Enhancing students’ critical thinking skills through inquiry-based learning model

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Abstract. Critical thinking is a process that is focused and clear used in mental activities such as problems solving, making decisions, persuade, analyze assumptions and conduct scientific research. The ability to think critically affected by the knowledge acquired competence of learners. Inquiry is one of the learning model that has potency to develop students’ critical thinking skills. This study aims to determine the effect of the inquiry learning model of the critical thinking skills of learners. This research is a quasi-experimental research design using Randomized Control Group Posttest-Only Design. The population in this study was the students of class VIII SMPN 11 Padang. The samples in this research that VIII.B class as an experimental class and the control class as a class VIII.C taken using purposive sampling technique. The instrument used was a final test in the form of essay as much as 14 items to see the effect of inquiry model of the critical thinking skills of learners. The hypothesis in this study were tested using t-test, for normally distributed data and has a homogeneous variation. Based on the results of the research data showed that critical thinking skills $t > t$ table (4.23 > 1.67). Therefore, it is stated hypothesis is accepted. It can be concluded that the implementation of inquiry learning model has a positive influence on learners’ ability to think critically.

1. Introduction

To be success in 21st century, students not only require learning achievement but also several skills that we called 21st century skills. Conceptions of 21st century skills include some familiar skills that have been the focus on school learning for many years, such as information processing, reasoning, inquiry, critical thinking and problem solving [1]. Our government, in Indonesia, also include these skills in our curriculum[2]. The 2013 Curriculum has goal of creating learners who believe, productive, critical and innovative, and able to contribute to the society and the state. Therefore, the 2013 Curriculum seeks to improve the ability of learners to think that one of them is the ability to think critically.

One of important skills that applicable whenever students’ in the workplaces critical thinking skill. Critical thinking focuses on deciding what to believe or do [3]. Luke states of critical thinking is reflective, involves standards, authentic and reasonable thinking[4]. Lai[5] suggest that critical thinking includes the component skills of analyzing arguments, making inferences using inductive or deductive reasoning, judging or evaluating, and making decisions or solving problems. Some indicators of critical thinking by Ennis[6], such as clarification, decision, inference, and advanced clarification.Critical thinking in the workplace will potentially affect people either in a negative or...
positive way through the decision making process. The practice of critical thinking encourages employees and managers to observe various situations, consider all possible solutions, then decide on a course of action and this skill can literally improve profits and capabilities of the employees[7].

Critical thinking skills learned in the classroom definitely have an impact on future learning in the workplace. Critical thinking skills of students is closely related to the learning activities at the time of learners using one of the critical thinking skills to understand the knowledge and solve problems that they faces. While, based on the results of questionnaires given to 46 learners in SMPN 11 Padang on October 12, 2017, found that 73.36% of teachers use the lecture method in the learning process. Through the use of this method makes the learning process tend to be focused only in one direction. The students get materials provided by the teacher. Application of this method has not been developing and improving critical thinking skills of learners. Furthermore, the skill to think critically is also influenced by the competence of the knowledge acquired by learners. This is evidenced by the results of Karbalei’s research [8] that academic achievement and critical thinking skills have a significant impact on learning outcomes of students. Based on the data obtained, show that knowledge competency of learners is still low. It can be seen from the percentage of completeness Middle Semester Exam learners in SMPN 11 Padang in the academic year 2017/2018 which showed that 87.5% of the students’ learning outcomes is still below the minimum completeness criteria that has been set is 75.

One effort to improve critical thinking skills of learners is by using a learning model that include groves of information processing. According to [9], using learning models that include groves of information processing will generally be more effective to develop and to improve thinking skill of learners. This is because of information-processing models emphasize the impact on the person's thinking and ways of processing information. One of processing information based learning model is inquiry learning model. Inquiry learning model has long been reported to produce superior learning outcomes in teaching science education[10]. It also encourage students’ to think logical, critical, systematic, analitic [11]. Many studies, in several subject, suggest that teacher should pay more attention in conducting a meaningful learning which support students to develop their critical thinking skills [12]–[17].

Characteristics of the material applied to the inquiry learning model that learners maximize all the ability to search and investigate in a systematic, logical, and critical so it can formulate its own invention. One material that can be applied to the inquiry model is the excretory system, because students have to investigate the mechanism of action of excretory organs, urinary stages, disorder or abnormality in the excretory system, and a healthy lifestyle to keep the excretory system in humans. So this material may be determined by using the inquiry learning model to achieve the critical thinking skills of learners.

2. Method
This type of research is a quasi-experiment. This study used two sample classes that control class and experimental class. In the experimental group was given treatment by applying inquiry learning model, while the control class without the inquiry learning model. The design of this study is Randomized Control-Group Posttest Only Design [18] illustration, design can be found in Table 1.

| Table 1. The study design Pretest Posttest Control Group Design |
|---------------------------------------------------------------|
| Class | Treatment | Posttest |
|-------|-----------|----------|
| Experiment | X | T2 |
| Control | - | T2 |

The population in this study are all learners Grade VIII SMPN 11 Padang enrolled in the academic year 2017/2018. The total number of members of a population of 273 people distributed into 7 classes. The samples in this study were students VIII.C as the controller class and the class as a class experiment is VIII.B. These samples were determined using purposive sampling technique which is sampling based on the characteristics required in the study. This research was carried out four times of
the meeting in the first week of March to the third week in March 2018 at SMPN 11 Padang. The ability to think critically assessed from the result of the posttest. Indicators used critical thinking skills is the ability according to Ennis [5] include clarification, decision, inference, and advanced clarification. The data in this study were analyzed using statistical tests such as t test. Before the t test first tested the normality and homogeneity of data.

Stages of learning conducted in the experimental class are: 1) Learners with his group into the subject contained in student’s worksheet, 2) Learners formulate the problem contained in student’s worksheet, 3) Students is given the opportunity to ask questions while hypothesis about the material being studied. 4) Having proposed a hypothesis, learners together with clumps fill tables contained in student’s worksheet, 5) Learners with his group processing the data that has been obtained, 6) Learners with his group to analyze the data that has been obtained, 7) One of the groups presented the results discussion.

3. Results and Discussion

Based on research that has been conducted, data on critical thinking skills of learners. Data is test the critical thinking skills of learners obtained from the posttest done in class VIII.B as an experimental class and class VIII.C as the control class. Test learners’ critical thinking in the form of 14 item description (essay) that have been tested for validity at SMPN 11 Padang VIII.A class. The data are presented in Table 2.

| Class   | N  | The highest score | The lowest score | S   | S2  |
|---------|----|-------------------|------------------|-----|-----|
| Experiment | 32  | 90.47             | 64.28            | 8.11 | 65.77 |
| Control  | 32  | 90.47             | 47.62            | 10.09 | 101.8 |

Based on Table 2, it appears that the average critical thinking skills of students in the experimental class is higher than the control class that is 78.05 compared to 68.38. The average value of critical thinking skills acquired by students can be seen in Table 3.

| No. | Indicator          | Average value per indicator                                      | Criteria | Control class | Criteria |
|-----|--------------------|-----------------------------------------------------------------|----------|---------------|----------|
| 1.  | Advanced Clarification | Experimental class = 77.77, Control class = 63.88              | Good     | Good          | Enough   |
| 2.  | Decision           | 78.77                                                           | Good     | 70.21         | Good     |
| 3.  | Clarification      | 78.82                                                           | Good     | 73.61         | Good     |
| 4.  | Inference          | 77.08                                                           | Good     | 64.58         | Enough   |

Based on Table 3, the average value of critical thinking skills indicator experimental highest class currently on clarified indicator is 78.82 with critical thinking skills criteria classified as good and the lowest are in the Inference indicator is 77.08 with critical thinking skills criteria as good. While the average indicator value critical thinking skills of the highest control class is at clarification indicator is 73.61 with critical thinking skills criteria classified as good and the lowest are in the advanced clarification indicator is 63.88 with the criteria is enough.

To determine the conclusion of the data obtained critical thinking skills, then performed statistical tests by using the t test. Before performing the t test first tested for normality and homogeneity test data.
3.1. Normality test
To test normality test score distribution end, the formula used is Lilliefors test. Of normality test on samples obtained both classes Lo and Lt prices on the real level $\alpha = 0.05$ for $n > 30$, as shown in Table 4 below:

| No. | Class      | N  | S    | $S^2$ | Lo        | Lt        | Ket         |
|-----|------------|----|------|-------|-----------|-----------|-------------|
| 1.  | Experiment | 32 | 8.11 | 65.77 | 0.119     | 0.156     | Normal      |
| 2.  | Control    | 32 | 10.09| 101.8 | 0.099     | 0.156     | Normal      |

**Table 4. Results of Normality Test Critical Thinking Ability Test Sample Class**

From the data above shows that both classes of samples have Lo $<$ Lt meaning both classes of data are normally distributed.

3.2. Homogeneity test
Homogeneity test aims to determine whether the sample class distributed homogeneously or not. Tests carried out to see homogeneity grade is F test sample homogeneity test analysis results are shown in Table 5.

| No. | Class      | N  | S    | $S^2$ | $F_{count}$ | $F_{table}$ | Ket         |
|-----|------------|----|------|-------|-------------|-------------|-------------|
| 1.  | Experiment | 32 | 8.11 | 65.77 | 1.55        | 1.84        | Homogeneous |
| 2.  | Control    | 32 | 10.09| 101.8 |             | 1.84        |             |

The data shows that the grade samples have $F_{hitung}$<$F_{table}$ which means both classes of homogeneous samples.

3.3. Hypothesis testing
The results of normality and homogeneity test showed that both classes of normally distributed samples and having variances were homogeneous. For normally distributed data and has a homogeneous variance t test as in Annex 17, the analysis results of hypothesis testing can be seen in Table 6.

| No. | Class      | N  | $T$ | $t_{table}$ | Ket         |
|-----|------------|----|-----|-------------|-------------|
| 1.  | Experiment | 32 | 4.23| 1.67        | The hypothesis is accepted |
| 2.  | Control    | 32 |     |             |             |

Critical thinking skills is the ability to think that involves cognitive processes, analytical, rational, logical, and encourage students to think reflectively against problems. To see the critical thinking skills, it can be measured using an instrument such as a description about the adjusted indicators of critical thinking. According to Ennis [5], there are five indicators, namely critical thinking classification, decision, inference, advance clarification, supposition and integration. In this study, the indicators that researchers use only four indicators is classification, decision, inference, and advance clarification.

The results showed that there are significant implementation of inquiry learning model of the critical thinking skills of learners. Inquiry learning model used in the experimental class affect learners' critical thinking skills better than the control class that uses the usual learning model applied by the subject teachers. It can be seen from the results of the average posttest in the experimental class are 78.05 and 63.38 in the control class. This result is also supported by research [13] learners who carry out inquiry learning model has good critical thinking skills compared with students who did not apply inquiry learning model. In line with these results, the study by [11] also states is appropriate for
application to real practice and helps student to develop the knowledge and skills that they will require to achieve success in the information age.

Based on the test results of the posttest-adjusted indicators of critical thinking is known that the inquiry learning model affects the critical thinking skills of students in the material excretory system. Teaching and learning in the experimental class guided learners to be more active in seeking its own concept in the learning process. According to [8] it is because inquiry learning model encourages students to find and understand the information. Inquiry is a series of learning activities that emphasize the process of thinking critically and analytically to seek and find their own answer to the problem in question[19].

The results also showed an increase in all indicators of the critical thinking skills of learners. The increase in each indicator critical thinking because the syntax of inquiry learning model is able to train to improve critical thinking skills of learners[20].

At this stage learners teacher orientation to be ready to implement the learning process and directing steps to formulate the problem up to formulate a conclusion. The stage of formulating the problem, the students are trained to formulate a problem containing puzzles. At this stage classification train the ability for learners to focus on formulating a question, identify and define the criteria for a correct answer[21]. Phase proposed a hypothesis, learners give temporary answer to the problems being studied. One of the ways that teachers can do to develop the ability to guess (hypothesize) learners is to ask questions that can encourage learners to be able to formulate a response while or various estimates of possible answers of a problem being studied. This stage Inference and Decision train the ability for learners to give some usulan to a problem and give reason to a problem.

At the stage of collecting data, the students are trained to think find the information needed to solve a problem. The result of this research is in line with the statement of [22] at this stage it can train classification ability for learners to focus on a question to solve and analyze the correct answer. Further clarification advance train capability for gathering with classifying things according to certain criteria and choose the answer with the appropriate criteria. The next train decision ability to collect data by applying a procedure to solve the problem. At this stage of testing hypotheses, learners are able to determine the answer to that is deemed acceptable in accordance with the data or information obtained based on the collection of data. At this stage it can train the ability of the decision as it gives reason to a problem and observe a data to test the hypothesis. At the stage of formulating its conclusions, the students describe the findings obtained based on the results of hypothesis testing. To reach an accurate conclusion should the teacher was able to show learners which data are relevant. At this stage according to Alzahrani [23] the train inference ability because it provides a conclusion that is consistent with the facts. The next train clarification ability of being able to summarize and provide conclusions to a problem using real experience the cognitive development of a person would be better than just using the language to communicate.

4. Conclusion
The conclusion of this study is the application of inquiry learning model has a positive influence to enhance the critical thinking skills of students in the material excretory system because this learning model significantly influence the critical thinking skills of learners. With this model teachers can create learning activities to become more active and practice of student’s critical thinking skills.

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