so students must be active to build their understanding. Learning with a contextual approach consists of seven main components: learning community, constructivism, asking, investigating (inquiry), modelling, reflection, and authentic assessment (Sanjaya, 2014). The contextual approach can improve students' understanding and critical thinking skills by linking concepts or theories with students' experiences and their living environment (Fadillah et al., 2017).

Validity of Research Instruments and Learning Tools

The research instruments first go through the review and validation process to test their validity before implementing in teaching and learning activities in school. One lecturer carries out the review process, and the validation process is carried out by two lecturers and one teacher at SMA Negeri 1 Gedangan.

The average percentage of validity results obtained on the learning tools are on the syllabus is 93.33% (very valid), on the lesson plan is 92.71% (very valid), on the student worksheet I is 98.24% (very valid), on the student worksheet II is 96.10% (very valid). While the average percentage of validity results on research instruments obtained the following results, on the learning implementation observation sheet is 96.67% (very valid), on the student activity observation sheet is 91.67% (very valid), on the critical thinking skills test sheet is 94.44 % (very valid), and the student response questionnaire sheet is 98.62% (very valid). These results indicate that the research instruments and learning tools are valid for collecting research data.

Implementation of Learning Model

The learning process is carried out by applying a guided inquiry learning model based on a contextual approach. This learning model implementation was carried out after the students worked on the pretest questions. The learning process is carried out in two face-to-face meetings, with an allocated time of 90 minutes. The first meeting was held on November 23, 2021, which discussed the effect of the concentration and surface area factors on the reaction rate. The second meeting was held on November 25, 2021, which discussed the effect of temperature and catalyst factors on the reaction rate. Three observers assessed the feasibility of the learning model using the implementation observation sheet for two meetings. The observation aims to determine the teacher's ability to manage learning activities and determine the suitability between teacher activities during the learning process with the syntax of the guided inquiry with a contextual-based approach that has been previously arranged in the lesson plans.

Observation of the learning model implementation was observed from the implementation of each learning model syntax consisting of preliminary activities, phase 1 (focusing students' attention and explaining the inquiry process), phase 2 (presenting a problem or inquiry phenomenon), phase 3 (asking students to formulate hypotheses to explain problems or phenomena), phase 4 (encouraging students to collect data to test hypotheses), phase 5 (formulating explanations and conclusions), phase 6 (reflecting on problems and thinking processes used during the investigation) and closing activities (Arends, 2012).

The average percentage of the learning model implementation at I and II meetings is presented in Figure 1.

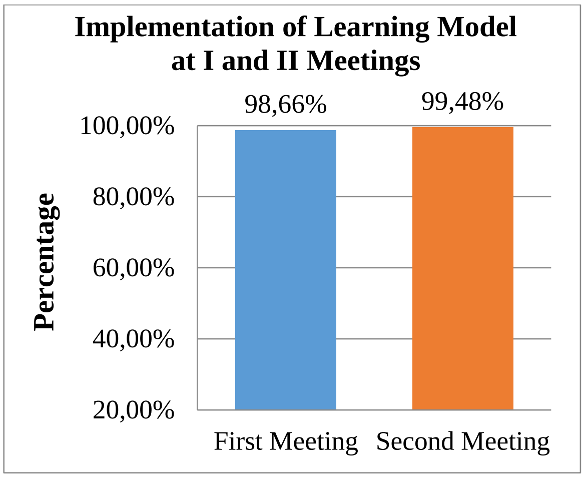
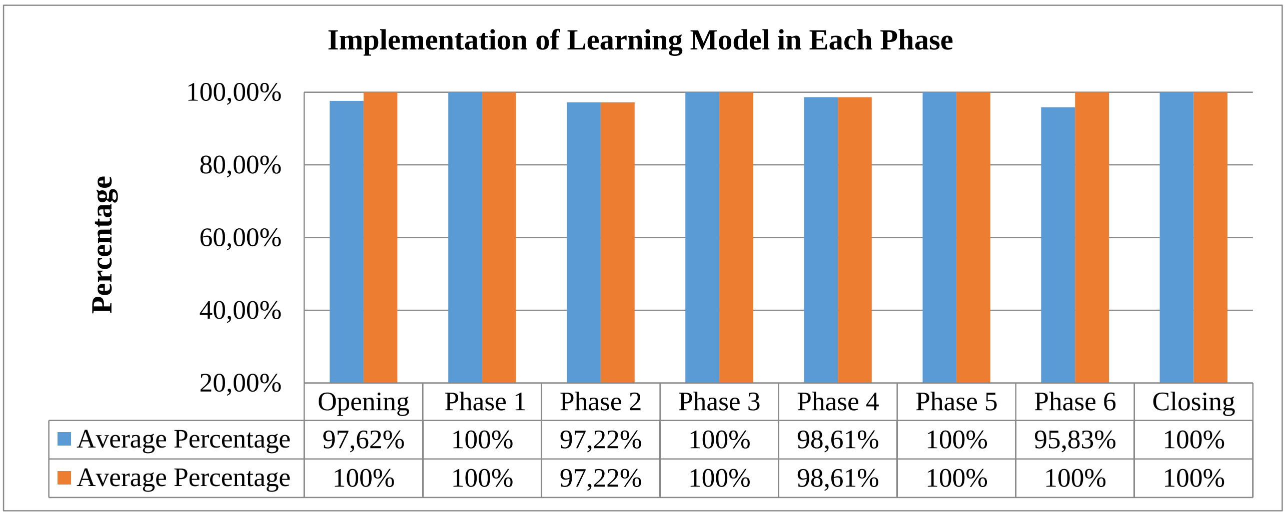


Figure 1. Percentage of learning model implementation at I and II meetings.

Figure 1 shows the average percentage of the implementation of this learning model at I and II meetings are 98.66% and 99.48%. Based on table 2 (criteria for the percentage of learning model implementation) and the average percentage of learning model implementation as shown in Figure 1, it can be concluded that the implementation of the guided inquiry learning model with a contextual-based approach can be carried out very well. Details of the results of learning model implementation in each phase are shown in Figure 2.



	Opening	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Closing
Average Percentage	97,62%	100%	97,22%	100%	98,61%	100%	95,83%	100%
Average Percentage	100%	100%	97,22%	100%	98,61%	100%	100%	100%

Figure 2. Percentage of learning model implementation in each phase

Observing the implementation of the learning model was starts from observing preliminary activities that aim to prepare students for learning. The preliminary activities begin with the teacher greeting, praying, checking the students' attendance, and giving apperception to students by asking questions about material that has been discussed at the previous meeting. Students are guided to relate the lessons learned on that day with their initial knowledge of collision theory. Besides that, in this activity, students are also given motivation by being given the phenomena related to factors that affect reaction rates in everyday life. Giving motivation aims to bring students' thinking closer to the concept of factors affecting the rate of reaction and encourage students to become enthusiastic in participating in learning process. The percentage of implementation of preliminary stages is 97.62% and 100% at I and II meetings, with very good criteria.

The core activities start from the first phase to the sixth phase. Phase 1 focuses on students' attention and explains the inquiry process (Arends, 2012). In this phase, the teacher makes heterogeneous groups with members of 4 students that apply the contextual approach component, namely the learning community. The concept of a learning community suggests that the learning outcomes obtained are the result of collaboration with other people. Students are divided into heterogeneous groups to share their knowledge and help each other. It is in line with the characteristics of the inquiry learning model, which is characterized by cooperation between students in small groups to do assignments, increasing the opportunity to obtain information from other members and develop thinking and social skills (Fung, 2017). After that, the teacher distributes worksheets to each group and guides students to observe phenomena in daily life contained in student worksheets, which apply the contextual approach component, namely constructivism. The percentage of learning implementation in phase 1 is 100% at I and II meetings, with very good criteria.

Phase 2 presents the problem or phenomenon of inquiry (Arends, 2012). The learning activities carried out in phase two are the teacher showing pictures of the phenomena in daily life regarding the factors affecting the reaction rate. Students are guided to observe the modelling description about the phenomena in daily life and asked to explain it based on their experience, which applies the contextual approach component, namely modelling. In contextual learning, the teacher is not the only model. The teacher can appoint students to model something based on their experience.

Many questions arise after observing the phenomenon, and students' curiosity about learning materials increases. Presenting phenomena carried out by teachers according to the characteristics of inquiry learning states that teachers can display interesting phenomena or problems that can raise questions from students in the teaching and learning process.

Furthermore, students are guided to ask questions by making formulations of the problem based on the phenomena in the modelling section, which are included in critical thinking indicators, namely interpretation (Facione, 2020). It is also the application of the contextual approach component, namely asking. According to DeWaelsche (2015), critical thinking skills can be initiated through asking questions. Many students answered incorrectly before the teacher gave guidance because they were still confused about making the correct problem formulation. When students formulate problems, the teacher guides students to make a question that relates the manipulation variable with the response variable and based on the phenomena, which aims to identify the phenomena. The percentage of learning implementation in phase 2 at I and II meetings is 97.22%, with very good criteria.

Phase 3 asks students to formulate hypotheses to explain problems or phenomena (Arends, 2012). The learning activity carried out in this phase is the teacher guides the students to make hypotheses based on the formulations of the problem that have been made previously, which are included in the critical thinking indicators, namely inference (Facione, 2020). This activity also applies the contextual approach component, namely inquiry. The teacher guides students to make hypotheses that connect the manipulation variables and response variables based on the problem formulation that has been made. The percentage of learning implementation in phase 3 is 100% at the I and II meetings, with very good criteria.

Phase 4 encourages students to collect data to test hypotheses (Arends, 2012). In this phase, students are guided to determine the experimental variables, including control variables, manipulation variables, and response variables, and asking students to observe four experimental videos regarding the factors affecting the reaction rate. In this phase, students are also guided to collect and organize the experiment results in tabular form. The critical thinking indicator trained in this phase is interpretation, and it is also the application of the contextual approach component, namely inquiry. The percentage of learning implementation in phase 4 is 98.61% at I and II meetings, with very good criteria.

Phase 5 formulates explanations and conclusions (Arends, 2012). The learning activities carried out were students are guided to analyze the experimental result by answering the questions in the student worksheets and make appropriate conclusions. The critical thinking indicators that are trained in this phase are analysis and inference, and it is also the application of the contextual approach component, namely inquiry. The percentage of learning implementation in phase 5 is 100% at the first and second meetings, with very good criteria.

Phase 6 reflects on the problems and thought processes used during the investigation (Arends, 2012). In this phase, four student representatives are asked to present their works. Each student presents about one factor affecting the rate of reaction, and the other can respond. The teacher comments on the course of the discussion, provide reinforcement and straightens things that are not quite right related to the results of the discussions presented by students. After students do the presentation, the teacher will give awards to groups that actively participate. The teacher also asks students to work on the explanation questions in the student worksheets and discuss them after they answer the questions. The critical thinking skills indicator trained in this phase is explanation. It is also the application of the contextual approach components, namely reflection and authentic assessment. By applying the reflection component students can use the newly learned material as a new knowledge structure, which is revision or enrichment of previous knowledge, and by authentic assessment, the teacher can find out the progress or difficulties of students in learning so that the teacher will be easier to make improvements and refinement of the learning process at the next meeting. The learning implementation percentage in phase 6 is 95.83% and 100% at I and II meetings, with very good criteria.

Closing activities are carried out by the teacher conveying conclusions about the material and asking students to express their impressions and messages about the learning process that has been done so that it can be developed in future lessons to be better. The teacher also asks students to prepare for the next meeting. The percentage of learning implementation in the closing activity is 100% at I and II meetings, with very good criteria.

Based on the description above, implementing each of syntax of the guided inquiry with a contextual-based approach at I and II meetings is included in the very good criteria. It shows that critical thinking skills could be trained and improved by applying a guided inquiry with a contextual-based approach. This result is strengthened by previous research stating that critical thinking skills could be trained and improved through the application of inquiry syntax because students would find out the concepts independently (Cahyani & Azizah, 2019).

Students Activities

The purpose of student activities observation is to determine the activities of students during the implementation of guided inquiry with a contextual-based approach. The students' activities were observed by three observers and observed every 2 minutes for 90 minutes. The results of the average percentage of students' activity during two meetings are shown in Figure 3.

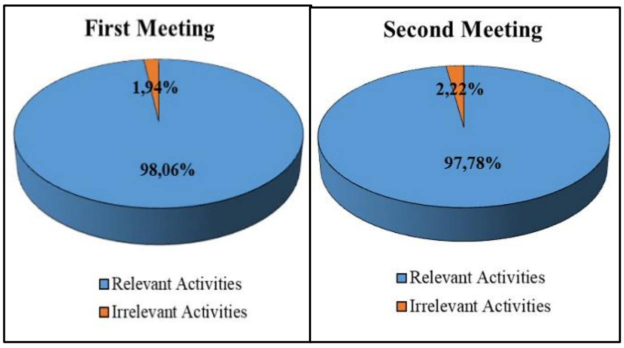


Figure 3. The pie chart of relevant and irrelevant students activities

Figure 3 shows that students do more relevant activities than irrelevant activities. There are more relevant activities in the I meeting than in the II meeting. Details of student activities are listed in table 4.

Table 4. Students Activities Percentage

No	Students Activities	First Meeting	Second Meeting
1	Answering the questions	12.22%	13.33%
2	Ask the teacher	5.00%	5.56%
3	Formulating the problem formulation (Interpretation)	3.89%	3.89%
4	Formulating the hypothesis (Inference)	3.89%	3.89%
5	Determining the appropriate experimental variables (Interpretation)	4.17%	3.61%
6	Observing video experiments on the factors that affect the rate of a reaction	15.56%	16.11%
7	Arrange experimental data into tabular form	13.61%	13.33%
8	Analyzing experimental data by answering analysis questions contained in the Students Worksheets (Analysis)	16.67%	16.67%
9	Making appropriate conclusions based on the experimental videos results (Inference)	5.83%	5.28%
10	Presenting experimental results and discussion (Explanation)	7.50%	7.50%
11	Responding to the presentation of observations and discussions conducted by representatives of other groups	3.89%	3.61%
12	Working on the application of the theory that has been learned (Explanation)	5.83%	5.00%
13	Doing irrelevant activities (such as disturbing friends, being noisy, and out of class without permission)	1.94%	2.22%

The results of percentage of students activity as shown in table 4, there is a dissimilarity in the average percentage between the student's activities at I and II meetings. The total percentage of relevant activities at the I and II meetings is 98.06% and 97.78%, respectively. Irrelevant activities get the percentage at the first and second meetings of 1.94% and 2.22%. The most dominant student activity in the first and second meetings is analyzing the experiment results by answering the analysis questions in the student worksheets with 16.67%.

All students' activities are carried out very well, which can support the learning model implementation. So students' critical thinking skills can be trained and improved. This result is strengthened by previous research stating that students' critical thinking skills successfully improved if relevant activities obtained a higher percentage than irrelevant activities (Firdausichuuriyah & Nasrudin, 2017).

Critical Thinking Skills

Critical thinking skills are the components of higher-order thinking and not a skill that can develop by itself along with human physical development (Utriainen et al., 2017). However, it must be trained by providing a stimulus that can train critical thinking skills as contained in the inquiry syntax.

The critical thinking skills of students' can be trained and improved by implementing a guided inquiry learning model based on a contextual approach. The contextual approach is a learning strategy that connects the learning materials with real-world situations to encourage and help students understand the learning materials and apply them in everyday life. The contextual approach was chosen because by applying it, the students will feel closer to the given modelling phenomena and can get easier to understand learning materials. There are seven main components of learning activities with a contextual approach or Contextual Teaching and Learning (CTL), namely learning communities, constructivism, modeling, asking questions, inquiry, reflection, and authentic assessment (Sanjaya, 2014).

The ability to think logically and reflectively which focuses on making decisions in solving problems is the definition of critical thinking skills (Rahmadhani & Novita, 2018). There are six main critical thinking skills: interpretation, inference, analysis, evaluation, explanation, and self-regulation

(Joyce, 2015). In this research, four critical thinking skills were taken to be trained and improved: interpretation, inference, analysis, and explanation. Critical thinking skills of students are trained by applying an inquiry learning model with a contextual-based approach that uses student worksheets with learning activities that are in accordance with the critical thinking skills indicators and contextual components that are trained.

Data on students' critical thinking skills were obtained from giving pretest sheets before the learning model was applied and post-test after the learning model was applied. The pretest and post-test sheets given to students contain questions about the factors affects the reaction rate to identify the improvement of students' critical thinking skills.

The students' pretest and post-test scores were analyzed descriptively using SPSS 23. The normality test was conducted to determine whether the data were normally distributed or not, and the paired sample t-test was conducted to determine the effectiveness of this learning model implementation. The N-gain score is calculated to determine the improvement of students' critical thinking skills on each indicator.

The following are the description of each critical thinking skills indicator:

Interpretation indicators are the ability to understand, explain, and express the meaning of phenomena, data, findings, or information (Facione, 2020). Learning activities carried out to train interpretation indicators are making problem formulation and determining the experimental variables based on problems or phenomena in everyday life contained in worksheets. The interpretation skills are assessed using a scale of 1-3 for activities making problem formulation and a scale of 1-4 for activities determining experimental variables with specific criteria based on a predetermined assessment rubric. The scores of students' interpretation skills are obtained by calculating the total score obtained by students on the interpretation indicator divided by the total score on the interpretation indicator.

The data on students' pretest and post-test scores on the interpretation indicator was analyzed by doing a normality test and paired t-test using SPSS 23 and calculating the N-gain score. The normality test of students' pretest and post-test scores on the interpretation indicator was carried out using the Kolmogorov-Smirnov method. The normality test results on the interpretation indicators are shown in table 5.

Table 5. The normality test results on the interpretation indicator

	Kolmogorov-Smirnov[a]		
	Statistic	df	Sig.
Pretest Score	,130	33	.167[*]
Posttest Score	,127	33	.167[*]

The normality test results on the interpretation indicator in table 5 show the significance value is 0.167 > 0.05, which indicates that the student's pretest and post-test scores on the interpretation indicator are normally distributed. Then a paired t-test on the interpretation indicator was carried out, with the result is shown in table 6.

Table 6. The paired sample t-test result on the interpretation indicator

	t	df	Sig. (2-tailed)
Pretest-Posttest	-38,955	32	,000

Based on table 6, it can be seen that the Sig. (2-tailed) is 0.000 < 0.05. It means that there is a significant difference between the students' pretest and post-test scores on the interpretation indicators. Calculations were carried out using the N-gain formula to determine students' interpretation skill improvement. The table 7 is the result of N-gain score percentage on the interpretation indicator:

Table 7. The average results on the interpretation indicator

Data	**Average**	**Category**
Pretest	34.30	Less
Post-test	88.81	Very good
N-gain score	0.85	High

The average results of the pretest, post-test, and N-gain score on the interpretation indicator as shown in table 7 show that there is an improve in the student's average score. All students get scores below the minimum mastery criteria at the pretest, with an average pretest score is 34.30 (less). After implementing the learning model, students' interpretation skills increased, as evidenced by an increase in post-test results with an average post-test score is 88.81 (very good). The average N-gain score in the interpretation indicator is 0.85 (high category). The details of the N-gain score percentage in each category are shown in figure 4.

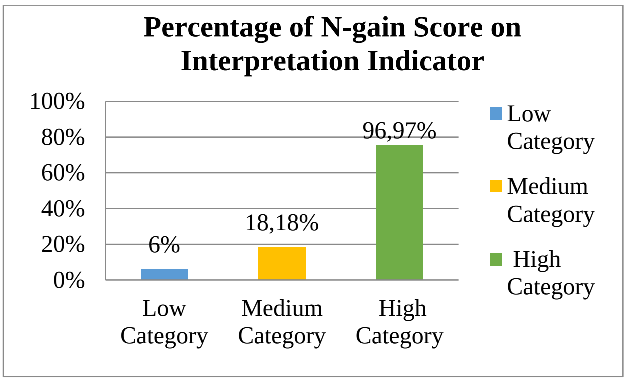


Figure 4. Percentage of N-gain score on the interpretation indicator

Based on the percentage of students' N-gain scores on the interpretation indicators in Figure 4, it can be seen that as many as 96.97%, 3.03%, and 0% of students are in a high, medium, and low category. These result indicates that students' critical thinking skills on interpretation indicators were successfully trained and improved by applying a guided inquiry with a contextual-based approach.

An inference indicator is the ability to obtain and identify the elements needed to make conclusions and make reasonable hypotheses (Facione, 2020). Learning activities carried out by students to train inference indicators are by formulating hypotheses and making conclusions based on experimental data. The inference skills are assessed using a scale of 1-3 for activities formulating the hypotheses and a scale of 1-2 for activities making conclusions with specific criteria based on a predetermined assessment rubric. The students' inference skills scores are calculated by calculating the total score obtained by students on the inference indicator divided by the total score on the inference indicator.

The data on students' pretest and post-test scores on the inference indicator was analyzed by doing a normality test and paired t-test using SPSS 23 and calculating the N-gain score. The normality test of students' pretest and post-test scores on the inference indicator was carried out using the Kolmogorov-Smirnov method, with the following results:

Table 8. The normality test results on the inference indicator

	Kolmogorov-Smirnov[a]		
	Statistic	df	Sig.
Pretest Score	,125	33	.145*
Posttest Score	,119	33	.145*

The normality test results on the inference indicator in table 8, the significance value is 0.145 > 0.05, which indicates that the student's pretest and post-test scores on the inference indicator are normally distributed. Then a paired t-test was carried out with the result is shown on table 9.

Table 9. The results of paired sample t-test on the inference indicator

	t	df	Sig. (2-tailed)
Pretest-Posttest	-43,677	32	,000

Based on the table 9, it can be known that the significance value (2-tailed) was 0.000 < 0.05. It means that there is a significant difference between the students' pretest and post-test scores on the inference indicators. Calculations were carried out using the N-gain formula to determine students' inference skill improvement. The table 10 is the result of N-gain score percentage on the inference indicator:

Table 10. The average results on the inference indicator

Data	Average	Category
Pretest	33.64	Less
Post-test	87.42	Very good
N-gain score	0.82	High

The average results of the pretest, post-test, and n-gain score on the inference indicator as shown in table 10, it can be known that there is an improve in the student's average score. At the pretest, all of the students get scores below the minimum mastery criteria, with the average pretest score is 33.64 (less). After implementing the learning model, students' inference skill increased, as evidenced by an increase in post-test results with an average post-test score is 87.42 (very good). The average of N-gain score in the inference indicator is 0.82 (high category). The details of percentage of N-gain score in each category are shown in figure 5.

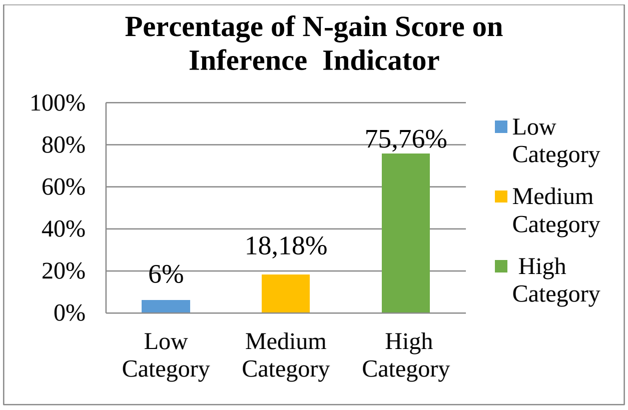


Figure 5. Percentage of N-gain score on the inference indicator

The percentage of students' N-gain scores on the inference indicators in Figure 4 shows that as many as 93.94%, 6.06%, and 0% of students are in the high, medium, and low category. These result indicates that students' critical thinking skills on inference indicators were successfully trained and improved by implementing a guided inquiry with a contextual-based approach.

An analysis indicator is the ability to test data or information by identifying the relationship between some information and providing reasonable arguments to express the results of thoughts or opinions (Facione, 2020). Learning activities carried out by students to train analysis skill is by answering the analytical questions contained in student worksheets. The analysis skills are assessed using a scale of 1-3 with specific criteria based on a predetermined assessment rubric. The score of students' analysis skills is obtained by calculating the total score obtained by students on the analysis indicator divided by the total score on the analysis indicator.

The data on students' pretest and post-test scores on the analysis indicator was analyzed by doing a normality test and paired t-test using SPSS 23 and calculating the N-gain score. The normality test of students' pretest and post-test scores on the analysis indicator was carried out using the Kolmogorov-Smirnov method, with the following results:

Table 11. The normality test results on the analysis indicator

	Kolmogorov-Smirnov[a]		
	Statistic	df	Sig.
Pretest Score	,121	33	.128*
Posttest Score	,114	33	.128*

The normality test results on the analysis indicator as shown in table 11, the significance value is 0.128 > 0.05, which indicates that the student's pretest and post-test scores on the analysis indicator are normally distributed. Then a paired t-test was carried out, and here is the result:

Table 12. The paired sample t-test result on the analysis indicator

	t	df	Sig. (2-tailed)
Pretest-Posttest	-30,413	32	,000

The significance value (2-tailed) result as shown in table 12 is 0.000 < 0.05. It means that there is a significant difference between the students' pretest and post-test scores on the analysis indicators. Calculations were carried out using the N-gain formula to determine students' analysis skill improvement. The table 13 is the result of the N-gain score percentage on the analysis indicator:

Table 13. The average results on the analysis indicator

Data	Average	Category
Pretest	37.38	Less
Post-test	84.09	Very good
N-gain score	0.77	High

The average results of the pretest, post-test, and n-gain score on the analysis indicator as shown in table 13 there is an improve in the student's average score. At the pretest, all of students get scores below the minimum mastery criteria, with the average pretest score is 37.38 (less). After implementing the learning model, students' analysis skill increased, as evidenced by an increase in post-test results with an average post-test score of 84.09 (very good). The average of N-gain score in the analysis indicator is 0.77 (high category). The details of the percentage of N-gain score in each category are shown in figure 6.

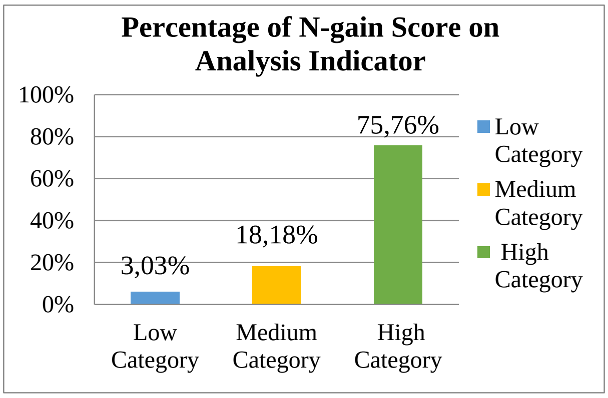


Figure 6. Percentage of N-gain score on the analysis indicator

Based on the percentage of students' N-gain scores on the analysis indicators in Figure 6, it can be seen that as many as 81.82%, 15.15%, and 3.03% of students are in the high, medium, and low category. These results indicates that students' critical thinking skills on analysis indicators can be trained and improved by applying the guided inquiry with a contextual-based approach.

The explanation indicator is the ability to explain and present the results of thoughts in verbal or non-verbal form based on evidence, methodology, and critical thinking (Facione, 2020). Learning activities carried out by students to train the explanation skill are by answering questions about the relationship between factors that affect the rate of reaction using collision theory and presenting the results of experiments and discussions. The explanation skill is assessed using a scale of 1-3 with specific criteria based on a predetermined assessment rubric. The students' explanation skill score is calculated by calculating the total score obtained by students on the explanation indicator divided by the total score on the explanation indicator.

The data on students' pretest and post-test scores on the explanation indicator was analyzed by doing a normality test and paired sample t-test using SPSS 23 and calculating the N-gain score. The normality test of students' pretest and post-test scores on the explanation indicator was carried out using the Kolmogorov-Smirnov method, with the results are shown in table 14.

Table 14. The results of the normality test on the explanation indicator

	Kolmogorov-Smirnov[a]		
	Statistic	df	Sig.
Pretest Score	,129	33	.158*
Posttest Score	,118	33	.158*

The normality test results on the explanation indicator in table 14 shows that the significance value is 0.158 > 0.05, which indicates that student's pretest and post-test scores on the explanation indicator are normally distributed. Then a paired t-test was carried out. The table 15 is the results of the paired t-test on the explanation indicator.

Table 15. The paired sample t-test results on the explanation indicator

	t	df	Sig. (2-tailed)
Pretest-Posttest	-30,937	32	,000

The significance value (2-tailed) of explanation indicator is 0.000 < 0.05. It means that there is a significant difference between the students' pretest and post-test scores on the explanation indicators. Calculations were carried out using the N-gain formula to determine students' explanation skill improvement. The table 16 is the result of N-gain score percentage on the explanation indicator:

Table 16. The average results on the explanation indicator

Data	**Average**	**Category**
Pretest	33.44	Less
Post-test	82.33	Very good
N-gain score	0.75	High

The average results of the pretest, post-test, and n-gain score on the explanation indicator as shown in table 16, there is an improve in the student's average score. At the pretest, all students get scores below the minimum mastery criteria, with the average pretest score is 33.44 (less). After implementing the learning model, students' explanation skills increased, as evidenced by an increase in post-test results with an average post-test score of 82.33 (very good). The average N-gain score in the explanation indicator is 0.75 (high category). The details of the N-gain score percentage in each category are shown in figure 7.

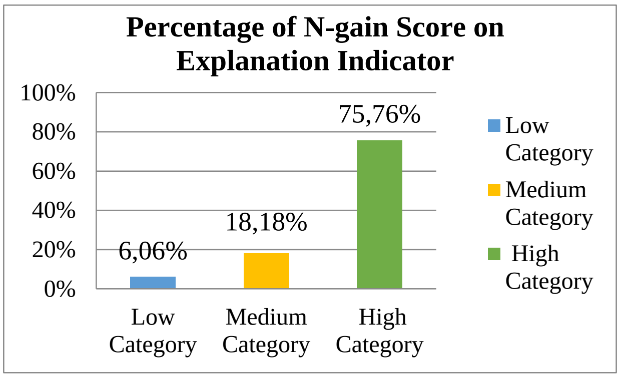


Figure 7. Percentage of N-gain score on the explanation indicator

The students N-gain scores percentage on the explanation indicators in Figure 7 shows that as many as 75.76%, 18.18%, and 6.06% are in a high, medium, and low category. These results indicates that students' critical thinking skills on explanation indicators were successfully trained and improved by implementing a guided inquiry with a contextual-based approach.

Some students get the low N-gain category in analysis and explanation skills. Students are less able to analyze experimental data by giving correct and complete reasons, so it makes some students' get a low category in analysis and explanation skills. The average N-gain score of students on each critical thinking skill indicators trained is shown in Figure 8.

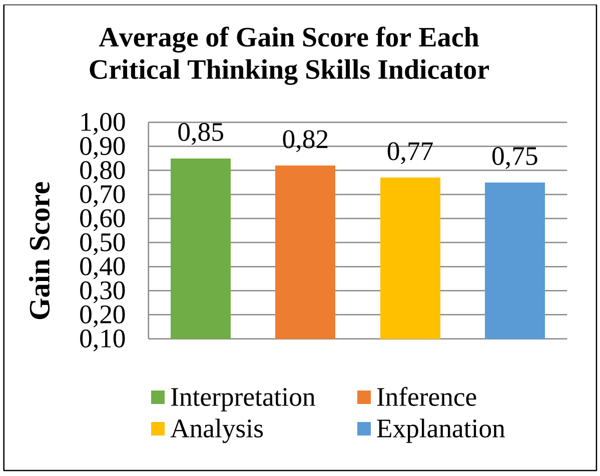


Figure 8. Graph of the average N-gain scores

Based on Figure 8, it can be seen that the four critical thinking indicators that were trained, namely interpretation, inference, analysis, and explanation skills have an average N-gain score of more than 0.7, which is included in the high category. So it means that the implementation of the guided inquiry with a contextual-based approach can improve students' critical thinking skills on the reaction rate material.

Student Response

Data on student responses to the implementation of the guided inquiry with a contextual-based approach were collected by filling out a questionnaire in the form of *Google Form*, which was carried out by each student of class XI MIA 7 after the learning process was completed. The purpose of distributing response questionnaires is to determine students' responses to this learning model implementation. The response questionnaire consisted of 37 positive statements and 2 negative statements. The average percentage of students' responses is shown in Figure 9.

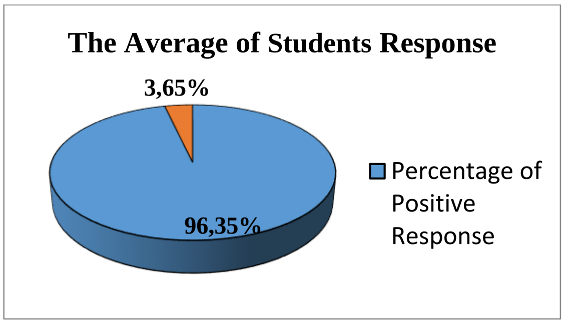


Figure 9. The students response pie graph

Based on Figure 9, the average percentage of students positive responses to the implementation of the guided inquiry with a contextual-based approach is greater than the percentage of negative responses with a percentage of 96.35%. The criteria is very good.

Through the implementation of the guided inquiry with a contextual-based approach, students feel their curiosity is increased, and it is easier for them to understand the reaction rate material, this is because the learning model applied uses a contextual-based approach by using every day phenomena as a matter for modelling and in constructing students' understanding.

In addition, the students feel more active in the learning process. In the implementation of the guided inquiry, students are required to be more active (students-center) through a series of inquiry activities such as formulating problems, hypotheses, observing experimental videos, organizing experimental data, analyzing experimental data, and making conclusions, so that critical thinking skills of students can be trained and improved.

The worksheets used as learning media also receive many positive responses from students and supports the teaching and learning process. This results indicating that the critical thinking skills of students are successfully improved by implementing the guided inquiry with contextual-based approach.

CONCLUSION

The conclusions of this research are: (1) The implementation of the guided inquiry based on contextual approach to improve students' critical thinking skills in the sub-material of factors that affect the reaction rate obtained the average percentage at I and II meetings are 98.66% (very good) and 99.48% (very good). It means that the teaching and learning process at the two meetings was successfully carried out with very good criteria. (2) Relevant student activities at the first and second meetings are 98.06% and 97.78%. The percentage of students irrelevant activities are 1.94% and 2.22%. It means that students overall activity can achieve very good results and can support the effectiveness of the learning process with relevant activities being greater than irrelevant activities. (3) The results of students pretest and post-test scores on each indicator of critical thinking are distributed normally, and there is a significant difference in the results of the students' pretest and post-test, which can be seen from the average N-gain score on the interpretation indicator is 0.85 (high), on the inference indicator is 0.82 (high), on the analysis indicator is 0.77 (high), and on the explanation indicator is 0.75 (high). N-gain scores on the four critical thinking skills indicators are in the high category. It means that the student's critical thinking skills are successfully trained and improved by implementing a guided inquiry with a contextual-based approach. (4) The implementation of the guided inquiry with a contextual-based approach to improve students' critical thinking skills get a positive response percentage of 96.35% which was included in the very good criteria.

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