

Analysis of the Characteristics of Students' Critical Thinking Skills in Completing National Exam Questions

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Abstract: This research is motivated by the renewal of the learning paradigm in the 2013 curriculum which prioritizes the application of higher thinking skills, which aims to increase the potential and skills of students in the 21st century. One of the life skills that students must have is critical thinking skills, this study aims to analyze the characteristics of students' critical thinking skills in completing the HOTS type national exam. The sample of this study was 50 students of class XII MIA in SMA Negeri 1 Jaya in the academic year 2019/2020 using purposive sampling technique. The data collection techniques in this study were test and non-test and focus group discussion. The data analysis technique used was descriptive analysis, the results showed that overall the critical thinking skills of students in solving HOTS type national exam questions were still in the medium category with a percentage of 44.6. Of the 5 indicators that have been mastered well by students, namely indicators provide simple explanations of 71.8% and build basic skills of 68.7% while other indicators are still in the low category, namely indicators conclude by 32.4% provide further explanation of 15.9% and set strategy and tactics 34.5%.

Keywords: critical thinking skills; national examination; hots questions

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Introduction

The Ministry of Education and Culture of the Republic of Indonesia, through the Joint Regulation of the Director General of Primary and Secondary Education Number 5496/C/KR/2014, stipulates that the 2013 Curriculum is one of the curricula that is enforced in the 2014/2015 academic year (Permendikbud, 2014). The 2013 curriculum prioritizes the application of higher order thinking skills, which aims to increase the potential and thinking skills of students in the 21st century. This is supported by the Partnership for 21st Century Skills which emphasizes that one of the life skills students must have in the 21st century is critical thinking skills (Lai, 2011). Critical thinking is thinking reasoned and reflective which emphasizes making decisions about what to believe or

do (Ennis, 2011). Furthermore, Ennis (1985) critical thinking skills are the ability to think clearly and rationally about what to do or what to believe, including the ability to engage in reflective and independent thinking.

National Examination according to Permendikbud number 5 of 2015 article 1 paragraph 5, National Examination is an activity of measuring and assessing the achievement of national competence of graduates in certain subjects. The usefulness of the results of the National Examination according to Permendikbud number 5 of 2015 article 21 paragraph 1 are as follows: (1) Mapping the quality of education programs and units; (2) Consideration of selection to enter the next education level; (3) considerations in fostering and providing assistance to educational units in an effort to improve the quality of education.

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Learning and assessment with various techniques and instruments that provide opportunities for students to develop thinking skills, including critical thinking, is believed to be able to improve and develop higher-order thinking skills, especially in the form of written assessments (Educational Assessment Center, 2019).

Based on the results of the analysis of the difficulty level of the 2018/2019 high school level National Examination questions at the Aceh Jaya Regency level for physics subjects, it is still very low. This can be seen from the average value for the higher order thinking skills (HOTS) type national exam questions, which is 30, meaning that the students' level of thinking is still low. Noviana (2016) states that HOTS questions have four indicators, namely problem-solving skills, decision-making skills, critical thinking skills, and creatives. Previous research has also shown that problem-solving methods can increase HOTS (Halim, et al, 2018). Based on this description, it can be concluded that one of the skills students must master to solve HOTS type questions is critical thinking skills.

Critical thinking skills in learning activities can be identified through the assessment process. HOTS question assessors can be seen from the results of the evaluation of learning through the National Examination and school exams. According to Nisa (2018), 22 of the 40 items in the 2017 National Physics Examination were categorized as HOTS questions with a percentage of 86% of C-4 questions (analyzing), and 15% C-5 (evaluating) according to the revised Bloom Taxonomy. Meanwhile, according to Ihksan et al, (2019) stated that the questions that were categorized as HOTS questions in the National Examination questions in physics subjects from 2017 to 2019 out of 40 items each year the average questions categorized as HOTS reached 50% of the total questions.

In 2019 the number of students who chose the science program in Aceh Jaya District was 324 SMA N 1 Jaya is one of the high schools with the most students from other high schools. This condition encouraged researchers to make observations at SMA Negeri 1 Jaya, where it was found that there were 50 students who chose physics in the National Examination.

Based on the description of the above problems, the researcher conducted a study with the title analysis of the characteristics of students' critical thinking skills in solving national exam questions.

Method

This research is a type of evaluation research, which is carried out by collecting, analyzing and reviewing the results of students' answers in answering HOTS type National Examination questions based on 5 indicators of critical thinking skills. This research was

conducted at SMA Negeri 1 Jaya. Determination of the sample in this study using purposive sampling technique, namely all students of class XII MIA 1 and MIA 2 which choose physics subjects on the National Examination.

The data collection techniques in this study were using the test technique and Focus Group Discussion (FGD). The test technique in this study was a written test consisting of 12 HOTS type questions in the form of descriptions. The test questions were taken from the National Examination questions which were then analyzed in the Aceh Jaya Physics subject teacher discussion FGD. The data analysis technique used in this research is descriptive analysis technique, namely the data analysis technique used to describe the state of the object qualitatively. Students' answers were analyzed based on 5 indicators of critical thinking skills developed by Robert Ennis (1993) and then processed in the form of percentages. The percentage formula used is as follows:

$$\text{Percentage} = \frac{\text{Number answered}}{\text{the maximum number of scores}} \times 100 \quad (1)$$

The percentage value is then interpreted in the form of very high, high, medium, low, and very low categories according to Table 1.

Table 1. Critical Thinking Skills Category

No	Percentage	Category
1	81 -100	Very high
2	61 - 80	High
3	41 - 60	Medium
4	21 - 40	Low
5	0 - 20	Very low

(Source: Riduan, 2013)

Result and Discussion

Analysis of students' critical thinking skills in solving HOTS type questions is measured according to the indicators of critical thinking skills, namely providing simple explanations, building basic skills, concluding, providing further explanations, arranging strategies and tactics. The results of the analysis of students' critical thinking skills indicators can be seen in Figure 1.

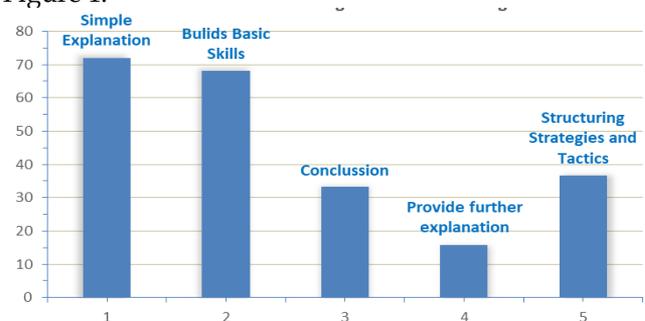


Figure 1. Percentage of critical thinking skills

There is a difference in the results of the percentage of students' critical thinking skills as described in Figure 1, the indicator providing a simple explanation produces the highest percentage score of other indicators with an acquisition of 71.8% with the criterion of high category critical thinking skills. Indicators of building basic skills obtained medium category critical thinking results of 68.7%. Indicators of critical thinking skills in the low category are concluding, with a score of 32.4% providing further explanation of 15.9, setting strategies and tactics of 34.5%. Based on the diagram of the test results achieved by students on each indicator of critical thinking skills, it can be explained as follows.

Provide a Simple Explanation

Indicators provide a simple explanation containing focusing questions, analyzing and evaluating a question, and answering questions about an explanation or statement. In this indicator, students make clear problem specifications by identifying important features and describing situations with the help of pictures, diagrams, and symbols based on information in the form of data and facts. On this indicator, students are able to write down the elements that are known and asked in the form of symbols and describe the diagrams contained in the question statement, write equations based on the known elements.

At this stage the students did not make many mistakes, only some students were less careful in reading and understanding the meaning of the questions. As the results of research that has been conducted on the analysis of student errors in working on questions. Common mistakes are in writing what is known and asked in the question into physics symbols, understanding the meaning of the problem, and writing down the data that is known to the question correctly. Errors are caused by students forgetting, not understanding the physics symbols from the data mentioned in the questions, and not being careful in reading and understanding the meaning of the questions (Rahmat et al, 2017).

Students' critical thinking skills on the indicators of providing this simple explanation obtained the highest level of skills from several other indicators with a score of 71.8%. This indicator shows that almost all students are able to write down the elements that are known and asked. These elements are in the form of symbols contained in the question statement, and can write down the equation correctly and correctly. This is due to the habits in answering questions that are always done and trained by the teacher continuously, especially in solving questions. It is hoped that students will be able to identify pictures, diagrams, and symbols based

on the information contained in the question statement. According to Leicester & Taylor, (2010) Students think critically in stages through practiced habits in the form of formulating problems and answering questions that require explanation.

Build Basic Skills

The indicator builds basic skills with sub indicators considering whether the source is reliable or not. This indicator measures students' skills in using proper procedures through existing assumptions by conducting investigations to solve problems, resulting in an explanation of the problems obtained or analyzing the symptoms or phenomena that arise from the question statement. In this indicator, the students' answers analyzed are a step in determining the right formulation according to the results of the analysis and concepts.

This indicator shows that students have been able to determine the steps in determining the right formulation according to the results of the analysis and concepts based on the phenomena that appear in the question statement. In this question, students analyze the relationship between kinetic energy and potential energy to get the velocity equation in the collision concept.

The results of students' answers to the indicators of building basic skills obtained moderate critical thinking results of 69.%. This means that there are still as many as 31% of students who have not been able to analyze the symptoms and phenomena that arise from the question statement, especially in paying attention to important information contained in the questions, so that it is difficult to analyze. A small proportion of students experienced errors in identifying the relationship between concepts and events from statements and questions. This happens because students forget the material and students tend to memorize in learning the material, so it is easy to forget. This is in accordance with the opinion of Carson, (2007) which states that even though students know a concept, students do not necessarily know how to use it.

Conclude

Making conclusions means identifying the elements needed to draw conclusions from the report data, principles, judgments, beliefs or opinions, concepts, descriptions, questions and other forms of attributes. Conclusions can be drawn by reasoning deductively or inductively. Deductive reasoning is drawing general to specific conclusions, while inductive reasoning is drawing conclusions that are specific to the general public (Agustiana & Miterianifa, 2019).

Critical thinking indicators conclude, in general, expect students to be able to identify and solve a

problem so as to draw a conclusion. This indicator measures students' skills in describing and understanding various aspects in stages to arrive at a new formula (Faiz, 2012).

Student activities are analyzed at this stage when students determine formulas mathematically by applying the right concepts, principles, laws and principles based on the identification results that have been carried out in accordance with their basic conceptual skills and how to derive equations so that they produce equations in new forms. For example, students are asked to determine the ratio of the density of the two cubes immersed in liquid, where this problem requires students to derive the equation using Archimedes' law. At this stage the students made many mistakes when completing the division count operation resulting in the wrong equation.

This indicator obtains a percentage of 32.4% with a low category, this is due to the low skills of students in completing equation solving steps and most students have difficulty using arithmetic operations. As the opinion of Sugiarto, et al. (2017) stated that the lack of students' accuracy in doing calculations is one of the reasons for the low skills of students in carrying out plans, to solve problems high accuracy is needed, if it is just a little wrong it will make all the answers wrong.

Provide further explanation

Provide further explanations, namely constructing student arguments, being able to analyze and provide explanations in the form of defining terms and considering definitions using appropriate criteria and identifying assumptions. In this indicator there are still many students who have not been able to identify assumptions. To answer the questions, it is necessary to have sufficient understanding of the material, if students do not master the material it will be influential in identifying assumptions and especially in solving problems, especially in describing the equations of several related equations or looking for relationships from several equations. This indicator expects students to be able to understand several related concepts, namely the concept of effort, regular changing straight motion and the concept of force in Newton's law, which are then derived into new equations in accordance with the question statement.

Critical thinking skills on indicators providing further explanation have the lowest value than other indicators. Based on the results of the analysis of students' answers, a percentage of 15.9 was obtained with a low category, this is due to the low initial knowledge of students about a concept, making it difficult to link knowledge between concepts (Ivie, 2001; Wati et al, 2020).

Concept understanding is a level in the cognitive realm that shows the ability to explain simple relationships between facts and concepts. Understanding the concept of physics is defined as the ability to express the meaning of a physical concept. The ability to distinguish, explain, further elaborate, and change concepts that contain ideas or ideas about a material, experience, event or object based on the characteristics of the object itself (Arends, 2012; Halim et al, 2020).

Lack of students in understanding the concept occurs due to the implementation of the learning process which still prioritizes memory and understanding processes. Students are more focused on memorizing a concept they get and only source from books and teachers (Ritonga, 2013). In this indicator there are still many students who have not been able to connect related concepts correctly. The answer given is still inaccurate, especially in determining the acceleration equation, where students tend to write down the tangential acceleration equation in the concept of circular motion, and what should be written is the acceleration equation from Newton's law.

Set Strategy and Tactics

Setting strategy and tactics is selecting criteria for considering possible solutions or solving a problem. Students think with their own knowledge to formulate an alternative solution by solving problems that occur, especially in using mathematical operations that are in accordance with the concept. In this indicator, the students' answers analyzed are how to use arithmetic operations in solving equations that require simplification from a combination of several other equations related to the concept. The questions given to students were pictures of two identical blocks fired by bullets from different rifles so that they had different heights. Students are asked to determine the ratio of the speed of the two rifles. In this problem, it is hoped that students can choose possible criteria as a solution to get the velocity equation based on the derivation of the equation from the concept using basic mathematical arithmetic operations.

Critical thinking skills on indicators of managing strategies and tactics have a percentage of achievement of 35% with a low category. Based on the results of the analysis of students' answers, most students have not been able to decide the right action to solve the problems in the problem, especially in using arithmetic operations to solve the derivation or combination of several equations. This is because students are still not careful in using basic mathematical arithmetic operations, especially in the form of fractions. As stated by Sugiarto, et al. (2016) the lack of students' accuracy in calculating is one of the reasons for the low skills of students in

implementing plans, in solving problems high accuracy is required, if it's just a little wrong it will make all the answers wrong.

Apart from the method used in this study, critical thinking skills can also be improved through Cognitive Conflict Approaches (Andayani, 2020), Discovery Learning (Qurniati & Andayani, 2015), analysis of critical thinking skills levels (Rizaldi, et al., 2019), science process skills (Pradana, et al., 2020), ethnoscience-based science learning model (Hikmawati, et al., 2021) and SAVI Learning Model (Ahmad, 2021), scientific approach to critical thinking (Handriani, et al., 2015), guided inquiry in terms of students' critical thinking abilities (Susilawani, et al., 2019). Besides that, there are also several treatments that affect critical thinking skills, including the mind mapping process (Polat & Aydin, 2020), media and information literacy (Al-Zou'bi, 2021), guided inquiry on critical thinking skills (Nurmayani, et al., 2018), Phet simulation assistance for critical thinking skills (Aminah, et al. 2020) and virtual simulation (Everett-Thomas, et al, 2021).

Conclusion

Based on the results of research conducted on students' critical thinking skills in completing HOTS type National Examination questions, it can be concluded that students' Critical thinking skills in solving HOTS type National Examination questions are still in the medium category with a percentage of 44.6. Based on the five indicators of critical thinking skills measured in this study, only two indicators have been well mastered by students, namely indicators providing simple explanations and building basic skills, respectively with a percentage of 71.8 and 68.7.

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