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IMPLEMENTATION OF GUIDED INQUIRY MODELS IN REDOX MATTER TO TRAIN STUDENTS CRITICAL THINKING WITH BACKGROUND COGNITIVE STYLE FIELD INDEPENDENT AND FIELD DEPENDENT

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Abstract

This study aims to observe the implementation, student activity, increased of students critical thinking after this models implemented in 37 student with Field Independent and Field Dependent cognitive style. Type of this study is quantitative descriptive research. Target of this research is student of X MIA 5 in SMAN 11 Surabaya with research design one group pretest-posttest. Instrument used in this research is observation of feasibility Guided Inquiry models sheets; observation student activity sheets; and critical thinking skills test sheets. Based on result of this research and discussion, so (1) feasibility of Guided Inquiry models for trained critical thinking skills student has average value at first meeting and second meeting is 3.8; and 3.85 in criteria very good; (2) based on percentage of student activity time, which showed student train critical thinking skills for Field Independent student as much as 43.03% (first meeting) and 44.48% (second meeting) also for student with Field Dependent as much as 38.3% (first meeting) and 40.6% (second meeting); (3) increased of critical thinking skills in high category for student Field Independent as much as 56% and 0% for student Field Dependent, in medium category for student Field Independent as much as 41% and 40% for student Field Dependent, in low category for student Field Independent as much as 3% and 60% for student Field Dependent

Keywords: Guided Inquiry, Criticall Thinking Skills, Cognitive style, and Redox

INTRODUCTION

Education is an important component that estabilised quality of human resource. Learning target of Curriculum 2013 observed three characteristics of science including attitude, knowledge, and skills, in order to adjust with implementation of Curriculum 2013, it can be done with scientific approach [1].

Scientific learning is a learning that adopts steps of scientists in building knowledge through scientific methods with an enhancement on the process of scientific learning. Chemistry is a part of science with contains three matters related with chemistry that is inseparable, those are: chemistry as a product, chemistry as a process, and chemistry as an attitude [2]. In accordance with the enhancement of the process, chemistry learning is a part of natural science, wherein the learning of chemistry must reflect the competence of scientific attitude, scientific way of thinking.

Based on observation that held on 30 September 2016 in SMAN 11 Surabaya, there were 62% of student's rarely conduct learning process which involves analysis, 28% of the students difficult to do a problem interpretation, 61% of the students found it difficult to do a problem analysis, and 58% of the students find difficult to do a problem inferences. There were 92% of the students's respond that learning models used by teacher are only lecture and assignment methods. Based on the fact above, it shows that scientific learning process gets little attention.

Graduate competence standard is a qualification of graduates' ability which includes attitude, knowledge, and skills that must be fullfiled or achieved from an educational unit at the level of primary and secondary education [3].

To achieve the learning objectives, based on the 2013 Curriculum, in Redox matter a learning model that can attract students' attention through model of active student is required, and one of models that suitable to be applied in this chemistry learning is Guided Inquiry. Guided Inquiry learning is a student-centered learning model, so at the end of learning student are required to find concept independently [4]. The characteristic of Guided Inquiry learning models is giving question or problems. So through question and problems, student will be trained to find the possible answers.

It can be known through phases in Guided Inquiry learning model. In observation phase to find a problem, formulate a problem, do experiment and collecting data analysis which in cognitive domain C4 that is analyzing. In the phase of proposing hypotheses and conclusion or finding that cognitive domain C5 which evaluating. Then,

in the phase of plan troubleshooting and experimenting that is in cognitive domain C6 which is created [5].

One of the considerations to choose the learning model, with the aim of improving the achievement of student learning outcomes, is Cognitive Style on Students. It can affect the acquisition of learning outcomes in students and the level of critical thinking skills in students. Cognitive style can be classified in any kinds, such as cognitive style field independent and field dependent. Student who has cognitive style field independent generally tend to process the received information, while students who have cognitive style field dependent generally tend to receive available information [6].Student cognitive style has advantages and disadvantages in achieving the learning outcomes. In learning, educators are required to be able to assess the students' type of cognitive style, then choose and apply the appropriate learning model in accordance with the cognitive styles of the students [7].

Redox matter is a part of chemistry that studies about oxidation number, in which the matter is contained in its abstract material, so that it does not only convey the concept but more than that.

METHOD

The type of this research is pre-experiment research with quantitative descriptive method. The pre-experimental studies are using one class and no class control [8]. Target of these studies is students of SMA Negeri 11 Surabaya class X MIA 5. With research design one group pretest posttest design.

The tools used in this research are syllabus, lesson study, and student worksheet. While the research instruments used in this research are observation sheet of the feasibility guided inquiry learning models, observation sheet of student activity, and critical thinking skills test.

Data collection technique in this study uses two methods, that is observation method and test methods. The observation method is used to observe the feasibility of the guided inquiry learning models and student activity during the learning. Test method is used to obtain data in the form of critical thinking skills test scores as an indicator of the achievement of critical thinking skills.

Data analysis technique used is data analysis of feasibility guided inquiry learning model, which is an analysis of student activity that appears every 3 minutes and reflects guided inquiry phase as well as critical thinking skills. And analysis result of student critical thinking skills are resulted after applying the guided inquiry learning models.

The value of feasibility guided inquiry learning models is obtained using an observation sheet of feasibility that contains guided inquiry syntax, observed by 3 observers.The data obtained then calculated by using the formula [8]:

$$\% = \frac{total\ score of\ collecting\ data}{scoring\ criteria} x\ 100$$

The scores were then interpreted in Table 1.

Table 1. Interpreting score

Value Scale	Category
0%-2%	Not appropriate
25%-40%	Less
41%-60%	Enough
61%-80%	Good
81%-100%	Very Good

The value of time student activity is obtained using an observation sheet of student activity that is observed every 3 minutes during learning. Data can be calculated using formula:

$$\%\ \text{student activity} = \frac{time\ activit\ that\ happend}{total\ time\ activity} x\ 100$$

The analysis of student cognitive style was obtained using GEFT instruments which contain complex images and are categorized according to Table 2. This analysis is used to student's ploting into two of kind cognitive style, which is Field Independent and Field Dependent. Then, compared critical thinking skills between student's with Field Independent cognitive style and student's with Field Dependent cognitive style.

Table 2. Scale of Cognitive Style

Score GEFT	Category
0-6	Field Dependent
7-10	Field Intermediet
11-20	Field Independent

Data analysis of students' critical thinking skill is obtained through test results that are receive by students during pretest and posttest which then converted with criterion based on *permendikbud No. 104 Tahun 2014*. The value of students' critical thinking skill can be calculated by:

$$\text{value of critical thinking skills} = \frac{score\ that\ get\ in\ indicator}{total\ score\ in\ indicator} x\ 100$$

RESULTS AND DISCUSSIONS

Implementation of Guided Inquiry Learning

Feasibility of guided inquiry learning models on the learning activity conducted during the two meetings has been done very well. This is proved by the average obtained at meetings I and II of 3.8 and 3.85. The quality of good learning is also supported by students' activities that were arised during learning. Observation of student activity is done to acknowledge the improvement of critical thinking skill of the students, which is reflected through student activity in analyzing and drawing conclusion.

In the learning models phase 4, phase 5, and phase 6, it can show up students' critical thinking skills. That phase, among others in phase 4, guides student to do experiment and collect the data and also in phase 5 to make explanations and conclusions, which elicits critical thinking skills of analysis and inference.

The observation data of the feasibility of the guided inquiry learning models showed in Figure 1.

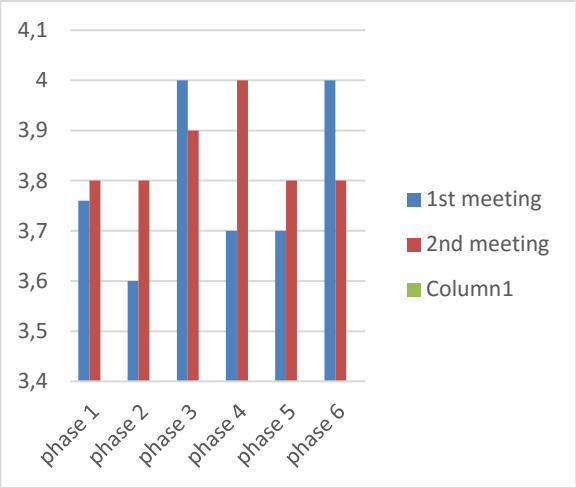

Figure 1. Comparison of Guided Inquiry components feasibility

Specification:

Phase 1: gain attention and explains inquiry process.

Phase 2: present inquiry problems

Phase 3: student made hypothesis to explain the phenomenon

Phase 4: guide student to conduct experiment

Phase 5: make explanation and conclusion

Phase 6: reflect in problem

In this introductory activity, the teacher draws attention and explains the Inquiry process to the students. Teacher then provides questions about relevant material or material related to the material they once got to build initial knowledge about redox material, in which the process of asking is called aperseption. After the teacher submits aperseption, the teacher then delivers the learning objectives to be achieved.

In phase 2, teacher presents or delivers the problems in the form of phenomena that often occur in daily life. This stage is given so that students can think broadly about the problems that occur and how to solve them by linking to the material they have received.

Phase 3, in this main activity, the teacher asks students to construct hypotheses of the phenomena that have been presented in the student worksheet. At this phase, it is given that students may give a temporary presumption over the phenomenon presented.

In this fourth phase, teacher guide students to conduct experiment based on the phenomena that presented and collect data on their experimental results. In this phase 4, the skill is trained by the researcher that is analysis. Analysis is a skill to identify the intended and actual inferential relationships between statements, questions, concepts, descriptions [9].

For this phase of 5, the activities of teacher are to guide students to be able to made conclusions on the learning they have done. In this phase of critical thinking skills trained in inference, which students are expected to think broadly to provide conclusions of the phenomena presented.

In this closing activity, the teacher ends the learning process by asking the conclusions about the material learned that day and the teacher will provide feedback on the conclusions of the day's learning. It aims to make students think the conclusions they get from their experiments on the phenomena presented and which are associated with the material they have obtained.

Student Activity

This research to observe of student activity aims to observe activity conducted by student during learning progress. The emergence of student activities in learning shows that students have been trained by critical thinking through Guided Inquiry learning model.

Observations of these student activities are differentiated into students who have a cognitive style of Field Independent and Field Dependent to compare activities performed by students. Student activity observation data can be shown in Figure 2.

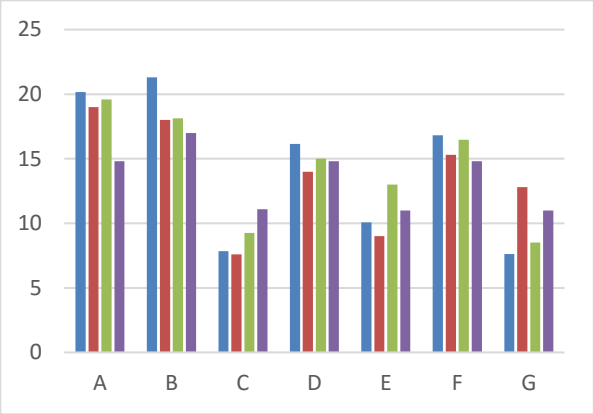

Figure 2. Comparison of Student Activity

Specification:
A: notice teacher explanation
B: reading student worksheet
C: do student worksheet
D: discussion among students
E: present work results
F: participate actively in learning
G: irrelevant behavior

Student activity during learning has a very important role in the learning process that aims to train critical thinking by using Guided Inquiry learning models. The activity of students with Field Dependent cognitive style is smaller than the students with the cognitive style of Field Independent, this is because the Field Independent students have the characteristic of separating something complex from the global region and have an analytic tendency. So, in student activity to show critical thinking skills, students with cognitive style of Field Independent tend to get a higher percentage compared to students who have Field Dependent cognitive style.

Student activity presented practices critical thinking skills for the Field Independent students as much as 56.03% at the first meeting and 56.87% at the second meeting while the Field Dependent students as much as 49.9% in the first meeting and 53.9% meeting in the Second Meeting. The activities of students who present the practice of critical thinking are activity number 4, 5, and 6.

The first activity done by the students is paying attention to the explanation from the teacher, where at first meeting the percentage obtained is very high. Because students have not received redox material so that the students still need to pay attention to the initial material to increase their initial knowledge about redox.

The second activity represents that the students practicing critical thinking are asked to read the Student Worksheet given by the teacher so that they get initial knowledge on how to determine the formulation of the problem, hypothesis, and variable for the experiment to be conducted. For the third and fourth activities, students are asked to work on student worksheets in discussion with the group that includes determining the formulation of the problem, hypotheses, and variables and to determine the tools and materials to be used.

The fifth activity represents that those students practicing critical thinking is proven by students doing observations for the critical thinking skills component of analysis and inference. The percentages obtained in the fifth activity are Field Independent students of 10.08% and 13%, Field Dependent students 9% and 11%. In the fifth activity there is an increase in percentage, this is because at the first meeting, students have not been trained to critical thinking analysis and inference. The difference in the percentage earned by Field Independent students and Field Dependent students is due to the characteristics of the Field Independent students which better at clarrifing the context from the general area to the specific area, and students with the cognitive style have a tendency of analytical properties. So that students with the cognitive style of Field Independent are able to convey the results of their analysis and conclude their results better than the Dependent Field students.

The last activity is activities that are not relevant to learning activities such as talking unnecessarily, leaving the class without permission, and not actively involved in the discussion. And the percentage of this activit can shown in Figure .

Student Critical Thinking Skills

In this study, observations were made for students' critical thinking skills. This critical thinking skill is trained during the learning process by applying the guided Inquiry learning model. Critical thinking skills in students are done by the method of pre-test and post-test. This pre-test is used to examine the critical thinking skills of each student before the implementation of the guided Inquiry learning model while the Post-test is used to examine students' critical thinking skills after the implementation of the guided Inquiry learning model.

The students' critical thinking ability is measured through tests that include questions from the critical thinking component proposed by Facione [9]: interpretation, inference, analysis, evaluation, explanation, and self-organization. But

this study is only limited to the domain: analysis and inference.

Post-test results obtained in very good category for Field Independent students as many as 75.6% of students, while Field Dependent students none of which get grades with very good category. In either category, Field Independent students are 10.8% and Field Dependent students are 5.4% students. In the category of less, only Field Dependent students get as many as 8.1% of students.

Table 3. Data Acquisition Post-Test Value Of Critical Thinking Skills

Cognitive Style \ Category	Very Good	Good	Less
Field Independent	88%	12%	0%
Field Dependent	0%	40%	60%

Based on the data in Table 3, it can be analyzed that students who have cognitive style of Field Independent tend to get grades with very good category compared to students who have cognitive style of Field Dependent. This is because the activities that demonstrate the critical thinking skills observed from students with the cognitive style of Field Dependent are less likely than students with the cognitive style of Field Independent in influencing the post-test results of critical thinking skills.

Based on its characteristics, students with cognitive style of Field Independent are more likely to have analytical properties compared to Field Dependent students so that it can also affect the post-test results received by each student.

Based on the data in Table 3 of post-test results, it can be known differences in students' critical thinking skills before the application of learning models and students' critical thinking skills after the implementation of Inquiry learning model Guided to students who have cognitive style Field Independent and Field Dependent, with testing and verification of difference significance is statistically tested for n-gain. Table 4 is the n-gain score data obtained by students who have the cognitive style of Field Independent and Field Dependent.

Table 4. Data Acquisition Student N-Gain Score

Cognitive Style \ Category	High	Average	Less
Field Independent	56%	41%	3%
Field Dependent	0%	40%	60%

Based on Table 4 which shows n-gain score obtained by students who have cognitive style Field Independent and Field Dependent, it can be analyzed that is:

1. Students with cognitive style of Field Dependent get low category improvement as much as 8.1% from 37 students with n-gain value of 0 - 0.1. While the gain of moderate category as much as 5.4% from 37 students with vulnerable n-gain value of 0.4.
2. Students with a cognitive style Field Independent get a low category improvement as much as 2.7% of 37 students with a n-value-vulnerable 0.3. Students who received a moderate category improvement were 35.1% of 37 students with a n-gain of 0.5-0.6. Students get a high category increase of 48.6% of 37 students with a n-gain value of 0.7-0.9.

CLOSURE

Conclusion

Based on the correspondence between the results and the aims, it can be concluded that:

1. In the data analysis of the implementation of guided inquiry learning model, the results obtained by teachers at meetings 1 and 2 mostly get grades with very good category.
2. In the analysis of student activity time, it shows that activity to train students' critical thinking skill with cognitive style of Field Independent get equal to 56.03% at meeting I and 56.87% at meeting II, while students with cognitive style of Field Dependent get equal to 49.9% at meeting I And 53.9% at the second meeting.
3. Increased students' critical thinking skills with high category for Field Independent students as much as 48.6% and 0% for Field Dependent students. Medium enrollment for Field Independent students of 35.1% and 5.4% for Field Dependent students. Low category increase for Field Independent students by 2.7% and 8.1% for Field Dependent students.

Recomendation

Suggestions that can be given to further researchers based on data analysis are:

1. Time allocation needs to be calculated in arrangement, because the guided inquiry learning model is a learning model with a practicum so it takes a long time for students to thoroughly conduct a research
2. Before the selection of suitable learning models for research, researchers also need to look at the cognitive style of the students so that researchers can find out the differences in critical thinking skills of students.
3. Not all materials match the guided inquiry learning, but the researcher can apply the learning model with the students' cognitive style differences on the material other than redox.

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