Schrödinger:Journal of Physics Education
Vol. 4, No. 1, March 2023, pp. 12~17
ISSN: 2716-1587, DOI: 10.37251/sjpe.v4i1.493

Critical Thinking Ability: Analysis of Flat Mirror Reflection Material

Erda Purwanti[1], Heldalia[2]
[1]Senior High School of Surulangun, Sumatera Selatan, Indonesia
[2]Physics Education, Faculty of Teaching and Education, Universitas Jambi, Jambi, Indonesia

Article Info

Article history:

Received Jan 10, 2023
Revised Feb 17, 2023
Accepted Mar 24, 2023

Keywords:

Critical Thinking Ability
Flat Mirror
Physics

ABSTRACT

Research Objectives: The aim of this study was to analyze students' critical thinking skills in the reflection material on plane mirrors. The instrument used in this research is a matter of critical thinking skills

Methodology: This type of research uses qualitative and quantitative research. With a sample of 84 students. Data were analyzed using the SPSS 23 program to obtain the mean, mode, median, maximum and minimum.

Main Findings: Based on the results of this study, students' critical thinking skills are still low. Because students are less enthusiastic in the learning process, students also do not respond optimally to these problems, the student's concept understanding factor is still low, causing misconceptions.

Novelty/Original Research: The novelty in this study is in the form of an analysis of students' critical thinking skills in the material of plane mirror reflection.

Corresponding Author:
Heldalia,
Department of Physics Education, Faculty of Teaching and Education, Universitas Jambi,
Jl. Lintas Jambi-Ma. Bulian Km. 15, Jambi, 36361, Indonesia
Email: heldaliaaa32@gmail.com

1. INTRODUCTION

Education is a conscious and planned effort to create a learning atmosphere and learning process so that students actively develop their potential to have religious spiritual strength, build personality, self-control, intelligence, noble character, and the skills needed by themselves and society. , country. , and country [1]. Education is a preparatory effort made by someone to acquire skills, knowledge and habits in life [2]. Education plays an important role in life, because with education a person is able to establish himself well in his environment both in the family and in society. For this reason, education is expected to continue to develop according to the times [3]. Education is a continuous process that aims to improve the quality of human resources [4]. Through a continuous education process from childhood to adulthood, education can improve the quality of human resources. To improve the quality of education when viewed from the national education system, the elements and factors that influence it are curriculum factors, teacher factors, facilities and infrastructure factors, time factors, money factors, objective factors, method factors, and educational environmental factors [5]. Education in Indonesia has been well refined and needs further development. Continuity of education must be fully related to the curriculum used. The educational curriculum used is in line with existing schools

Education is defined as a conscious and planned effort to create a learning atmosphere and learning process so that students actively develop their potential to have religious spiritual strength, self-control, personality, intelligence, noble character, and the skills needed by themselves. the people of the nation and the State (6)]. Education is a process that "matures" humans. Through the world of education it is hoped that students will be able to become individuals who are able to solve various kinds of life problems. Education is an

effort to provide certain knowledge, insight, skills and expertise to humans to develop Haryanto's talents and personality [7].

Learning is a process of teaching and learning activities in schools consisting of teachers and students as active actors [8]. Teachers are people who impart knowledge to students and carry out assessments and evaluations, while students are people who receive knowledge that has been officially registered to take lessons at school. There are 2 factors that influence the learning process, namely internal and external. Internal factors are factors that come from within students, internal factors have two aspects, namely physiological aspects (body, eyes and ears) and psychological aspects (student intelligence, student attitudes, student talents, student interests and student motivation [9]. is important to develop because attitude is the foundation of students to be able to appreciate the work of others and respect themselves [10] And external factors, namely from the surrounding environment The learning process is a learning activity carried out by students.Education, a learning activity is one important factor in influencing learning outcomes, one of the many learning processes is learning physics.

Physics subject is one of the subjects that study natural phenomena. Physics is one of the subjects that presents natural phenomena and real changes. Where physics is known as a difficult and difficult subject for students [11]. In studying natural phenomena will provide knowledge to train thinking and reasoning. Physics learning is directed towards a goal, namely that students can develop intellectual abilities, think critically, logically, and scientifically and be able to understand concepts and solve problems, especially those related to everyday life [12]. Physics is a subject that is difficult to learn so that in the learning process with theory it is difficult to develop students' science skills, this can be seen from the low learning outcomes [13]. Low learning outcomes caused by an inadequate learning process. The learning process is expected that students can obtain good learning outcomes, so that these learning outcomes can be one of the benchmarks for the success of the learning process, especially in physics subjects [14].

Learning physics is considered important to understand and learn, so that in tertiary institutions there is further education about physics, namely the existence of a special physics education study program. Physics is one of the subjects that presents natural phenomena and real changes. Where physics is known as a subject that is difficult and difficult for students. But physics is important for us to learn. There are two reasons why we have to study physics, namely (1) it is one of the most basic sciences, namely physics and (2) all technological and engineering sciences are the basis of learning. Physics learning can be a place to train students' thinking skills [15]. To achieve these goals, appropriate learning resources and learning models are needed (Suparwoto, 2007). Good learning media and resources will be very helpful in building critical thinking skills and abilities.

Critical thinking is a cognitive and mental process used in making decisions, analyzing, synthesizing, evaluating information, and applying information, arguing, and solving problems effectively. Critical thinking is a central component of human intelligence and is responsible for many achievements. Critical thinking is part of higher order thinking (higher order thinking skills) [16]. According to Nugraha, Suyitno, & Susilaningsih (2017: 37), critical thinking is a key competency that must be possessed to solve problems that individuals need in order to live successfully and live responsibly and for society to face present and future challenges. Critical thinking also trains students to think logically and not accept things easily.

The thought process is a way that a person remembers the knowledge that has been stored in his memory to receive information, process it, and conclude [17]. According to Rohim, Suswanto & Ellianawati (2012: 2), thinking skills really need to be developed from an early age, because they are expected to be capital in dealing with problems in everyday life. One of the thinking skills that students must have is higher order thinking skills. High-level thinking skills-HOTS is a thinking process that is not only limited to memorizing and conveying the information that has been obtained [18]. Meanwhile, the ability to think at a high level means the ability of students to provide connections between learning that has been taught and other things that have not been taught [19]. In learning physics, students are not only required to have thinking skills, but also have high-level thinking skills.

Higher-order thinking skills include critical and creative thinking [20]. Higher order thinking skills are divided into four groups, namely problem solving, decision making, creative thinking and critical thinking. Critical thinking skills have long been a major goal in education. Of the many competencies demanded by the Ministerial Regulation, which is one of the content standard points in achieving these functions and objectives, the ability to think critically is a very important competency to be trained. This critical thinking ability is very necessary in life and quality resources will be created if knowledge is obtained by practicing a culture of critical thinking [21]. Critical thinking is a high-level thinking process that can be used in the formation of students' conceptual systems [22]. After students have scientific process skills, students will be able to solve problems and have critical thinking skills.

Natural Sciences consists of biology, chemistry and physics. Each of these lessons requires critical thinking skills in solving a problem. Therefore, the purpose of this research is to analyze the prediction of students' critical thinking skills in reflection material on plane mirrors.

2. RESEARCH METHOD

This type of research uses qualitative and quantitative research. In quantitative research, survey research procedures are used. Survey research is carried out if the researcher conducts a survey of samples or populations to describe attitudes, behaviors, opinions, and special characteristics of the population [22]. For more details, this type of qualitative research is also carried out, namely by using interview techniques. The research design was used in accordance with the research objectives, namely knowing the HOTS description of critical thinking indicators for students of SMAN 7 Jambi City in Physics subjects.

The instrument used in this study is a matter of Critical Thinking Ability. The questions were distributed to 84 students of class XI SMA in Jambi City. The questions used refer to various physics textbooks and articles that discuss mirror reflection material, which are in accordance with indicators of students' critical thinking skills. The indicators of critical thinking skills measured in this study can be seen in table 1. The problem of critical thinking skills in this study uses a format adapted from the research of John, Molepo & Chirwa with a total of 8 questions [22]. The rubric used has a score range of 0 to 4 on each criterion which is then calculated to get a maximum score of 4 on each item per ability category. With a score scale range of 0.00-6.4, critical thinking skills can be categorized as very low ability on a scale of 0.00 to 1.60, low ability for a scale range of 1.63 to 3.20, ability to range a. scale 3.21-4.80, and high ability for the scale 4.81 - 6.40 and very high ability for the scale 6.41-8.00.

Table 1. Interval of students' critical thinking skills disturbance

Interval	Category
0.00 - 1.60	Very Low
1.61 – 3.20	Low
3.21 – 4.80	Enough
4.81 – 6.40	High
6.41 – 8.00	Very High

3. RESULTS AND DISCUSSION

The results of this study are data on students' critical thinking skills of 84 students which are shown in table 2, namely students' critical thinking skills per indicator and the average value of students' critical thinking skills as a whole.

Table 2. Data on the Results of Critical Thinking Ability per Indicator

Indicator	Score
Give a simple explanation	3.59
Build basic skills	2.34
Give further clarification	2.21
Create strategies and tactics	2.89
Average	2.75

Based on the result data in Table 2, it is found that the indicator value provides a simple explanation with a value of 3.59, the indicator builds basic skills with a value of 2.34, the indicator provides further explanation with a value of 2.21 and the indicator makes strategies and tactics with a value of 2.89. The average value of all indicators is 2.75.

Table 3. Description of Students' Critical Thinking Skills

Indicator	Mean	Median	Mode	Max	Min
Give a simple explanation	2,4286	2,5000	3.50	4.00	0,50
Build basic skills	2,3393	2,7500	3.50	3.50	1.00
Give further clarification	2,1964	2,5000	1.00	3.50	1.00
Create strategies and tactics	2,8929	3.0000	3.50	3.50	0,50

Based on the results data in table 3, the description of students' critical thinking skills on the indicators provides a simple explanation for the average value of 2.4286, median 2.5000, mode 3.50, maximum 4.00 and minimum 0.50. description of students' critical thinking skills on indicators of basic building skills with an average value of 2.3393, median 2.7000, mode 3.50, maximum 3.50 and minimum 1.00. The description of students' critical thinking skills on the indicators provides further clarification for the mean score of 2.1964, median 2.5000, mode 1.00, maximum 3.50 and minimum 1.00. The description of students' critical thinking skills on the indicators provides a simple explanation with an average score of 2.8929, median 3.0000, mode 3.50, maximum 3.50 and minimum 0.50.

3.1 Difficulties in Categories provide a Simple Explanation

Giving simple explanations is the first indicator of critical thinking skills used in the test questions. The first problem given is to provide a simple explanation in order to know the incident light and reflected light and the object distance is equal to the image distance. From the results of this study it appears that the scores obtained by students are high. This highest score was not obtained from all students. Because there are still some students who still have difficulty in solving problems. This indicator obtained the highest value compared to other indicators. However, the achievement of this indicator is still relatively moderate. Not yet in the high category.

3.2 Difficulties in the Basic Skills Building Category

The highest score does not come from all students who successfully complete the problem. The reason is, some students still have difficulty solving the problem. Several students did not complete the questions correctly on the first and second question indicators in the category of building basic accounting skills a little.

3.3 Difficulty in the Category of Ability to Provide Further Explanation

There are also most students who experience the misconception that if an object placed in front of the mirror image will be behind the image in an inverted position, then the image calculation with the image is mostly wrong in seeing the position of the reflected light. and sianar the arrival The two indicators concerning the abilities category provide an explanation for more of the same number of misconception factors which are mentioned as factors in influencing the achievement of good critical thinking skills.

3.4 Difficulty in Category Ability Set Strategy

Indicator questions in the category of critical thinking skills in managing strategies present problems that ask students to explain the right strategy to someone standing in front of a mirror to determine the length and height of the mirror that should be used. This problem indicator is included in the management strategy indicator because students are expected to be able to analyze from a height that person. In this question, most of the students answered correctly, but a small number of students still had the same misconception as when answering the question, namely the reflection analysis on a plane mirror. Some students are still not able to think critically about a problem.

From the description above it can be seen that students' critical thinking skills are still low and moderate. Based on research, the results of achievement indicators provide simple explanations including in the medium category, while indicators build basic skills, provide further explanations, make strategies and tactics in the low category.

Researchers conducted interviews with teachers to see students' critical thinking skills. The teacher stated that the students' critical thinking skills in class XI MIA, especially in Physics, were still low. This is because the enthusiasm of students in answering the questions posed by the teacher is still limited, in theory they have not shown development in accordance with their potential and abilities. students are less able to describe the conditions of the problem being discussed, do not have a strong curiosity, and are unable to use spoken language in varied and interesting ways to hear, this can also be seen from the way students listen to expressions or explanations, students tend not to try understand and try to find or detect things that are special and necessary or important. The explanation above occurs because students do not analyze and reflect on the results of their thinking.

From the results of observations and interviews conducted with teachers and students above, it can be concluded that students' critical thinking skills are still low. Because students are less enthusiastic in the learning process, students also do not respond optimally to problems, the student's conceptual understanding factor is also low, causing misconceptions. The high and low categories of critical thinking skills certainly have causal factors. One of the causative factors identified as inhibiting the ability to think critically about material reflected in a flat mirror in this study is misconception. The fact that students experience misconceptions is often found in the use of concepts that are still wrong in solving problems. Another point of view that arises when identifying information in a question is able to bring up other assumptions that are not in accordance with the context being discussed in the problem, thus triggering misconceptions [22]. Problems that often arise in the learning process in the classroom include the inability of students to relate one concept to another, many misconceptions, and the low ability of students to solve problems and understand physics concepts [22]. Misconceptions have a negative impact on the development of students' critical thinking skills when studying reflection in a plane mirror. Misconceptions that are not prevented or eliminated will lead to the development of misunderstandings in students about the concept of reflection in a plane mirror that has been studied. Therefore, this study recommends that further research aims to reduce students' misconceptions and improve students' critical thinking skills in reflection in the mirror.

4. CONCLUSION

The critical thinking skills of class XI students in the reflection material on flat mirrors obtained the results of critical thinking classified as moderate and low. Achievement indicators provide simple explanations including in the medium category, while indicators build basic skills, provide further explanations, create strategies and tactics in the low category. The level of results obtained in critical thinking skills in this study has several factors. Negative causal factors make students experience difficulties in doing the tests given. The causes of these difficulties include students being less accurate, students not focusing on the context of the problem or it can be said that students have not been able to correctly identify useful information in the problem. In addition, there is also a misconception that there are still customers. The causes of students' difficulties in solving problems on these problems affect the results of students' critical thinking. Higher-order thinking skills, including critical thinking skills, are very important and needed to solve conceptual problems, especially in the 21st century. Reflection material on flat mirrors raises concepts that are often encountered in everyday life applications so as to support conceptual problems. The concept of reflection on a flat mirror requires critical thinking skills to study it and understand whether it has been able to meet these needs, the development of appropriate critical thinking needs and research that aims to improve critical thinking skills and reduce levels of misconceptions is very important to do.

ACKNOWLEDGEMENTS

Praise be to God Almighty, the SMAN 7 Jambi City school, the students of SMAN 7 Jambi City, and all parties who have participated in helping in the making of this article.

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