*Unesa Journal of Chemical Education* *ISSN: 2252-9454*
*Vol. 9, No.1, pp.140-147. January 2020*

# IMPLEMENTATION OF GUIDED INQUIRY LEARNING MODELS TRAIN CRITICAL THINKING SKILLS IN REACTION RATE MATERIALS FOR ELEVEN CLASS SMAN 3 LAMONGAN

**Nurvita Eka Wulansari, *Ismono, and Bertha Yonata**
Chemistry Department, FMIPA, State University of Surabaya, Ketintang Street 60231
**E-mail**: ismono@unesa.ac.id

**Abstract**

This research aims to describe the critical thinking skills, the implementation of learning models, activities, and students 'responses in the implementation of guided inquiry learning to train students' critical thinking skills. The study was conducted with a pre-experimental research method One Group Pretest-Posttest Design at the eleven class Science 4 SMAN 3 Lamongan with a total of 30 respondents and using observation, tests (pretest and posttest), and questionnaires. This research found (1) The average feasibility of the guided inquiry learning for 3 meetings, in phase 1 87.5% (very good), phase 2 100% (very good), phase 3 96.87% (very good) , phase 4 87.5% (very good), phase 5 90.62% (very good); (2) Student activities related to the implementation of guided inquiry learning models and critical thinking skills of 97.22% at meeting 1, 97.78% at meeting 2, and 98.33% at meeting 3; (3) Critical thinking skills after trained for 3 meetings in interpretation, analysis, explanation, and inference components resulted with a percentage of 93.33% got N-Gain score in high category and 6.67% got the medium and completeness classical categories obtained 90%; (4) Student responses related to the process of guided inquiry learning and critical thinking 86.86% gave positive responses and 13.14% gave negative responses.

**Keywords**: Guided inquiry, critical thinking skills, reaction rates.

## INTRODUCTION

Education, as a meaningful aspect as the development of science and technology that now a concern of various part. Education has no limit in space and time. Education is also a basic aspect to create a competent generation of the nation. Education, along with the development of the times must continue to be improved and developed.

The government comducst improvements by updating the curriculum according to demands of development. The curriculum used is the 2013 revised 2018 curriculum. The curriculum is expected to prepare students to achieve the abilities needed in the 21st Century. The skills needed in the 21st century are 4C (communication, collaboration, critical thinking and problem solving, creativity and innovation) [1].

The 2013 curriculum emphasizes that students can be more active and the teacher's role is limited as a facilitator which means that teachers are limited to providing guidance to students in learning activities in order to meet graduate competency standards. Graduate competency standards was mentioned in *Permendikbud* Number 20 year 2016 which states that students can have the skills to think and act creatively, productively, critically, independently, and collaboratively by using a scientific approach [2].

Critical thinking skills is one standards competency of graduates and also the skills needed in the 21st century. Critical thinking skill can make the students have the ability to make decision on their own [3]. Critical thinking skills are also closely related to daily life, so for this reason critical thinking skills are important to be trained in the school [4].

One of critical thinking skills is according to Facione which is divided into 6 components, those are interpretation, analysis, explanation, inference, evaluation, and self regulation [5]. One of the efforts made to practice these skills to connect lessons in school with everyday life that is often encountered by students. One of the related subjects is chemistry.

Chemistry is a branch of science that related to the phenomena sorrounding. In learning, it is not only required to master concepts, principles, but also the process of how to obtain these concepts and principles. Students are expected to gain experience and apply scientific methods, and conduct scientific experiments after studying chemistry.

Based on *Permendikbud* Number 22 year 2016, efforts that can be made to practice thinking skills are through learning models that support one of them, that is discovery-based learning

(discovery/inquiry learning) [6]. Inquiry learning can make students act like a scientist to produce a concept [7]. The inquiry model is a learning activity in which students with all their abilities are directly involved in searching as well as conducting systematic, critical, logical investigations so that they can formulate their own findings with confidence [1].

Using guided inquiry learning teachers not only able to train critical thinking skill but also improve learning outcomes. The students' spirit of learning which is internal factors and environmental known as external factors are influence learning outcomes. In this case the environmental factors involved are the application of guided inquiry learning models.

Based on the results of the pre-research conducted on May 14, 2019 with 30 respondents who had received 70% reaction rate material expressed an interest in learning chemistry, but 56.67% stated that the chemical matter especially in reaction rate was difficult to understand because it was delivered with a lecture. Most of the chemistry lesson in school were only memorize the materials, which make it is not in line with direction of national education. The number of students' responses 93.33% which states they prefer to study chemistry with experiments.

Based on the results of the pre-research, the impelmentation of guided inquiry learning is required in sub matter factors that affect reaction rate to train critical thinking skill because on this matter there are many experiment that can be done to get a concept..

Based on interviews with 2 chemistry teachers, the result has shown that critical thinking skills have never been trained or applied before. Students when given a test of critical thinking skills and the results obtained on the interpretation component of 0-33.33%; inference of 0-55.55%; analysis of 0-44.44%; and explanations of 0-33.33%.

These results indicate that students still have difficulty to apply critical thinking skills by analyzing the phenomena that are around them. The results obtained are still in the low category so that as an initial stage, it is only intended to practice 4 components, namely interpretation, analysis, explanation, and inference.

Based on the background that has been described, a study that proposed by the researcheris the implementation of guided inquiry learning models is used to practice critical thinking skills in the reaction rate material for class XI of SMAN 3 Lamongan.

## METHOD

The study was conducted with a quantitative descriptive type with pre-experimental type and using a sample of 30 students in class XI Science 4 SMAN 3 Lamongan in odd semester 2019/2020. The research design uses One Group Pretest Posttest Design.

$$O_1 \; X \; O_2$$

Information :

O1 : Pretest (initial ability of critical thinking skills).

X : The application of guided inquiry learning model according to Joyce on the reaction rate material.

O2 : Posttest (The final ability of critical thinking skills).

The instruments used in this research were syllabus, lesson plans, student worksheet. The instruments used include the performance sheet, the student activity sheet, the critical thinking skills test sheet and learning outcomes, and student response questionnaire to the guided inquiry learning model to practice critical thinking skills.

Data collection methods were observation methods for the implementation of learning models and activities of students, test methods are used on the results of critical thinking skills and learning outcomes, and the questionnaire method is used when distributing questionnaire students responses.

Two observers observed the implementation of guided inquiry learning by giving scores at the phase 1, phase 2, phase 3, phase 4, and phase 5. Scores are awarded with a Likert scale which is presented in Table 1.

Table 1. Likert Scale

| Score | Criteria |
|---|---|
| 4 | Very Good |
| 3 | Good |
| 2 | Enough |
| 1 | Not Good |
| 0 | Not doing |

[9]

The score obtained is then analyzed using the formula:

$$\% \text{ Implementation} = \frac{\Sigma \, Score}{Maximum \; Score} \; x \; 100\%$$

The results of calculating the percentage of feasibility then interpreted based on Table 2.

Table 2. Implementation Criteria

| Percentage (%) | Category |
|---|---|
| 0 – 20 | Very Less |
| 21 – 40 | Less |
| 41 – 60 | Enough |

| Percentage (%) | Category |
|---|---|
| 61 – 80 | Good |
| 81 – 100 | Very Good |

[9]

Student activities consisting of 6 groups, which 1 observer observed 2 group. Activity analysis carried out with formula:

$$\% \text{ Activity} = \frac{\sum student\ activities\ that\ arise}{\sum overall\ activity}\ x100\%$$

Student activities called as good if the percentage of relevant activities to inquiry learning and critical thinking is greater than irrelevant activities.

Students' critical thinking skills analyzed by calculating the <g> value before a normality test performed. If the Sig value of data> 0.05 then the data is declared normal distribution and if the Sig value <0.05 then the data is declared not normally distributed. If the data is normally distributed, it can be continued with <g> analysis..

$$< g > = \frac{posttest\ score - pretest\ score}{\text{maximum score} - pretest\ score}$$

[10]

The results of the <g> score obtained were interpreted with the categories as in Table 3.

Table 3. Score Criteria <g>

| Score<g> | Category |
|---|---|
| Gain Score ≥ 0,7 | High |
| 0,7> Gain score ≥ 0,3 | Medium |
| Gain Score < 0,3 | Low |

[10]

The learning outcomes of the knowledge with 15 multiple choice questions are calculated by the formula.

$$\text{Learning outcomes} = \frac{\Sigma\ score\ obtained}{\Sigma\ Maximum\ Score}\ x\ 100$$

Analyzed of learning outcomes of each student declared completed if the value more than 75, and if less than 75 is incompleted and then the classical completeness percentage is calculated using the formula.

$$\% \text{ Classical} = \frac{\Sigma\ complete\ respondent}{\Sigma\ respondent}\ x\ 100$$

Students' responses to guided inquiry learning were conducted using a questionnaire method and were calculated based on Table 4.

Table 4. Guttman Scale Assessment Criteria

| Statement | Answer | Score |
|---|---|---|
| Response (+) | Yes | 1 |
| | No | 0 |
| Response (-) | Yes | 0 |
| | No | 1 |

[9]

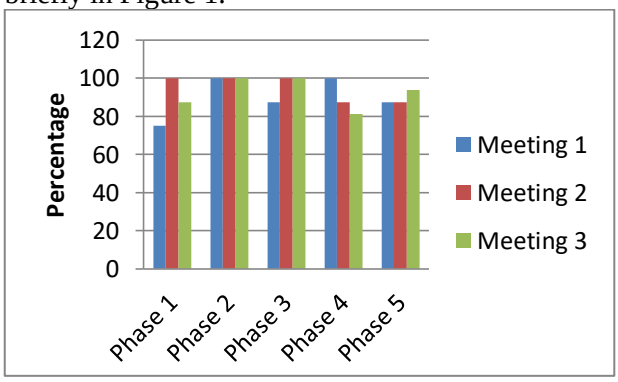
Student response analyzed descriptive quantitatively with describe the percentage in each question. The calculation of each category is analyzed with the following percentages:

$$\%\text{Answer} = \frac{\sum respondents\ answered}{\sum Respondent}x\ 100\%$$

## RESULTS AND DISCUSSION

### Implementation of Learning Models

The results of the implementation of guided inquiry learning for 3 meetings are presented briefly in Figure 1.




Picture 1. Percentage of Workability Graph Guided Inquiry Learning Model

Based on Figure 1 the average implementation of the inquiry learning l for 3 consecutive meetings 91.07%; 92.86%; and 93.75% with a very good category. This research was conducted for 3 meetings. The concentration factor discussed in meeting 1, surface area factor in meeting 2, catalyst and temperature factor in meeting 3. Students asked to discover concepts from the presented phenomena with applying critical thinking skills and the teacher only acts as a facilitator and guide if students experience difficulties during the process of finding concepts.

The teacher at each meeting started the lesson by providing a concept map. Concept maps are given so that students are easier to remember important material aspects [11]. The implementation of the preliminary stages are 100%, 87.5%, and 100%, respectively. The teacher then enters the core activities of guided inquiry learning which is divided into 5 phases.

The teacher in phase 1 confronts students with the problem. The teacher then gives a phenomenon as motivation related to the factor that

effect reaction rate that will be studied. Motivation is given as one of the success factors to achieve learning goals, motivation must arise in students in order to have motivation to learn [12]. Motivation that given by teacher can generate some questions from students but the teacher does not give clear answers, the teacher only give “yes” or “may be”.

The teacher asked to read the phenomena in student worksheet that lead to the experiments that will be conducted according to the reaction rate factor. Students in this phase listened to the teacher's explanation, expressed opinions, paid attention to the phenomena presented. Students then formulate the problem. The teacher provides assistance but reduce it gradually so that students learn independently [13]. The implementation of phase 1 at 3 meetings was 75%, 100%, and 87.5%, respectively.

Phase 2 is verification of data collection. Students after the appropriate problem formulation next to make a hypothesis experiment. The teacher in this phase provided guidance on how to characteristic of hypotheses at the first meeting and reduced them at the next meeting. Teachers and students communicate together the hypotheses that they have gotten. Implementation at three meetings is 100%.

Phase 3 is collecting experimental data. Students in this phase before conducting the experiment had to analyzed the experiment variables. Students found the difficulties because they had never done it before so the teacher at meeting 1 help by giving a little review related to what types of variables, definitions of each variable, and how to determine.

Teachers at meetings 2 and 3 were no longer provide this assistance. Students then analyzed the experiment variables and communicated with the teacher. The teacher and students then analyzed the experimental procedure and proceed by taking the tools and materials that needed for experiment and the teacher asked each group to conduct the experiment together with their group then wrote the result into the observation table. The actuality of this phase is 87.5%, 100%, 100%, respectively.

Activities carried out in groups according to the characteristics of the inquiry learning model was collaboration between students in small groups to carry out joint tasks so that they can obtain information from the other, the development of thinking and social skills.

Phase 4 is organization and formulation an explanation. The teacher asked the group to stop the experiment and start analyzed the data by answering questions in the student worksheet. Students worked with their groups. Students in this phase performed critical thinking components, those are analysis and explanation. The teacher applied the principle of the guided inquiry learning model, which given opportunity to the students for found their own answers to the problem being questioned. This statement supported Bruner's learning theory, namely the achievement of a problem solving and meaningful knowledge based on search and own effort [14].

Students in phase 4 is also asked to link the results they get with previous knowledge related to collision theory. This statement supported by learning theory according to Ausubel which states that learning is meaningful if it is linked between new knowledge and important concepts that exist in a person's cognitive structure [15]. The results of the data analysis then communicated with the teacher and responded by other groups. The implementation of this phase was consecutive for 3 meetings, namely 100%, 87.5%, and 81.25%.

Phase 5 is an analysis of the inquiry process. Students were given time to formulate conclusions related to what they have gotten during the experiment and based on data analysis that has been done before. Students in this phase will found a new concept related to the influence of concentration, surface area, temperature, and catalyst factors on the reaction rate.

Students found the difficulties In accordance with Piaget's theory of development which states that students aged 15 years exist in the formal operational stage that can analyzed a phenomenon and solve problems that exist in a phenomenon and then conclude it systematically [14]. This statement supported Bruner's learning theory, namely the achievement of a problem solving and meaningful knowledge based on search and own effort [14]. The implementation of this phase in a row for 3 meetings was 87.5%, 87.5%, and 93.6%.

The last step is closing. The teacher asked again about what they have gotten during learning process. Students expressed that they were happy because they could conduct experiments and got new experience for used laboratory equipment. These results supported the results of the questionnaire responses that 100% stated that got experience using laboratory equipment and by 73.33% expressed feeling better than understanding of the material after conduct experiments and being active during class. The results of conclusion stage in 3 meeting respectively to 87.5%, 87.5%, and 100%.

Based on the description that has been presented, the syntax of the guided inquiry learning model according to Joyce has been implemented in a very good category. Students can found concepts related to the influence of concentration factors, surface area, temperature, and catalysts on reaction rates by applying critical thinking skills possessed by students. Students can discover these new concepts through information provided on the phenomena around them with critical thinking skills. Inquiry is able to conduct research like a scientist to organize knowledge and create new concepts [14].

**Student Activity**

The student activities during the inquiry learning to train the critical thinking skill in the reaction rate matter were observed every 3 minutes and conducted by three observers with each observer in two groups which each group consist of 5 student. The result of relevant and irrelevant activities showed in Table 5.

Table 5 Relevant and Irrelevant Activity

| Meeting | Relevant/ Irrelevant | Value (%) |
|---|---|---|
| First | Relevant | 97.22 |
| | Irrelevant | 2.78 |
| Second | Relevant | 97.77 |
| | Irrelevant | 2.23 |
| Third | Relevant | 98.34 |
| | Irrelevant | 1.66 |

The relavant activity through guided inquiry and critical thinking in each meeting has increased and the relevant activity more than irrelevant activity. The result is show that the student active at the learning process and it is accodance with the Bruner learning theory which mention that student can found concepts through themselves by actively participating [13].

**Critical Thinking Skills**

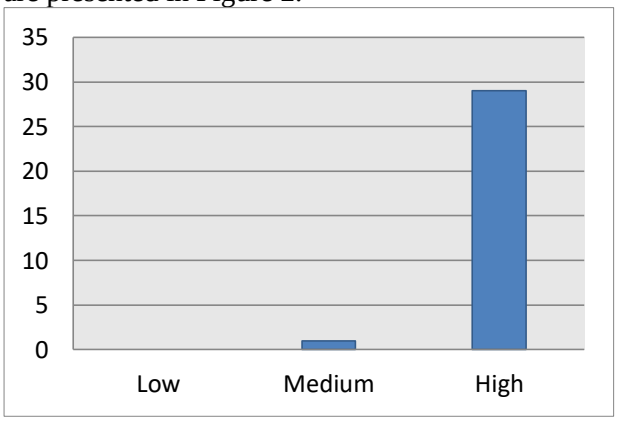
The components of critical thinking skills according to Facione are 6 but, only 4 are used in this study, namely interpretation, analysis, explanation, and inference. The teacher uses the help of student worksheet to make it easier for students to practice critical thinking, the student worksheet used has been adapted. Critical thinking skills test is carried out in 2 stages, before the learning model is applied and after the learning model is applied. Two tests is conducted to find out whose students trained in critical thinking skills, which show from the increasing of the student tests results. The results of the critical thinking skills test are presented in Table 6.

Table 6. Pretest and Posttest Results

| Student Number | Score *Pretest* | C/ NC | Score *Posttest* | C/ NC |
|---|---|---|---|---|
| 1 | 12.5 | NC | 87,5 | C |
| 2 | 25.00 | NC | 81.25 | C |
| 3 | 6.25 | NC | 78.12 | C |
| 4 | 6.25 | NC | 84.38 | C |
| 5 | 3.12 | NC | 84.38 | C |
| 6 | 9.36 | NC | 84.38 | C |
| 7 | 12.50 | NC | 87.50 | C |
| 8 | 9.36 | NC | 90.62 | C |
| 9 | 9.36 | NC | 87.50 | C |
| 10 | 9.36 | NC | 93.75 | C |
| 11 | 12.50 | NC | 71.88 | NC |
| 12 | 9.36 | NC | 78.12 | C |
| 13 | 0.00 | NC | 87.50 | C |
| 14 | 0.00 | NC | 84.38 | C |
| 15 | 3.12 | NC | 78.12 | C |
| 16 | 21.88 | NC | 81.25 | C |
| 17 | 18.75 | NC | 84.38 | C |
| 18 | 9.36 | NC | 90.62 | C |
| 19 | 0.00 | NC | 81.25 | C |
| 20 | 0.00 | NC | 81.25 | C |
| 21 | 31.25 | NC | 75.00 | C |
| 22 | 15.62 | NC | 75.00 | C |
| 23 | 3.12 | NC | 84.38 | C |
| 24 | 3.12 | NC | 81.25 | C |
| 25 | 15.62 | NC | 81.25 | C |
| 26 | 6.25 | NC | 93.75 | C |
| 27 | 15.62 | NC | 78.12 | C |
| 28 | 6.25 | NC | 100.00 | C |
| 29 | 12.50 | NC | 75.00 | C |
| 30 | 3.12 | NC | 78.12 | C |

Information :
C = Complete NC = Not Complete

The pretest and posttest used descriptions form questions with 8 question. The persentage students did not complete 100% with a value less than the minimal completeness criteria. Students trained with critical thinking skills and applying guided inquiry learning in 3 meetings. The test was given back after the 3rd meetings and the results were 96.67% of students completed and 3.33% not complete. Gain score analysis then performed to find out whether there are differenced in the pretest and the posttest values of critical thinking skills. The results of the increasing students' gain scores are presented in Figure 2.

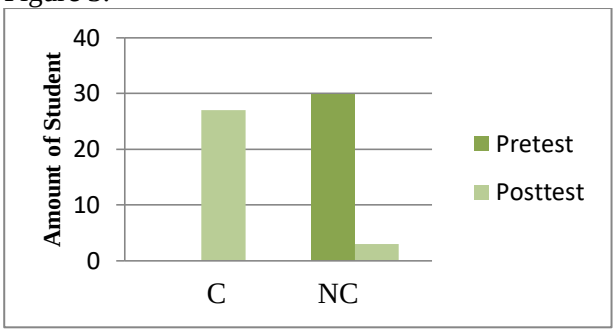



Picture 2. Gain Score of Critical Thinking Skills.

The graph above shows the result of the pretest and posttest gain score data on the implementation of the guided inquiry learning to practice critical thinking skills. Based on thirty students, it shown that none of the students got the low category, 3.33% in the medium category and 96.67% in the high criteria. Critical thinking skills of students are said to be trained if they obtain a gain score in the medium to higher category.

The results shown in Graph 2. Based on the thirty students with gain score in medium to higher category or 100%, it can be said that the implementation of guided inquiry learning was success to train students' critical thinking skills on the material rate of reaction, it carried out with the increasing the result of students critical thingking skills.

Knowledge learning outcomes were measured using a multiple choice question instrument with 15 questions in pretest and posttest. Learning outcomes are said to be completed if the value obtained ≥ 75 is the minimal completeness criteria score in SMAN 3 Lamongan. Complete learning outcomes of students are summarized in Figure 3.




Picture 3.Graph of Complete Learning Outcomes
Information :
C = Complete NC = Not Complete

Based on Figure 3, all students during the pretest were incomplete and got score below of 75. The results of the posttest obtained a classical completeness of 90%, meaning that 27 students were stated with a value ≥ 75 and with an average value of 87.11.

These results indicate that the implementation of guided inquiry learning models to practice critical thinking skills can also train students' knowledge on basic competency 3.6 which is broken down into 4 indicators, namely analyzing the effect of concentration, surface area, temperature, and catalyst on reaction rates based on experimental data. The four indicators formulated are complete because students get a percentage of completeness > 75%.

**Student Responses**

The response questionnaire is used to obtain students 'response data to the application of the guided inquiry learning to practice students' critical thinking skills. The response questionnaire was divided into 16 positive questions and 2 negative questions. Student responses will get positive results if the percentage obtained is ≥ 61%. Data on the results of student response questionnaires are presented in Table 7.

Table 7. The Statement on Response Questionnaire.

| | **Statement** |
|---|---|
| 1. | The chemistry learning model is fun with the guided inquiry learning. |
| 2. | The guided chemistry learning model makes me more critical in thinking. |
| 3. | Learning the rate of reaction with guided inquiry makes me feel depressed. |
| 4. | I better understand learning the reaction rate with the guided inquiry learning. |
| 5. | This learning model can give me a lot of new experiences. |
| 6. | I am more actively involved in learning. |
| 7. | I absorb more lessons independently and do not depend on the teacher. |
| 8. | The learning atmosphere is more fun. |
| 9. | Student worksheet that used can support learning. |
| 10. | After participating in learning, I am more critical of the phenomena around me. |
| 11. | Practicum makes it easier for me to understand the material. |
| 12. | Learning chemistry by using guided inquiry and practicum needs to be continuously implemented because it requires students to be more active in absorbing their knowledge than teachers who only give explanations and students hear a lot. |
| 13. | I gained experience in using practical tools. |
| 14. | The teacher guides students in conducting experiments. |
| 15. | Monotonous teacher explains so that I become bored. |
| 16. | Information in student worksheet is quite helpful in completing tasks in student worksheet. |
| 17. | The language used in student worksheet is easy to understand. |
| 18. | The task sequence and steps are very systematic. |
| 19. | The learning model used can be used on all chemistry materials. |

The amount of positive statement is 17 and the other is negative statement. The results of students' responses can be seen in Figure 4.

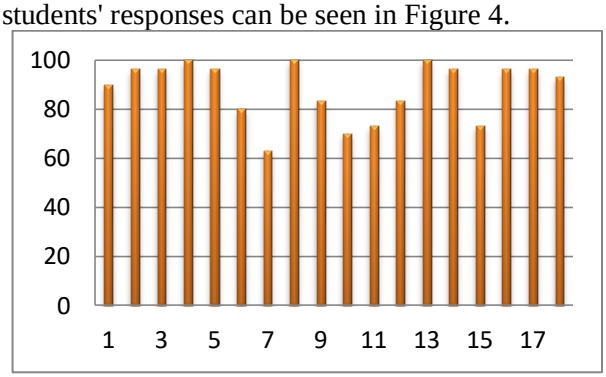



Figure 4. Graph of Student Response Results

Based on Figure 4 which shows if the response of students is said to be positive because each statement has reached a percentage ≥ 61%. Students feltl happy and not getting bored while learning with the guided inquiry learning. Students also feel that after being trained in critical thinking they become trained in applying critical thinking skills. New experiences in using laboratory tools during the experiment also received positive responses and the use of student worksheet also supported the application of guided inquiry learning models to train students' critical thinking skills on the reaction rate material.

## CLOSING

### Conclusion

The conclusions obtained based on research conducted include:

1. The implementation of the guided inquiry learning to practice the critical thinking skills of students in Phase 1 87.5%, Phase 2 100%, Phase 3 96.87%, Phase 4 87.5%, and Phase 5 90.62% with all received in very good category.
2. The students activities can be said supporting the learning process after applying guided inquiry learning models with a percentage relevant activities respectively at each meeting 97.22%; 97.78%; and 98.33%.
3. Critical thinking skills can said to be increased on the components of interpretation, analysis, explanation, and inference of 96.67% get a high category and 3.33% get a medium score gain category and classical completeness obtained by 90% which means 27 participants students in class get a score ≥ 75 and 3 people get less than 75. These results show that the application of guided inquiry learning models can practice critical thinking skills and can improve learning outcomes in the realm of knowledge.
4. Guided inquiry gives positive responses in students' critical thinking skill evidenced by the results of an average questionnaire 86.86% which belong to positive response if the result obtain ≥61%.

### Suggestion

1. The critical thinking component which is analysis gets the lowest average posttest score when compared to other components, further research should better guide students in working on problems when analyzing data so that the value obtained becomes more maximal.
2. Problem pretest and posttest critical thinking skills should have a balanced amount of each component so that the scores obtained are evenly distributed for each component and are not dominant in certain critical thinking skills components.

## REFERENCES

1. Daryanto, & Karim, S. (2017). *Pembelajaran Abad 21*. Yogyakarta: Gava Media.

2. Permendikbud. (2016). *Undang-Undang Nomor 20 tentang Sistem Pendidikan Nasional.* Jakarta: Depdiknas.

3. Munfaricha, F., & Ismono. (2018). Penerapan Lembar Kerja Siswa (LKS) Berbasis Inkuiri Terbimbing dalam Meningkatkan Keterampilan Berpikir Kritis Siswa pada Sub Materi Faktor-Faktor yang Mempengaruhi Laju Reaksi. *Unesa Journal of Chemical Education*.

4. Zahra, E. E., & Ismono. (2017). Peningkatan Keterampilan Proses Sains dan Penguasaan Konsep Siswa Melalui Penerapan Model Pembelajaran Inkuiri Terbimbing Materi Larutan Lektrolit dan Non-Elektrolit. *UNESA Journal of Chemistry Education*.

5. Facione, Peter A. (2011). Critical Thinking: What It Is and Why It Counts. *http://www.student.uwa.edu.au/data/assets/pdf_file/0003/1922502/Critical-Thinking-What-it-is-and-why-it-counts.pdf* Diakses pada tanggal 5 Desember 2019.

6. Permendikbud. (2016). *Salinan Lampiran Permendikbud Nomer 22 Tentang Standar Proses Pendidikan Dasar dan Menengah.* Jakarta: Dekdikbud

7. Joyce, Bruce., Weil, Marsya., & Calhoun, E. (2011). *Models of Teaching Model-Model Pengajaran.* Yogyakarta: Pustaka Pelajar.

8. Riduwan. (2015). *Skala Pengukuran Variabel-Variabel Penelitian.* Bandung: ALFABETA.

9. Hake, R. R. (1998). Interactive-engagement Versus Traditional Methods: ASix-Thousand-Student Survey of Mechanics Test Date For Introductory Physic Course. *J.Phys Volume 66*, 66-74.

10. Zvacek, S. M., Restivo, M. T., & Chouzal, M.F. (2013). Concept Mapping for HOTS. *International Journal of Engineering Pedagogy, Vol 3* (2), 6-10.

11. Emda, A. (2017). Kedudukan Motivasi Belajar Siswa dalam Pembelajaran. *Lantanida Journal, Vol 5*, 93-196.

12. Nurhayati, E. (2017). Penerepan Scaffolding untuk mencapai kemandirian belajar siswa. *Jurnal Penelitian Pendidikan dan Pengajaran Matematika, Vol 3*, 21-26.

13. Trianto. (2011). *Model-Model Pembelajaran Inovatif Berorientasi Konstruktivistik.* Jakarta: Prestasi Pustaka Publisher.