The role of students’ critical thinking skills in junior high schools on chapter organism and its environment

Novita Ratnasari¹, Sarwanto², Baskoro Adi Prayitno³

¹,²,³Science Education, Postgraduate Program, Sebelas Maret University, Ir. Sutami St. No. 36A Kentingan Jebres, Surakarta, Indonesia

¹nrsari19@student.uns.ac.id, ²sarwanto@fkip.uns.ac.id, ³baskoro_ap@fkip.uns.ac.id

Abstract. Thinking skills, especially critical thinking skills are complex skills currently needed by every individual to analyze personal and social problems that exist in the environment with a broad and detailed format. This study aims to analyze and classify the students’ level in constructing critical thinking. The subjects of the study were 20 students of class VIII B MTs PSM Tanen Rejotangan Tulungagung in academic year 2019/2020. Data were collected through interviews and tests of critical thinking skills. The critical thinking skills test instrument consists of 10 essay questions, including 6 indicators. The test instrument used has been tested as valid and reliable as a measuring instrument. Test was validated by experts and the results of the validity, reliability, difficulty index and discrimination power levels were determined as a good test instrument to use as critical thinking skills test for students. The analysis was conducted on the results of students’ tests and categorized into five categories of critical thinking skills, consisting of very good (VG), good (G), medium (M), less (L) and very less (VL). The results showed that 75% of students had critical thinking skills with very less categories (VL) and 25% of students had less categories (L) in critical thinking. The average score of the highest critical thinking indicators obtained in the explaining indicator is equal to 41.5. The indicators analyzing have the lowest average score of 9. The results show that students’ critical thinking skills still need to be improved for future study.

1. Introduction
The 21st Century skills have become one of the most prevalent discussed topics in recent times. The 21st century has the competence that is very necessary that professionalism / work ethic, oral and written communications, teamwork / collaboration, critical thinking / problem solving, and ethics / social responsibility [1]. Critical thinking skills is the ability needed by each individual to be able to analyze the problems that exist in the environment with a broad and detailed. The analysis carried out can solve personal and social problems easily. The ability to think critically is also one of the important goals of education in Indonesia.

Critical thinking is the mindset of individuals or students through reasoning activities, scientific methods, analyzing problems, gathering information, expressing hypotheses, and making conclusions [2]. According to [3], critical thinking is also a skilled and active interpretation and evaluation of observation and communication, information and statements. [4] found the capacity of critical thinking
is an idea focused in making decisions about the problems that are being faced. This thinking is based on efficient concepts. Implementation of critical steps that requires thinking from different angles and have an alternative, the statements are concrete, vote with a library of clear, identify an inference, reason, and assumptions. [5] states that critical thinking is a way to think rationally and logically in interpreting, proving and resolving a case. Critical thinking is a process of deep thinking that guides us to know right from wrong through analysis of experience and previous theories [6]. [7] argue that critical thinking is the process we use to make decisions regarding what to believe and what to do.

[8] stated in the ability to make basic decisions on indicators of critical thinking, requiring identification of problems, question, and conclusions. Basically students have the potential to critical thinking skills. The potential of these can be trained right through learning model enabled the approach of student centered learning, so that learners can participate in acquiring knowledge [9]. [10] states similarly, that active learning can make learning atmosphere more enjoyable so that it can improve critical thinking skills. Students who are equipped with the ability to think critically can examine the opinions of others based on scientific truth and science so that they can make decisions in problem solving without hesitation [11].

This research is a preliminary study that aims to determine students’ critical thinking skills on the material interaction of creatures and their environment. Critical thinking indicators used refer to [12] which consists of interpreting, analyzing, evaluating, concluding, explaining and strengthening themselves. When the students’ abilities are known, it will be easy to design a learning plan to improve the abilities that are still lacking.

2. Method
This type of research is a qualitative descriptive. This research was conducted at MTs PSM Tanen - Rejotangan Tulungagung Regency. Subject of research is the students of class VIII at academic year 2019/2020 with a sample of 20 of learners, in this case students. The instrument used in this study a grain matter of critical thinking skills developed from [12]. The critical thinking skills measured consist of six indicators. The six indicators are contained in 10 items of description that have been tested for validity, reliability, level of difficulty and different power tests on the results of the initial profile test of students’ critical thinking skills. The score of students’ critical thinking skills analysis results are converted into categories [13] according in Table 1. Data collection is done through interviews and tests of critical thinking skills. Test results are calculated using the following formula.

\[
\text{Score} = \frac{\text{Score}}{\text{Totalscore}} \times 100
\]

Final scores on the initial and prevalent profile test of students’ critical thinking skills are then categorized in Table 1.

| Table 1. Category of students’ critical thinking skills |
|-------------------------------------------------------|
| **Score**   | **Category**      |
| 81.25 – 100.00 | Very Good (VG)   |
| 62.50 – 81.25  | Good (G)         |
| 43.75 – 62.50  | Medium (M)       |
| 25.00 – 43.75  | Low (L)          |
| < 25.00        | Very Low (VL)    |
3. Results And Discussion

Tests of critical thinking skills on the material interaction of living things and their environment have been done showing variations in the acquisition of scores. Analysis of the acquisition of critical thinking test scores is presented in Figure 1.

![Figure 1. Analysis of students’ critical thinking skills on score](image)

The test score chart has 2 categories of critical thinking ability values, namely low (L) and very low (VL). The results showed that 75% of students had critical thinking skills with very low category (VL) and 25% of students had low category (L) in critical thinking.

In terms of each indicator of critical thinking skills, an analysis of students’ answers is presented in Table 2.

| Critical Thinking Skills Indicators | Mean Score | Category          |
|-----------------------------------|------------|-------------------|
| Interpreting                      | 24         | Very Low (VL)     |
| Analyzing                         | 9          | Very Low (VL)     |
| Evaluating                        | 20.5       | Very Low (VL)     |
| Inferring                         | 27         | Low (L)           |
| Explaining                        | 41.5       | Low (L)           |
| Self-regulation                   | 11         | Very Low (VL)     |

Analysis of students’ answer based on indicators of critical thinking skills showed a less varied. Aspects of interpreting, analyzing, evaluating and strengthening themselves are categorized as very low (VL). In the interpreting stage, students are required to understand and be able to express the events presented in the problem [12]. But in this study, students have not been able to describe the events presented in the form of pictures on the questions. This means that students do not understand the event. Learners only write down what is in the picture without linking what actually happened to the picture.
The analysis phase requires students to be able to identify the relationship between statements and forms of factual representation and concepts to provide accurate information [12]. In fact, some students are only able to show which statements are true without presenting the identification of the answer choices. According to [12], students are stated to be able to evaluate if they are able to assess the credibility and logic of opinions and the beliefs of some people who judge things from various points of view. The results of this study indicate that students do not understand the concept so that the ability to evaluate it is very low. [12] says that students are able to deduce a problem if they have the ability to identify and guarantee the logical nature of the information provided relating to statements, principles, concepts or other representations. Students in this study are in the category of low (L) in concluding. Students have not identified the maximum so that the conclusions drawn are not in accordance with the actual concept. This is also supported by the results of students’ ability at the analysis stage which also requires the ability to identify. Aspects explained, students get an average score in the category of low (L). This category is the highest acquisition in this study. Students are quite capable of giving convincing arguments. [12] also states that in the explaining stage, students are required to state convincing results from one reason. Based on the analysis of the Learning Program Design (RPP), it was found that there were many test items in the "explaining" domain. This proves that students have been trained in the "explaining" problem. The last aspect is self-strengthening. In this aspect, students are in the very low category (VL). Students are said to have self-regulation if they are able to control their cognitive activity by applying skills in the analysis and evaluation of a problem being faced [12]. The lack of self-regulation of students in this study is also supported by the weak ability of students to analyze and evaluate. Students are less able to put themselves in the face of a problem but are also less able to analyze and evaluate the problems presented thoroughly so that their placement becomes less than optimal.

The critical thinking ability of students of MTs PSM Tanen - Rejotangan is relatively low. This is evidenced by the acquisition of scores that are dominated by the category of critical thinking skills that are lacking (SK). In line with research conducted by [14], [15], [16], and [17] who stated that the critical thinking skills of students at the SMP / MTs level were relatively low. The low critical thinking ability of students is influenced by the teaching and learning process in schools that are still teacher centered so that there is no reciprocity between teachers and students. This is also supported by [18] which states that learning at the SMP / MTs level is still dominated by teachers. The results of observations made by [19] also said that the learning chosen by the teacher still made students tend to be passive. Not only that, teaching materials used in the learning process also affect students’ critical thinking skills. The results of the analysis of teaching materials used in the learning process for critical thinking skills indicators are shown in Figure 2.

![Figure 2. Analysis of learning material on critical thinking skills](image-url)
Figure 2 shows that the learning materials used by teachers has medium and low critical thinking categories. This proves that the learning process in class does not optimal in train critical thinking so that students’ critical thinking skills are low.

The low ability of students’ critical thinking can make it difficult to face life in the 21st century. Therefore, the ability to think critically needs to be trained. Critical thinking skills training meant that learners are able to be adaptive in facing the challenges and demands of everyday life effectively [1]. One way to practice critical thinking skills is through the science learning process. Science is learning that can help students develop critical thinking skills through solving natural science problems or real problems that are complex [20]. Teachers must be able to apply science learning models that can train students’ critical thinking skills. The use of learning models also aims to make science material easily understood by students so that critical thinking is trained [21]. The selection of the right learning model can make students learn independently without forgetting cognitive, psychomotor, and affective aspects so that they can improve their critical thinking skills [22]. One learning model that can improve critical thinking skills is the guided inquiry learning model. This is in line with [23], [24], [25], and [26], who state that guided inquiry can improve students’ critical thinking skills.

4. Conclusion
Based on the results of data analysis from results and discussion, it can be concluded that the students’ critical thinking skills at MTs PSM Tanen is still low. This is evidenced from the non-achievement of the mean score and the and achievement indicators of critical thinking skills and critical thinking test scores in the good category (B). The cause of the low to the inability to think critically namely teacher centered learning; teaching materials used in the learning process do not have aspects of critical thinking in either category; and students are not accustomed to facing test questions that maximize their critical thinking potential. The study provides an overview to the teachers and researchers about the condition of the critical thinking skills of learners SMP / MTs. Teachers are required to be creative in developing learning tools in order to improve students’ critical thinking skills. In addition, teachers must apply various active learning models to involve students’ critical thinking skills.

References
[1] Partnership for 21st Century Skills 2009 Framework for 21st Century Learning Retrieved from http://www.p21.org/our-work/p21-framework
[2] Fahim M and Eslamdoost S 2014 English Language Teaching 7 141-151
[3] Fisher A 2001 Critical Thinking An Introduction (New York: Cambridge University Press)
[4] Ennis R H 2011 The Nature of Critical Thinking : An Outline of Critical Thinking Dispositions (Illinois: University of Illinois) pp 1–8
[5] Facione Peter A 2013 Critical Thinking What It Is and Why It Counts (Insight Assessment)
[6] Moon Jennifer 2007 Critical Thinking an Exploration of Theory and Practice (New York: Routledge)
[7] Facione Noreen C and Facione Peter A 2008 Critical Thinking and Clinical Judgement (Insight Assessment)
[8] Nilson et al 2014 Int. J. of Arts Educ. 8 31-45
[9] Eggen P D 2012 Strategies for Teachers Teaching and Thinking Skills (Boston: Allyn and Bacon)
[10] Duron et al 2006 Int. J. of Teach. and Learn. in Higher Educ. 17 2 160-166
[11] Arends R 2012 Learning to Teach, 9th Edition (New York: Mc-Graw Hill)
[12] Facione Peter A 1989 Critical Thinking: A Statement of Expert Consensus for Purposes of
Educational Assessment and Instruction (Insight Assessment)

[13] Setyowati et al 2011 J. Pend. Fis 7 89-96
[14] A Febri et al 2019 J. Phys.: Conf. Ser. 1397 012018
[15] Yohanes Prian Budi Pawanto et al 2019 J. Phys.: Conf. Ser. 1233 012086
[16] A N Fauziah and H Kuswanto 2020 J. Phys.: Conf. Ser. 1440 012098
[17] I Suryani et al 2020 J. Phys.: Conf. Ser. 1440 012096
[18] Patonah 2014 J. Pend. IPA Ind. 3(2) 128-133
[19] N W Parwati et al 2019 J. Phys.: Conf. Ser. 1318 012096
[20] Choy S Chee and Pou San Oo 2012 Reflective Thinking and Teaching Practice: A Precursor for Incorporating Critical Thinking Into the Classroom (Int. J. of Instr., vol. 5, no. 1) pp 167-182
[21] Wenning C J 2011 Journal Physics Teacher Education Summer 2011 6 2 2-8
[22] Sani R A 2014 Pembelajaran Saintifik untuk Implementasi Kurikulum 2013 (Jakarta: PT Bumi Aksara)
[23] Azizmalayeri K et al 2012 J. of Educ. and Practice 3 10 42-47
[24] P Thaiposri and P Wannapiroon 2015 Enhancing Students’ Critical Thinking Skills through Teaching and Learning by Inquiry-based Learning Activities using Social Network and Cloud Computing (Procedia - Soc. Behav. Sci., vol. 174) pp 2137-2144
[25] M Duran 2016 The effect of the inquiry-based learning approach on students’ critical thinking (vol. 12, no. 12) pp 2887-2908
[26] B Turnip et al 2016 The effect of inquiry training learning model based on just in time teaching for problem solving skills (J. Educ. Pract., vol. 7, no. 15) pp 177-181