Analysis of students’ critical thinking skills on chapter of motion of objects and living things

L. S. Najaah¹, W. Sunarno², Sukarmin³

¹,²,³ Master of Science Education, Teacher Training and Education Faculty, Sebelas Maret University, Jl. Ir. Sutami 36 A, Kentingan, Jebres, Surakarta, Indonesia

E-mail: ¹lathifah.najaah@student.uns.ac.id, ²widhasunarno@staff.uns.ac.id, ³sukarmin67@staff.uns.ac.id

Abstract. This study aimed to analyze the ability of students to think in critically analytical and evaluative ways on chapter of motion of objects and living things. The object of the study was 280 students of 8th grade of MTs Negeri 1 Wonogiri in the academic year 2019/2020. This study used descriptive qualitative method to describe students’ critical thinking skills. Data was collected using reasoned multiple choice test which was developed based on skills of critical thinking according to Facione’s theory. As a result, it can be concluded that the criteria of the analysis and inference ability of the students were lack. While the ability of interpretation, evaluation, explanation, and self-regulation were in the very lack criteria.

1. Introduction

Nowadays, people must have some skills to face various problems in their lives. One important skill that must be owned by people is critical thinking. Critical thinking skill is very necessary for learning because it is one important component in 21st-century learning. Besides, critical thinking skills will be needed by students to face the real world, through critical thinking skills, students can analyze a problem and solve the problem. Critical thinking skill’s indicators are closely related to a learning outcome, so, if students’ critical thinking skills are low, the learning outcomes are also low. Critical thinking means skillfully conceptualizing, applying, analyzing, synthesizing, and evaluating various information gathered from or generated by observation, experience, reflection, reasoning, or communication, as a guide to belief and action [1].

Critical thinking is careful thinking, measured, and exact [2]. Generally, critical thinking refers to an individual’s ability to use a number of his or her general cognitive processing skills which fall into Bloom’s high-order thinking levels of analyzing, evaluating, and creating [3]. Furthermore, critical thinking is a systematic process used in learning activities such as problem-solving, decision making, and analyzing [4].

Critical thinking defines as the ability to reason effectively, recognizing the connections between various things to solve problems and make decisions. Critical thinking needs clarity, accuracy, and precision of expression; relevance of arguments or questions; the logic of thought; and thinking with sufficient depth and breadth to consider complexities and perspectives of a problem [5]. To decide whether information can be rejected or accepted, everyone needs to think critically [6]. Critical thinking consists of several skills, those are interpretation, analysis, inference, evaluation, explanation, and self-regulation. Each skill consists of several subskills, as explained in Table 1 below.
Table 1. The Core of Critical Thinking Skills [7]

| Skill      | Subskill                                      |
|------------|-----------------------------------------------|
| Interpretation | Categorize                                    |
|            | Decode significance                           |
|            | Clarify meaning                               |
| Analysis   | Examine ideas                                  |
|            | Identify arguments                             |
|            | Identify reasons and claims                    |
| Inference  | Query evidence                                 |
|            | Conjecture alternative                         |
|            | Draw conclusions using inductive or deductive reasoning |
| Evaluation | Assess the credibility of claims               |
|            | Assess the quality of arguments that were made using inductive or deductive reasoning |
| Explanation| State results                                  |
|            | Justify procedures                             |
|            | Present arguments                              |
| Self-Regulation | Sel-monitor                                    |
|            | Self-correct                                   |

This study aims to analyze the ability of students to think in critically analytical and evaluative ways on chapter of motion of objects and living things.

2. Experimental Methods

This research used descriptive qualitative method and assisted by quantitative data. The object of the research was 280 students of 8th grade of MTs Negeri 1 Wonogiri in the academic year 2019/2020. The data of this study was the result of a critical thinking test in the form of reasoned multiple-choice test which was developed based on skills of critical thinking according to Facione’s theory. The reasoned multiple-choice test consisted of 16 questions that were suitable with critical thinking’s subskills. The instrument used was validated by expert lecturers. The critical thinking test was done by students in 80 minutes.

The scoring guidelines used in this study referred to Graded Response Models (GRM), as explained in Table 2.

Table 2. Score’s Criteria [8]

| Criteria                              | Score |
|---------------------------------------|-------|
| The answer and the reason were correct| 3     |
| The answer was correct but the reason was wrong | 2     |
| The answer was wrong but the reason was correct | 1     |
| The answer and the reason were wrong  | 0     |

The total score obtained by the students in each skill of critical thinking was categorized into five criteria, as explained in Table 3.

Table 3. Score’s Criteria [9]

| Score Interval     | Criteria |
|--------------------|----------|
| Mi + 1.5 Sbi < X   | Very good |
| Mi + 0.5 Sbi < X ≤ Mi + 1.5 Sbi | Good     |
| Mi - 0.5 Sbi < X ≤ Mi + 0.5 Sbi | Sufficient |
| Mi - 1.5 Sbi < X ≤ Mi - 0.5 Sbi | Lack     |
| X ≤ Mi - 1.5 Sbi   | Very lack |
\[ \text{Mi} : \text{ideal mean} = \frac{1}{2} \text{(maximum score-minimum score)} \]
\[ \text{Sbi} : \text{ideal deviation standard} = \frac{1}{6} \text{(maximum score-minimum score)} \]
\[ X : \text{total score each skill} \]

Criteria for interpretation, analysis, inference, and explanation skills, as in Table 4.

**Table 4. Score’s Criteria for Interpretation, Analysis, Inference, and Explanation Skills**

| Score Interval | Criteria    |
|----------------|-------------|
| 7 < X          | Very good   |
| 5 < X \leq 7   | Good        |
| 3 < X \leq 5   | Sufficient  |
| 1 < X \leq 3   | Lack        |
| X \leq 1       | Very lack   |

While criteria for evaluation and self-regulation skills, as in Table 5.

**Table 5. Score’s Criteria for Evaluation and Self-regulation Skills**

| Score Interval | Criteria    |
|----------------|-------------|
| 4 < X          | Very good   |
| 3 < X \leq 4   | Good        |
| 2 < X \leq 3   | Sufficient  |
| 1 < X \leq 2   | Lack        |
| X \leq 1       | Very lack   |

3. Result and Discussion

Data from the critical thinking test result as in the diagram below.

![Critical Thinking Test Result](image)

**Figure 1.** Critical Thinking Test Result of 8th Grade Students of MTs Negeri 1 Wonogiri

Based on the diagram above, most of the abilities in interpretation, evaluation, explanation, and self-regulation of 280 students of 8th grade of MTs Negeri 1 Wonogiri are in the very lack criteria, while most of the abilities of analysis and inference of 280 students of 8th grade of MTs Negeri 1
Wonogiri are in the lack criteria. The result of this study shows that the profile of the critical thinking skills of 8th-grade students of MTs Negeri 1 Wonogiri is very lack.

In interpretation skill, the lowest total score is in the subskill of clarify meaning, because most of the students' answers and reasons are wrong. This is in accordance with research conducted by Susilowati that in interpretation skill, 54,87% of students are in the lack criteria [10]. Research conducted by Hendrik shows that in interpretation skill, student’s achievement is only 28,8% [11]. The low results are possible because students' understanding and practice in critical thinking questions are still lack.

In the analysis skill, the lowest total score is in the identification reasons and claims subskill, because most of the students' answers and reasons are wrong. This is in accordance with research conducted by Susilowati that in analysis skill, 46,56% of students are in the lack criteria [10]. Research conducted by Hendrik shows that in analysis skill, student’s achievement is only 28,3% [11]. The low results are possible because the students do not understand the material that has been delivered, so that when they face the problems, the students have some difficulties in solving them.

In the inference skill, the lowest total score is in the evidence query subskill, because most of the students' answers and reasons are wrong. This is in accordance with research conducted by Susilowati that in inference skill, 49,24% of students are in the lack criteria [10]. Research conducted by Hendrik shows that in inference skill, student’s achievement is only 32,5% [11]. The low results are possible because the students rarely practice in solving various problems, and their mastery in the subject material that has been delivered are still low.

In the evaluation skill, the lowest total score is in the assess quality of arguments that were made using inductive or deductive reasoning subskill, because most of the students' answers and reasons are wrong. This is in accordance with research conducted by Susilowati that in evaluation skill, 54,58% of students are in the lack criteria [10]. Research conducted by Hendrik shows that in evaluation skill, student’s achievement is only 30,2% [11]. The low results are possible because of the low ability of students to make generalizations and conclusions, and they are still confused in applying their knowledge to solve problems.

In explanation skills, the lowest total score is in the justify procedure subskill, because most of the students' answers and reasons are wrong. This is in accordance with research conducted by Susilowati that in explanation skill, 43,83% of students are in the lack criteria [10]. Research conducted by Hendrik shows that in explanation skill, student’s achievement is only 18,2% [11]. The low results are possible because students have difficulty in identifying and defining the problems, so they also have difficulties in formulating alternative solutions.

In self-regulation skill, the lowest total score is in the self-monitor subskill, because most of the students' answers and reasons are wrong. This is in accordance with research conducted by Susilowati that in self-regulation skill, 60,44% of students are in sufficient criteria [10]. Research conducted by Hendrik shows that in self-regulation skill, student’s achievement is only 22,8% [11]. The low results are possible because students do not understand the material so they can not consider alternative choices.

There are many causes of low ability in students’ critical thinking. Lack of learning activities and practice in answering questions and limited resources, time, and perception lead to low students' critical thinking skills [12]. Although the students have understood certain concepts, they are not able to apply them in solving the problems [13]. Lack of basic knowledge can result in students’ disabilities to solve the problems [14].

Students' critical thinking skills can be improved through learning that applies the scientific method. One of learning model that applies scientific method is guided inquiry. The syntax of guided inquiry consists of initiation, selection, exploration, formulation, collection, and presentation, based on the syntax, students’ various skills and thinking processes can be improved, one of which is critical thinking [15]. Improving students’ critical thinking skills through teaching and learning by inquiry-based learning helps students to develop the knowledge and various skills [16]. To apply this learning,
learning guidelines are needed. Hopefully, the teachers can design good learning activity processes that can empower students’ critical thinking skills.

4. Conclusion

The test result shown that most of the analysis and inference abilities of 280 students of 8th-grade of MTs Negeri 1 Wonogiri were in the lack criteria, while the interpretation, evaluation, explanation, and self-regulation abilities were in the very lack criteria. Therefore, the critical thinking skills of students in the 8th-grade of MTs Negeri 1 Wonogiri should be improved.

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