The correlation among students’ response in applying problem based learning and cognitive conflict strategy to improve critical thinking skills and curiosity attitude based on academic level

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Abstract. The purposive of this research was to describe and analyse correlation of student’s response in applying Problem based learning and cognitive conflict strategy (PBLCCS) to improve critical thinking (CT) and curiosity attitude (CA). This research design was quantitative and qualitative research. The population was consisted of undergraduate students of mathematics education study program and samples were chosen purposive sampling. The instruments used in this research were observation, questionnaire and interview sheets. The findings showed that: (1) response of students in increasing critical thinking (CT) and curiosity attitude (CA) in teaching and learning process through problem based learning model and cognitive conflict strategy based on academic level was positive and very good category and they helped student to solve problems given and there were correlation among them based on academic level. (2) There were correlation between of students’ response in applying Problem based learning and cognitive conflict strategy (PBLCCS) to improve critical thinking (CT) and curiosity attitude (CA) based on academic level. They were known through observations, questionnaire and interviews results.

1. Introduction

Critical thinking is an essential skill that everyone should have. By thinking critically, one will always be careful in doing something and make decisions about a given problem. In Higher Education, this skills is very necessary because every subject requires students to be critical thinking. By using critical thinking, students are expected to solve the problem given. Critical thinking requires students when faced with challenges and they must make decisions, evaluate and consider well the information received, used and trusted, make plans and determine the actions to be taken. Eventhough the curiosity, that curiosity is indispensable to every human being in life, because with this attitude one will always try to ask about the unknown. Curiosity as a state of emotional arousal caused by conceptual conflict or insecurity, which then stimulate the search for information or research to resolve this uncertainty. Especially for students in teaching and learning Berlyne (1960) in [1]. Fostering the scholarly attribute of curiosity in learners is an important task; one that is at the heart of education and effective learning as it challenges and promotes active participation in learning [2]. Therefore, the development of curiosity should be the goal of learning. Because when learners have curiosity high on something, the closer they
are to the learning environment, including group study [3]. One learning that can develop critical thinking skills and students' curiosity is Problem Based Learning and Cognitive Conflict Strategy (PBLCCS) [4]. In her research, [4] have interviewed students as a sample to find out the student’s response to the learning that is applied, whether it influences the improvement of critical thinking skills and curiosity about the problems given in learning.

In this study, in addition to learning factors, there are other factors that are considered that affect the ability to think critically and curiosity, namely the student's academic level, meaning that in a group of students will always be found students from high, medium and low groups. Galton in [5] states that a group of students is very rarely found to have the same ability, but spreads according to normal distribution.

Next, this research to describe and analyze correlation of Student’s Response about Problem Based Learning and Cognitive Conflict Strategy in developing critical thinking skill and curiosity attitude based on academic level.

2. Method

2.1 Research Design

This research uses a quasi-experimental design [6] and [7]. Design research is using combine of quantitative and qualitative methods (mixed method). The collection of data, both quantitative research conducted during experiments and quantitative data were analyzed, then from the qualitative data was conducted after the collection of quantitative data and analyzed separately for both the data to answer the problem formulation different.

2.2 Participants

The participants are consisted of undergraduate students of Mathematics Education Study Program FKIP Riau of Islamic University that are given of PBLCCS in learning.

2.3 Instrument of research

Instrument of collect quantitative and qualitative data were test, observation and interview sheets. Test to describe mean critical thinking skills, observation sheets to describe student’s curiosity attitude and interview sheets to describe student’s critical thinking skills in teaching and learning in qualitative.

2.4 Analysis of Data

For quantitative data, namely critical thinking skills and curiosity attitude using mean and percentage and the development of curiosity attitudes. The mean formula is :

$$\bar{X} = \frac{\sum X}{N}$$  \hspace{1cm} (1)

Where : $\bar{X}$ = mean ; $\sum X$ = sum of score ; $N$ = number of sample

And the percentage formula is :

$$\text{percentage} \text{ (\%)} = \frac{S}{TS} \times 100\%$$  \hspace{1cm} (2)

Where : $S$ = score obtained ; $TS$ = total score

With category can be seen in Table 1:
Table 1. Percentage and category of critical thinking skills and curiosity attitude

| No | Interval of percentage | Category   |
|----|------------------------|------------|
| 1  | 80 --- 100             | Very Good  |
| 2  | 60 --- 79,9            | Good       |
| 3  | 40 --- 59,9            | Fair       |
| 4  | 20 --- 39,9            | Poor       |
| 5  | 0,0 ---19,9            | Not Good   |

While the qualitative data is described based on the results of interviews obtained and analyzed and correlated with the responses of students about learning. From Quantitative and qualitative results both are correlated. If the student's response is good about PBLCCS and the ability to think critically and curiosity is good also, then it says there is a correlation, but on the contrary if what happens is contradictory, then there is no correlation.

3. Result and Discussion

3.1 Quantitative analysis of the critical thinking skills and curiosity attitude

From analysis of qualitative data about critical thinking skills and curiosity attitude can be describe on in Table 2:

Table 2. Critical thinking ability and curiosity based on level academic

| Level   | Mean CT | %   | Category | Mean CA | %   | Category |
|---------|---------|-----|----------|---------|-----|----------|
| High    | 13,45   | 89  | Very Good| 112     | 70  | Good     |
| Medium  | 13,56   | 90  | Very Good| 116     | 72  | Good     |
| Low     | 13,18   | 87  | Very Good| 131     | 82  | Very Good|

Information:
Total score Critical Thinking (CT) : 15
Total score Curiosity Attitude (CA) : 160

3.2 Qualitative analysis of the critical thinking and curiosity attitude process

From observations and interviews can be described a process of critical thinking and mathematical curiosity. In following Table 3 illustrates how students develop their critical thinking skills and curiosity about the material given in the PBLCCS learning process, such as asking directly if there are things that are not understood, giving opinions in discussions and enthusiastic in learning.

Table 3. Observations about the process of critical thinking and mathematical curiosity group of students based on academic level

| Level   | Critical Thinking Process                                                                 | Curiosity Process                                                                 |
|---------|------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|
| High    | 1. Asking questions about the task given excellent                                        | 1. Asked, most students ask about things that are not understood                   |
|         | 2. Giving opinions in discussions with aplomb                                              | 2. Enthusiastic in learning, looking from the spirit in completing a given task    |
|         | 3. If there are things that are not yet understood, immediately asked the lecturers in order to assist in solving a given problem | 3. Explain it well to his friend from a given task                                  |
Middle Asked his friend in the group, full of curiosity about the settlement of the problem given  Ask, ask a friend in the group, if it can not be a satisfactory answer directly ask the lecturer  

Low  Following discussions and listened to his well Noting with curiously given task in a group discussion  

### 3.3 The Qualitative Data from interview sheets

Based on data analysis about developing of student’s critical thinking skill in teaching learning with problem based learning and cognitive conflict strategy based on academic level, can be described in the following table:

**Table 4. Student’s Perception about PBLCCS**

| Question about PBLCCS | Level    | Student’s Response                                                                 |
|-----------------------|----------|------------------------------------------------------------------------------------|
| How do you think about the application of problem-based learning with cognitive conflict strategy in helping you understand the concept given? Can it grow your critical thinking process and your curiosity? | High     | In my opinion, this strategy is good to implement, because it makes my thinking grow, and feels challenged with the questions given, the existence of learning groups helps me solve problems given. |
|                        | Middle   | Using this strategy, makes me try to understand the problem given. If I don't understand, I can ask my group friends directly |
|                        | Low      | In my opinion, problem-based learning with cognitive conflict strategy is very good and very helpful, can fosters the process of critical thinking and curiosity because I was given the opportunity to answer questions in groups in our way |
| Can the Student Worksheet (SW) that is used understand the material provided? Are you challenged with the questions given? Are you curious or even confuse you? | High     | The worksheet helped me understand the material and made me curious. |
|                        | Middle   | Very help, can make me ask more questions about the problem given, provoking curiosity |
|                        | Low      | Helpful, I feel challenged because in the worksheet there are questions that I do not understand, so I am challenged |

### 3.4 Discussion

From the analysis of quantitative data on critical thinking skills and curiosity attitude from tabel 2, can be seen that were very good base on academic level, it means that there were improving critical thinking skills and curiosity attitude after applied the model of PBLCCS in learning. And from the analysis of qualitative data on critical thinking skills and curiosity attitude from tabel 3, can be seen that is the students from academic level developed critical thinking process and curiosity attitude process. They asked questions about the task were given and things that are not understood. So enthusiastic in learning, looking from the spirit in completing a given task and explain it well to his friend from a given task. If they didn’t understand about problem were given, they asked his friend in the group or ask to lecturer directly. The last, from Table 4, can be conclusion that student’s response or PBLCSS were positive and very good, both about learning applications and worksheets provided based on academic level. It means, on high academic level, critical thinking skills and curiosity attitude are very good have response positive in apply PBLCCS, so medium and low academic level. It can be concluded that there
is a correlation between student responses to learning with an increase in critical thinking skills and students’ curiosity attitudes to mathematics on all academic level. This is supported by research that has been carried out by [4], [8], [9]. In research result, [4] stated that Problem-Based Learning and Cognitive Conflict Strategy (PBLCCS) can improve students’ critical thinking skills and improved their curiosity attitude on academic level. This finding research was supported by [8] in his paper. He was found that Problem-Based Learning can improve the ability of high order mathematical thinking of junior secondary school learners. In addition, this finding was also supported by [9] who has proven the effectiveness of cognitive conflict strategy in improving learners’ high order mathematical thinking. Focusing on strategy, [10] also found that PBLCCS can improve the creative and critical thinking of junior secondary school.

4. Conclusion

Problem-based learning and cognitive conflict strategy had been given satisfactory results to improve the critical thinking skills and curiosity of students in process, but if the terms of the process of critical thinking and curiosity during the learning process show a good critical thinking process and the attitude of curiosity towards mathematics. Expected PBLCCS educators can implement this in the right situation. From theoretical study can be state that the Skills to think critically and the scientific attitude of mathematical curiosity can be facilitated by PBLCCS. It is recommended that lecturers or teachers can use PBLCCS in mathematics learning.

5. References

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