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Early profile analysis of student's critical thinking in material system circulation in XI MIA class of high school in Surakarta

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Abstract. This study aims to analysis student's critical thinking abilities in the material circulation system. The sample of this study was taken by cluster random sampling as many as 32 student of XI MIA class in a high school in Surakarta. The test using essays as many as 6 questions developed based on aspects of critical thinking by fascione. Data were analyzed by using qualitative descriptive method. Based on the data analysis, the average percentage of student's critical thinking ability was low (37.29%). Percentage of interpretation aspect was low (45.81%). Percentage aspects of analysis was low (33.59%). Percentage of evaluation aspect was low (30.01%). Percentage of aspects inferential was low (27,01%). Explained aspect percentage was low (24.84%). Percentage aspect of self-regulation of medium category (62,50%). The results of this study indicate student's critical thinking skills are still low category. This is because teachers still have not innovated the approach to the learning process, so students are less interested in the learning process. It causes the critical thinking skills acquired by students to be low.

1. Introduction

Education aims to prepare the students facing demands in 21st century. The students must have ability in education through developing thinking skill, process skill, scientific attitude, mastery in concept, technology activity, and environmental management efforts [14]. These days information can widespread freely through internet access and there is no guarantee that information is correct. Everyone must be able to evaluate information so that they can be used for good. The ability in evaluating and taking decision to use that information correctly requires critical thinking skills [11]. The ability to use critical thinking would be very useful for everyone to assess information as to whether the information is valid and trusted. Fascione [6] states that critical thinking skill is very useful even in the latter stage of life. It is because critical thinking skill improves one's decision making ability.

Critical thinking skills should ideally be mastered by every individual, especially students in high school. As it will be helpful for them in the latter life ahead of them. Critical thinking is a cognitive and intellectual disposition skill which is required to effectively identify, analyze, and evaluate arguments to find out the truth without personal prejudice and to provide reasons which support the conclusion and the decisions made afterwards.[4].

Critical thinking skill is an individual mental or intellectual skill which is used to verify knowledge or statement, using some criterion to decide about the subjects by delivering proofs of what is read and heard before getting claim or ideas from others [9].



Theodurus M. Tuanakotta [16] in The national Council For Excellent in Critical Thinking states that critical thinking is a discipline of thinking process that comes from the ability and the activity to conceptualize, applicate, analyze, synthetize and evaluate information obtained from reflection, communication and action. Critical thinking skill consists of six aspects which are analysis, evaluation, inference, explanation and self regulation[6].

Fact shows that critical thinking skill of students in Indonesia is rather low compared to other countries. It can be seen from PISA data in 2000 that Indonesia was ranked 38th out of 41 countries. In 2003 Indonesia was ranked 38th of 400 countries. In 2006 Indonesia was in the 50th position out of 57 countries. In 2009 Indonesia was 60th out of 65 countries. In 2012 Indonesia was 71st out of 72 countries. In 2015 Indonesia was ranked 64th out of 72 countries. The aspects measured by PISA was the ability to formulate problem, the ability to obtain knowledge the ability to explain phenomenon, the ability to make conclusion skill, and the ability to investigate mathematics and sciences problem.

The same fact found in a high school in Surakarta. Based on the observation result in the school, the teachers do not direct the students to do critical thinking. Teachers require more students to listen and memorize during the learning process, so the students tend to be passive and not accustomed to critical thinking while following the lessons. After interviewing the teachers and students, it is known that the teachers are not used to using learning models that can facilitate critical thinking skills. The teachers still have not applied a learning process that is scientific oriented. The results of interviews on students showed that students are not yet accustomed to implementing a learning process of investigation. Students feel that the learning process is still teacher-centered and rarely practical. Based on the problems above, it is advised that the teachers design learning activities that can train and develop student's critical thinking skill. So that student can be able to solve problems faced in everyday life well.

Marzano in Slavin [12] states that one of the primary goals of schooling is to improve student's critical thinking skill, in order to make rational decisions about what to do or what to believe. Critical thinking is one of the thinking skills that everyone needs to have. A learning process that make students involved can provide them experiences in dealing with problems, which will in turn develop the student's critical thinking skill. Because the students would be required to analyze the problem independently.

Mellanie L. Buffington [8] concludes that student's critical thinking skills will improve if teachers require the students to display their critical thinking skill in every learning step. A skill which would be useful for their life. The results of Duron, Limbach, and Waugh [4] suggest that in the process of learning in the classroom students, it is highly recommended to emphasize the critical thinking skills of students in hopes of gaining more pleasant learning experience that is meaningful for the teachers and the students. Svecova, Rumanova, and Pavlovicova [15] and Chukwuyenum [3] states that in the learning process activities that engage student's critical thinking skills should be implemented to give students opportunities to hone their critical thinking skills.

This research is a result of initial observation. The study was aimed to analyze the critical thinking skills of students in a high school in Surakarta. It is expected that after being exposed with this research results, teachers would be motivated to design better learning activities so that students have better ability in their critical thinking.

2. Research Method

This research was conducted in a high school in Surakarta. Participants were 32 students of XI MIA class. The method used in this research is cluster random sampling. It is a method which samples participants from a group with equal chance to be taken as samples. [13]. This research is a descriptive research with qualitative approach. Descriptive research is a study that describes variable, phenomenon, or situation. Research with qualitative approach is a research that aims to understand the phenomenon experienced by research subjects [1]. This study uses qualitative statistical data in the form of the mean value of students' initial critical thinking abilities. The study is part of research and information collecting of the development research.

Data collection techniques used in this study was observation sheets and essay questions which were developed based on the aspects of critical thinking skill on the material of the circulatory system. Every essay question that is made refers to one aspect of critical thinking skills. The aspect used as a reference consists of six aspects, namely: 1) *interpretation*; 2) *analysis*; 3) *evaluation*; 4) *inference*; 5) *explanation*; and 6) *self-regulation* [6]. The way the calculation of percentage values is as follows:

$$\text{Presentation score} = \frac{\text{number score}}{\text{maximal score}} \times 100\%$$

Score percentages of Critical thinking skill obtained from the calculation were then categorized into table 2[7].

Tabel 1. Category of presentation critical thinking skill.

Interpretation	Category
$81,25 < x \leq 100$	Very High
$71,50 < x \leq 81,25$	High
$62,50 < x \leq 71,50$	Medium
$43,75 < x \leq 62,50$	Low
$0 < x \leq 43,75$	Very Low

3. Result and Discussion

Based on the analysis of critical thinking skills test in the high school, it is found that students' critical thinking ability is low. The low critical thinking skills of the students is shown from the essay test of critical thinking skills. The following table describes students' critical thinking skills.

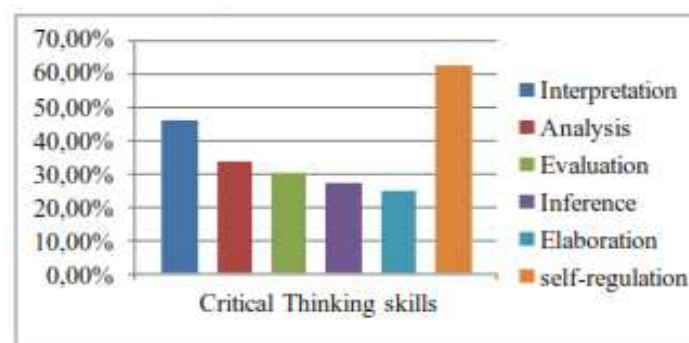


Figure 1. Percentage score of students' critical thinking skills.

Figure 1, it shows that students' critical thinking skills are still low. In the category of interpretation, a low percentage score of 45,81% was obtained. The percentage score for Analysis was also low which 33,59%. In the evaluation category, the obtained percentage score was 30,01%. Inference category percentage score was 27,01%. Explanation percentage score was lowest with 24,84%. In the self-regulation category the percentage score was 62,50%.

Based on the data analysis, the level of critical thinking skills of the students are low. The descriptive elaboration of every aspect of the critical thinking skills of the students in accordance with the data above is as follows:

3.1. Interpretation aspect

Interpretation is to categorize problems, identify characteristics, and clarify meaning [17]. In

Figure 1, it shows the percentage of students' critical thinking skills of 45.81% is in the low category. In the answer to the problem related to the interpretive aspect, it is obvious that there are still many students who cannot analyze and evaluate the problem correctly. It was also observed from the student's answers of students that they were not very good at understanding and expressing the meaning of a given phenomenon to eventually solve the problems. These results indicate the need for teachers' efforts to improve students' ability in categorizing problems and identifying characteristics.

3.2. Analysis aspects

Analysis is to identify the inferential relationship between statements, questions, concepts, descriptions, data or other forms of representation which is intended to convey ideas. Figure 1 shows the percentage of students' critical thinking ability of 33.59% is in the low category. Based on the answer of the problem related to the aspect of the analysis, it shows that there are many students who are unable to connect the concepts used in solving the problem. These results indicate the need for a teacher's effort to improve students' ability in identifying, linking concepts, and expressing them.

3.3. Evaluation aspect

Evaluation is to judge credibility and ideas that explains perceptions, experiences, beliefs or opinions and to assess the logical power of actual inferential relationships. The disposition toward critical thinking is the consistent internal motivation in interest to engage problems and make decisions by using thinking [5]. Figure 1 shows the percentage of students' critical thinking ability of 30.01% is in the low category. Based on the answer of the problem with the evaluation aspect, it shows that there are still many students who are unable to write the solution of the problem. Teachers should guide students in interpreting facts and logic in the form of new findings as objective information about the answer of the subject matter.

3.4. Inference aspects

Inference is identifying and defining the elements needed to draw plausible conclusions, formulating allegations and hypotheses based on evidence and phenomenon. Figure 1 shows that the percentage of students' critical thinking ability of 27.01% is in the low category. Based on the answer to the problems with the inference aspect it shows that many students are not able to draw conclusions from the problem logically. These results indicate the need for teachers' efforts to improve students' ability to describe each data obtained and present conclusions based on existing facts.

3.5. Explanation aspects

Explanation is the ability of students in providing explanations based on the data in the form of a convincing argument. Figure 1 shows the percentage of students' critical thinking ability of 24.84% is in the low category. Based on the answer of the problem with the explanation aspect, it shows that there are still many students who are unable to give a reason about the conclusions. These results indicate the importance of teacher's role to guide students in arguing by using real data.

3.6. Self-regulation aspects

Self-regulation is the ability to determine action, interact with others, and apply your own self-analyzing and evaluating skills. Figure 1 shows the percentage of students' critical thinking ability of 62.50% in the medium category. Based on the answer to the problems with self-regulation aspects, it shows that many students are able to review the answers given. This indicates that during the learning process the students were active interacting with their peers.

Based on the description above, it is seen that in the learning process, the teacher should also train

student's critical thinking. It is supported by Asyari [2], who states that problem-based learning motivates students to formulate arguments, states problems, practices to conclude, and evaluate. Yet, problem-based activities cannot be applied to all materials, so there is still a need for implementation or the development of the learning process that is adjusted to the content of the material, so that the effort of improving critical thinking becomes optimum.

4. Conclusion and Suggestion

Based on the results of data analysis and discussion, it can be concluded that the critical thinking skills of the high school students are low. This issue is demonstrated by the analysis of students' critical thinking skills test results. Based on the data analysis, the average percentage of student's critical thinking ability was low (37.29%). Percentage of interpretation aspect was low (45.81%). Percentage aspects of analysis was low (33.59%). Percentage of evaluation aspect was low (30.01%). Percentage of aspects inferential was low (27,01%). Explained aspect percentage was low (24.84%). Percentage aspect of self-regulation of medium category (62.50%). The results of this study can provide information to students, teachers and the school so the teachers are expected to present learning activities that can empower students' critical thinking skills.

Suggestions submitted by researchers based on the results of this study are: 1) For teachers and the school, it is advised to be able to design teaching and learning activities that can empower students' critical thinking skills; 2) For further researchers, it is advisable to use indicators of critical thinking skills based on other experts; 3) Other researchers should conduct research on critical thinking skills on different materials and subjects.

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