



Critical Thinking Skills Analysis Students Studying Chemistry Using Problem Based Learning and Guided Inquiry Model

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Abstract: Critical Thinking Skills Analysis Students Studying Chemistry Using Problem Based Learning and Guided Inquiry Model. The purpose of this study is to analyze the critical thinking skills of students. The independent variable is the guided inquiry learning model and the Problem Based Learning (PBL) model and the variable is critical thinking skills. The type of research used is a quasi-experimental design with a Non-equivalent Posttest Only Control Group design. 146 Students are subject in this study. Data collection was carried out with a description of 14 questions. The results showed that the Critical Thinking Skills of students who were taught using the Problem Based Learning model was better than the guided inquiry learning model.

Keywords: Guided Inquiry, Problem Based Learning (PBL), Higher Other Thinking Skills.

Abstrak: Analisis Keterampilan Berpikir Kritis Peserta Didik yang Belajar Kimia Menggunakan Model Pembelajaran Inquiry Terbimbing dan Model Pembelajaran Berbasis Masalah. Tujuan dalam penelitian ini yaitu untuk menganalisis keterampilan berpikir kritis peserta didik. Variabel bebasnya adalah Model Pembelajaran Inquiry terbimbing dan model pembelajaran PBL dan variabel terikatnya adalah keterampilan berpikir kritis. Jenis penelitian yang digunakan yaitu quasi eksperimen dengan desain Non-equivalen Posttest Only Control Group. Sampel dalam penelitian ini yaitu 146 peserta didik yang di tentukan dengan teknik Purposive sampling. Pengumpulan data dilakukan dengan soal tes uraian yang berjumlah 14 soal. Hasil Penelitian menunjukkan Keterampilan Berpikir Kritis (KtBK) peserta didik yang dibelajarkan dengan model PBL lebih baik dibandingkan dengan model pembelajaran inquiry terbimbing.

Kata kunci: Inquiry Terbimbing, PBL, Keterampilan Berpikir Kritis

• INTRODUCTION

According to Nofrion, N., & Wijayanto, B. (2018), global community life has an impact on different learning needs and learning methods, which make students able to understand science at a basic level, for example conducting investigations by utilizing the natural surroundings. One of the demands of the 21st century, namely, students should have a critical thinking skills, according to Facione (1990) the critical thinking

is a process mental and logic thinking in a people to evaluation and understand information obtained and become the basis for making decisions about what to do.

Chemistry learning requires a good understanding to be able to understand concepts well, starting from understanding previous concepts which must also be well understood. The knowledge gained by students is built or constructed according to their respective learning experiences according to the stage of development and the influence of the surrounding environment. One way to get success in learning is to link old understanding with new understanding. The process refers to the view of constructivism which is one view that focuses more on students to learn to think innovatively and develop their potential optimally (Afifah, I. R. N., & Retnawati, H. 2019). Therefore, learning is more than student-centered learning and learning is not an amount that students have to memorize. Chemistry learning should be applied with a learning model that refers to constructivism.

Problem-based learning model and inquiry learning model guided skills used will affect critical thinking skills students, because both models have a syntax that requires students to students in identifying problems, solving problems and demanding teamwork, this syntax is in accordance with critical thinking indicators, namely (1) interpret the problem, (2) analyze the problem, (3) evaluate, (4) make inferences, (5) provide explanations. Students who have High critical thinking skills will automatically result in academic achievement would be good too. These two models will be compared, the model which one is better in developing critical thinking skills and academic achievement of students. (Zulkarnain, dkk 2019).

One of the learning models that can be used to help make it easier for students to find problem solving according to student experience is to use a guided inquiry learning model. This model is more effective in helping to train and guide students in finding concrete concepts and can build higher thinking patterns. The results of Damayanti's research, I., (2018), show that learning using the inquiry model is more effective than learning using conventional learning models (lectures or only from textbooks). The results of the research by Seprianingsih, et al (2017), show that the inquiry learning model is effective for developing students' critical thinking skills. The results of another study by Nugraha, et al (2017) that students' critical thinking skills have increased after being taught using the Problem Based Learning model.

The data were analyzed using the Rasch model. Rasch model is used for validation and reliability analysis of the question instrument. Rasch models is a modern appraisal theory that can classify item calculations and person in a distribution map. This model is part of item response theory. The Rasch model is based on two principles. The first principle is the subject's ability to this is the student's ability to predictable questions using a set of factors called traits. (Hadi, S.A., dkk. 2018).

Traits are a dimension of ability individual which can consist of verbal abilities, cognitive and psychomotor abilities. Principle The second states the relationship that occurs between the ability of the subject, in this case the student, at a question or question on ability others can be depicted in a curve grain characteristic. In the Rasch model, the test taker with high ability should have a greater probability to answer correctly a question than other students. And vice versa, student have less chance to answerreally a question that has a level of difficulty higher. In the Rasch model approach, in addition to pay attention to items also pay attention to aspects response and correlation. The advantages of Rasch modeling over other methods, especially classical test theory, namely ability to make predictions on data missing data (missing

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data), which is head based systematic response pattern. A test instrument is said to be good if able to provide accurate information related to student's ability to competence tested. (Corebima, 2017)

Winstep software is a name of tool computation on the Rasch model to analyze the score generated from the test instrument with the aim of discerning Outfit MNSQ, Outfit ZSTD, Point Measure Correlation, Item reliability and Alpha Cornbach. MNSQ outfit is useful for see the suitability of the data with the model used. Expected mean square value is 1 (one). If the mean-square value on fit greater than one, the variation of the instrument is more many of the predictions made by Rasch model. If the infit value is less than 1, then the variation on the instrument is less when compared with predictions made by the Rasch model. In this study, the researcher wants to know the quality of the test instruments used to find out students' abilities in life insurance premium calculation principle material with the Rasch model approach. This quality measured based on several indicators, namely questions that fit the Rasch model and reliability question item. Therefores designed the test instrument is then determined which items only those who fit and those who don't fit the model rasch. In addition, with the help of Winstep software, will determine the value of crobach's alpha for know the reliability of the items. (Ihsan, M S, dkk. 2019)

Based on the student learning outcome in report cards, it shows that only a small number of students can have the ability to analyze. The aim of this study are describe the critical thinking skills of students who studying with the guided inquiry learning model and the Problem Based Learning model.

METHOD

The chemistry material taught in this research is Electrolyte solution and reduction and oxidation (redox) reactions. This type of research is a quasi-experimental research and non-equivalent posttest only control group design research. The sampling technique used is purposive sampling. Sampling is done by selecting classes that meet the criteria to be used as samples. The criteria used are the similarity of the teaching teachers, the uniformity of the initial data. So that the sample in this study amounted to 146 students.

The research instrument describes all the data collection tools used, the data collection process and the technique for determining the quality of the instrument. The instruments referred to in the research to be carried out are:

1. Learning Instruments

The instrument is a learning device that provides treatment at the time of research. The treatment instruments to be used are as follows:

a. Syllabus

Syllabus is a learning plan that includes core competencies, basic competencies, time allocation, assessments and learning resources developed by each educational unit.

b. Learning Implementation Plan

The learning implementation plan is a guide to the steps that will be taken by the teacher in learning activities that are arranged in activity scenarios.

c. Student Worksheet

Student worksheets are sheets containing assignments that must be done by students.

d. Essay Questions

This description question is used to measure critical thinking skills and academic achievement consisting of the same questions, but different analytical techniques. Critical thinking skills are analyzed according to the rubric.

Category	Assessment indicators	Score
High score	The answers given are clear, focused and accurate. Relevant points raised (related to the question in the question)	3
Medium score	The answers given are clear and quite focused, but not complete. The examples provided are limited. The relationship between answers and questions is lacking clear.	2
Low score	The answer given does not match the answer referred to in the question contains information that is less accurate, or shows lack of use of the material. Pinpoint given is not clear, does not provide supporting example.	1

Table 1. Critical thinking skills censorship rubric

There are two variables in this study, videlicet the independent variable and the dependent variable. The dependent variable is critical thinking chops, measured using five pointers (facione, 1990)

a. Interpreting the problem,

Interpretation is the capability to understand and express meaning or significance of a wide variety of gests.

b. Analyzing the problem

Analysis is the capability to identify connections from some statements, questions, generalities, descriptions, and forms other representations to reflect and express studies, views, beliefs, opinions, reasons, information and opinions. Estimate other people's ideas and opinions, descry arguments and assaying the argument is part of the analysis.

c. Evaluation

Evaluation is the capability to test the verity of statements used to convey studies, comprehensions, views, opinions, reasons, and opinions. Evaluation is also the capability to examine the relationship of colorful statements, descriptions, questions, and forms others used in reflecting studies.

d. Inferencing

Inference is the capability to identify and elect rudiments demanded to draw logical conclusions, to form conjectures and suppositions, to consider information applicable and to decide the consequences to be drawn from data, reports,

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principles, substantiation, judgments, beliefs, opinions, generalities, description, question, or other form of representation.

e. Giving explanations.

Explaining is the ability to express the results of thoughts, explain reasons based on evidence considerations, methodological concepts, criteria and context. This skill includes abilities deliver results, explain procedures, and present argument.

The independent variable is guided inquiry model and Problem Based Learning model. In this research used five Problem Based learning syntax and six guided inquiry syntax.

Phase	Teacher activity
Phase 1	Explain the learning objectives, logistics needed,
Orient students to the problem	motivate students to be involved active in problem
	solving activities chosen.
Phase 2	Helping students limit and organize study-related
Organizing students to learn	tasks with the problems faced
Phase 3	Encourage students to collect appropriate
Guiding research individual or	information, implement experiments, and looking
group	for explanations and solving
Phase 4	Helping students plan and prepare appropriate
Develop and presenting the	works such as reports, videos, and models, and help
work	them to share tasks with friends.
Phase 5	Helping students to reflect to the investigations and
Analyze and evaluate process	processes that used during the split problem.
solution to problem	

Table 2. Problem Based Learning Syntax

This research used six guided inquiry syntax, as follows:

1. Orientation stage.

At this stage, the teacher conditions the students to be ready learning, doing apperception, and learning objectives.

2. The stage of formulating the problem

At this stage the teacher gives problems and Students are assigned to ask questions related to with the problem.

3. The stage of formulating a hypothesis

At this stage the teacher proposes various questions that require temporary answers from student questions that have been formulated in the previous stage.

4. Data collection stage

At this stage, students do activities to find and collect data or facts needed to answer the problem formulation and test the hypotheses that have been made.

5. The stage of testing the hypothesis.

At this stage, students are assigned to prove the hypothesis and determine the answer that is considered correct by giving reasons.

6. The stage of formulating conclusions.

Students reveal whether the hypothesis is true or not, after that the students formulate conclusion to the problem being discussed with describe the findings that have been obtained.

RESULT AND DISCUSSION

Data on the level of Critical Thinking Skills was obtained through two data collection techniques, namely observation and test results using questions.



Figure 1. Percentage analysis of critical thinking skills

Based on Figure 1. it can be seen that of the five critical thinking skill indicators, the PBL learning model shows a higher percentage than the guided inquiry learning model. The indicators of critical thinking skills were analyzed based on the average value. In indicator I, namely interpretation, the Problem Based Learning model has a better category than the guided inquiry model. This is because the principle of the PBL model is to train students to interpret data with the existing syntax, especially in the second syntax, which is to guide individual and group investigations. This is in accordance with the opinion of Retnawati H, et al (2018) that the stages of the Problem Based Learning model are divided into three important stages, namely, the preliminary stage, the stage of problem based learning, and the final stage. In the first stage, the first activity carried out is problem orientation and then trains students to interpret the data.

Second indicators were analysis, the Problem Based Learning model has a better category than the guided inquiry model. This happens because one of the advantages of the Problem Based Learning model is that it can train students to analyze problems that occur in real life based on the given problem orientation. Indicators of this analysis are integrated in the Problem Based Learning syntax, namely orienting students to problems and organizing students to learn. This is in accordance with the

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opinion of Diani (2016) that the PBL learning model has the characteristics of encouraging students to ask questions and analyze the information provided.

Susilowati's research results (2016). shows that with the Problem Based Learning model the level or ability to analyze students is getting better and increasing. A person who has the ability to think critically mathematically has the intellectual ability to think logically and reflectively in understanding mathematical problems, analyzing problems, and deciding the right solution (Sari, 2017).

Third Indicator, namely Evaluation of the Problem Based Learning model has a better category than the guided inquiry model. This is because one of the syntaxes of the Problem Based Learning model trains students to evaluate problems or seek justification from the information provided. The syntax in question is to analyze and evaluate the problem solving process. The results of Nailis, et al., (2017) showed that through the PBL model students showed good problem-solving skills.

In addition, the results of Yeung's research, S. S. (2016), argue that in the process of solving problems encountered during Problem Based Learning, students can be assisted in considering appropriately, challenging assumptions, and evaluating different options. Thus, Problem Based Learning can help students to develop and improve decision-making decisions.

However, not all indicators show a good category, out of 5 indicators only three indicators show a good category while two indicators show that students in both groups have a less critical category. The indicators are inference and explanation. Indicator. One can think inductively (inference) by characterizing the characteristics or properties of various phenomena, then draw conclusions on all types of phenomena (Rochman, S., & Hartoyo, Z., 2018). This happens because students are not used to learning to use learning models that are student center in principle, so that the application of learning models is not optimal.

CONCLUSION

Based on the objectives, research results and discussion, it can be concluded that, in general, the critical thinking skills of students who learn to use the Problem Based Learning model are better than students who learn to use the guided inquiry model. The Problem Based Lerning model is proven to be effective in training students' critical thinking skills.

For this research, it is only limited to chemistry learning materials for class XII SMA, namely electrolyte solutions and redox reactions. This study only focuses on the syntax that has been described in the research method section.

Suggestions for further researchers are: to maximize student activity by adding observers in the class. So that all syntax is carried out properly and critical thinking skills are achieved, it is necessary to research in a longer period of time.

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