

IMPLEMENTATION OF GUIDED INQUIRY LEARNING MODELS TO TRAIN STUDENTS CRITICAL THINKING SKILLS IN SUB MATERIAL GASES STATE EQUATION

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Abstract

In the 21st century students are required to have learning skills and innovation. One of the learning skills is critical thinking skills (CTS). Guided Inquiry is one of the learning model that able to develop CTS students through its learning syntax. This study aims to describe the quality of learning implementation and improvement of CTS. The enhanced CTS includes indicators of interpretation, analysis, evaluation, inference, and explanation. The research design is pre-experimental with one-group pretest-posttest design. The subjects of the study are students of class XI MIA 8 and XI MIA 7 SMA Muhammadiyah 2 Surabaya. The improvement of CTS was analyzed using paired t-test and normalized gain-score analysis. The results showed that the guided inquiry implementation is 100% with good criteria and CTS improved significantly with gain score categorized as medium.

Keywords: guided inquiry, critical thinking skills, gases state equation

INTRODUCTION

The government has realized that education is the key to the progress of nation. Evidence of government's attention to education can be seen from the alternation of the prevailing curriculum. Curriculum that currently applies is K'13. The objectives of Kurikulum 2013 which is listed in Permendikbud No. 67 of 2013 is preparing the Indonesian people to have the potential and ability to live and able to contribute to the life of society, nation, state, and the world. Entering the 21st century, where the problems facing humans increasingly complex, because salig related, rapidly changing and full of paradox. Students and teachers are required to have 21st century learning abilities. P21 (Partnership for 21st Century Learning) develops a 21st century learning framework for 4C's learning and innovation skills consisting of 1) Communication; 2) Collaboration; 3) Critical thinking; and 4) Creativity (P21, 2015).

Indonesian participation in a numbers of TIMSS surveys has bottom-rated results in ability to analyze, design, formulate, evaluate, summarize. All the indicators mentioned before was the indicator of critical thinking. By the TIMSS results it can indicate that the critical thinking skills of students in Indonesia are still low. The results of pre-research that conducted in January also showed that students had difficulty answering critical thinking questions.

According to Johnson (2007) critical thinking skills are skills in which a person allows to evaluate or investigate evidence, assumptions, and logic that underlie other people's ideas. The ability to think critically is one of the basic capital or intellectual capital that is important to everyone.

In the study of physics, where complicated and abstract material requires learning that allows students to understand the concept of the material. The inquiry model is a learning model that involves students actively in the learning process. One of the inquiry learning models is guided inquiry. Guided inquiry learning models help students to develop their individual responsibilities, cognitive methods, reporting, problem solving and skills (Fatmaryanti, et al., 2015).

One of guided inquiry learning characteristics is students in the group given the problem to be solved through scientific method, that is include observation or exploring problems, focusing problems, planning experiments, doing experiments, analyzing data, building knowledge, and communicating new knowledge (Liewellyn, 2014).

The ability to think critically can be trained and developed by teachers during learning. Facion's critical thinking indicators are analysis, interpretation, inference, explanation, evaluation, self regulation. Those indicators can be trained through the guided inquiry stage of learning as in Table 1.

Table 1. Relationship between Guided Inquiry Learning Model with Critical Thinking Skills Indicator

The Syntax of Guided Inquiry Learning Models	Critical Thinking Skills Indicator
Identify problems and make observations	a. Interpretation b. Analysis
Creating Hypotheses	Inference
Designing an experiment	Interpretation
Eksperimenting	Interpretation
Analyze data	Analysis
Formulating Conclusions	Evaluation
Communicate the results	Eksplanation

(Adapted Lutfi Supriyono Budi Prabowo ; 2015)

METHOD

The design of this research is pre-experimental design with one-group pretest-posttest design. This research was conducted in SMA Muhammadiyah 2 Surabaya. In this research, XI MIA 8 is experimental class and XI MIA 7 is replica class.

Table 2. Design Research

Class	Pre-test	Treatment	Post-test
Eksperiment	O ₁	X	O ₂
Replication	O ₁	X	O ₂

Description:

O₁ = pre-test to know the critical thinking skills of student's before applying guided inquiry learning in sub material gases state equation

X = application of guided inquiry learning in sub material gases state equation

O₂ = post-test to know the critical thinking skills of student's after applying guided inquiry learning in sub material gases state equation

The quality of instructional learning implementation was measured by using a instructional learning implementation evakuuation sheet that is filled by two observers during the lesson. The improvement of students' critical thinking skills were analyzed by paired t test and normalized gain test.

RESULT AND DISCUSSION

The following table is the results of the guided inquiry instructional implementation in two meetings in both classes:

Table 3. Quality of Learning Activity

No	Aspect	XI MIA 8		XI MIA 7	
		M. 1	M. 2	M. 1	M. 2
1	Preparing students	3 (G)	3 (G)	3 (G)	3 (G)
2	Identification of problems	4 (VG)	4 (VG)	3 (G)	4 (VG)

No	Aspect	XI MIA 8		XI MIA 7	
		M. 1	M. 2	M. 1	M. 2
3	Asking question	3 (G)	3 (G)	3 (G)	3 (G)
4	Design an experiment	3 (G)	3 (G)	3 (G)	3 (G)
5	Collecting data	4 (VG)	3 (G)	3 (G)	3 (G)
6	Analyzing data	3 (G)	3 (G)	3 (G)	3 (G)
7	Formulate Conclusion	3 (G)	3 (G)	3 (G)	3 (G)
8	Communicate results	3 (G)	3 (G)	3 (G)	3 (G)
9	Closing	4 (VG)	3 (G)	4 (VG)	4 (VG)
10	Suitability of time allocation	4 (VG)	4 (VG)	3 (G)	4 (VG)
Mode of each meeting		3 (B)	3 (G)	3 (G)	3 (G)
Mode of each class		3 (G)		3 (G)	

The score was obtained based on the calculation of the rating mode of the two observers. Based on the Tabel 3, the implementation of guided inquiry learning in the class of experiments and replicas was 100% with good category.

Based on the result of paired t test the value of $t_{\text{calculate}}$ is greater than t_{table} , then H₀ is rejected which means that there was significant difference between pretest and post-test score. To know the difference between pre-test and post-test score, a normalized gain analysis was performed.

Table 4. N-gain Critical Thinking Skills

No	Class	N <g>	Criteria
1	XI MIA 8	0,720	High
2	XI MIA 7	0,572	Medium

Table 4 shows the improvement of students critical thinking skills, in experiment class it obtained high criteria and in replica class it obtained medium criteria. From the results of normalized gain analysis of each student, it is known that in the experiment class more than 50% of students was got a high criteria whereas in the replica class almost all students get a medium criteria.

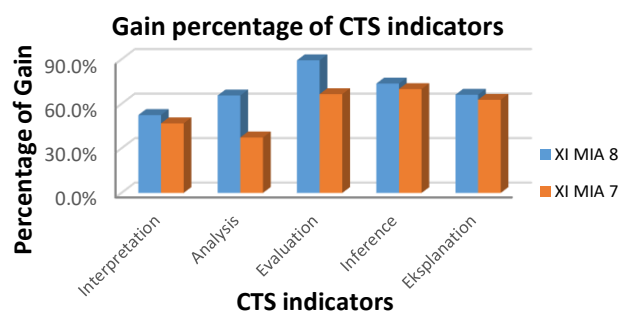


Figure 1. Index Gain for Each CTS Indicators

Based on Picture 1 the highest improvement of critical thinking skills is found in the evaluation indicators followed by indicators of inference. And the lowest improvement is in the interpretation indicator. Initial skills of students on evaluation and explanatory indicators are very low. This is because students tend to apply the formula but in critical thinking skills to solve the problems needed explanation of the concept. The pre-test value of the students is very low because they are less accustomed to working on critical thinking skills based on problems related to the concept of gas state equation, and students are less able to describe the concept they have.

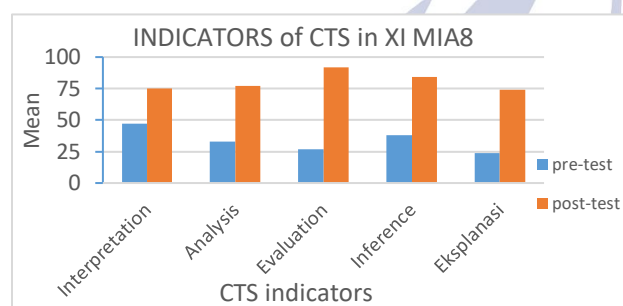


Figure 2 average score of CTS indicators in XI MIA 8

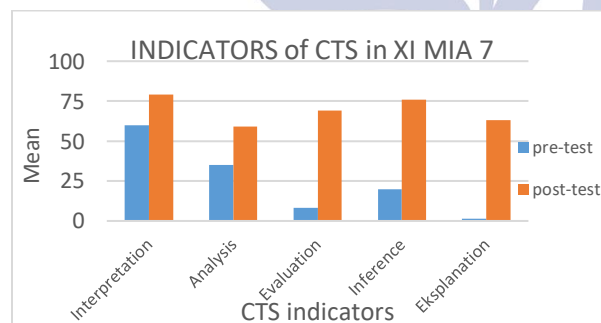


Figure 3 average score of CTS indicators in XI MIA 7

Based on the results that showed in Pic. 2 and 3, the conclusion of all critical thinking indicators increased after applied guided inquiry model learning in experimental and replica class. Discussion of each indicator of critical thinking skills as follows.

a. Interpretation

Initial ability of students in doing problem on indicator of interpretation have been good in both class, so that can be seen in picture 4.5 big increase in indicator of interpretation with medium criteria.

b. Analysis

Initial ability of students in doing the problem on the analysis indicator is low. This is due to the inability of students to analyze the graph, and to analyze the cause and effect relationship. But after applied guided inquiry learning ability analysis of students increase.

c. Evaluation

In this case students are asked to mention the wrong statement. Initial ability of students in working on questions on evaluation indicators is very low, especially class XI MIA 7. This is because many students who do not answer. In class XI MIA 8 there is a rapid increase in this indicator with high criterion, while in class XI MIA 7 increased with moderate criteria.

d. Inference

In this case students are asked to infer the conditions that occur in a phenomenon and its explanation. The result of critical thinking skills after learning on this indicator increases with medium criteria.

e. Eksplanasi

In this case learners explain what happens to the balloon in the injection with four different codes. As with the evaluation indicator, almost all replica grade students are not able to answer this question. In the experimental class some students have been able to answer but not quite right. After learning the ability of students expansion increase.

Inconsistency increment in both classes occurs because students in the replication class are less active during the learning activities. It is also caused by the ability of different students during the experimental activities in learning. Students are different individuals and have different developments. It is described in Piaget's theory that each individual grows through the same developmental order, yet at different speeds. In addition, the difference of gain score criteria in the two classes is also caused by the less 100% identical learning, it is shown from the questionnaire of the implementation of learning at the first meeting where in the experimental class (XI MIA 8) 4 out of 10 aspects performed very well, while in the replica class only 1 of 10 aspects that performed very well. The existence of different treatment is what causes the inconsistency of the results between the two classes.

The results of this study in accordance with research conducted by Puspita & Jatmiko (2013) which states that after applied guided inquiry learning there is improved critical criterion of moderate criteria. Supported by research by Agustin & Supardi (2014) which stated that critical thinking skills increased significantly after the application of guided inquiry learning.

CLOSING

Conclusion

The implementation of the guided inquiry instructional model in the sub-matter of gas state equation in SMA Muhammadiyah 2 Surabaya is done 100% with good criteria. Students' critical thinking skills improved significantly with gain score categorized as medium.

Suggestion

Guided inquiry learning takes a long time in its implementation, so that things that can reduce learning time must be minimized. Guided inquiry learning activity with PhET Simulation media to train CTS in sub material gases state equation preferably applied to another school or another class with a longer duration of time and select research subject with the condition of students already have good science process skills and high academic ability.

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