



Analysis Of Critical Thinking Ability Physics Education Students to Solve Geometrical Optics Problems

Sarah Octaviana^{1*}, Abdul Hamid², Elisa²

¹ Student of Physics Education Department, Universitas Syiah Kuala, Banda Aceh - Indonesia

² Lecturer of Physics Education Department, Universitas Syiah Kuala, Banda Aceh - Indonesia

*Corresponding email: sarahoctaviana96@gmail.com

(Received: June 28, 2020; Accepted: September 27, 2020; Published: October 27, 2020)

ABSTRACT

This research was conducted aiming to determine the critical thinking skills of Teacher Training and Education Department Syiah Kuala University physics students based on critical thinking indicators in solving optical geometry problems. This research uses a quantitative approach with descriptive research methods. The population of this research is the 2016 Physics Education students as many as 57 students with 40 students as a sample of respondents. Data collection was performed using a test consisting of 5 essay questions that have been validated for use as an instrument for critical thinking tests. The data obtained is then averaged per indicator and then presented and then categorized using the criteria table for critical thinking skills. The results show the average percentage of values obtained by students in solving optical geometry problems for each critical thinking ability is 43% in the ability to provide an explanation simple, 33% in the ability to build basic skills, 25% in the ability to conclude, 33% in the ability to provide further explanation, and 13% in the ability to formulate strategies and tactics. Based on these results it can be concluded that the critical thinking ability of students based on each indicator in the physics education student at Teacher Training and Education Department Syiah Kuala University is still low.

Keywords: Analysis of critical thinking, critical thinking, optical geometry

INTRODUCTION

The development and progress of the world today brings people to face new challenges, one of which is the industrial revolution 4.0. In this era, advances in technology and science are becoming increasingly sophisticated and adapting to human mobility and needs. This was stated by Pratama in the UGM Forkomsu (2019: 35) that in the era of the industrial revolution 4.0 there would be an invasion with the emergence of new technologies marked by the creation of various artificial intelligence, super computers, the development of nano tech and others.

The impact of this era is that many jobs will be automated so that employment will be reduced. Reduced employment drives human resources in the industrial revolution 4.0 era to develop the abilities or competencies needed and mastered in this era. One of the competencies that must be mastered and possessed by everyone to face the era of the industrial revolution raised by Taubany and Suseno (2017: 173-174) is the ability to think critically. Neolaka (2019: 77) revealed that one of the causes was the absence of a person's limit in obtaining information

so that each person was required to be able to choose and sort out good and correct information in order to enrich his knowledge with accurate information. In addition, critical thinking skills are also very needed in the process of problem solving. Maulana (2018: 7) states that in solving the problem of critical thinking is needed. With the ability to think critically, a person is able to organize and adjust his thoughts so that they can make the right decisions and actions.

There are several categories that must be mastered in critical thinking to solve a problem. These categories were stated by Ennis in Maulana (2018: 14), namely: (1) ability to provide simple explanations, (2) build basic skills, (3) conclude, (4) provide further explanation, the, (5) set the strategy. The five categories must be instilled early on, especially in students. The cultivation of critical thinking skills is instilled early on, especially in students as human resource candidates. For this reason problem-based learning is needed that can improve students' critical thinking skills. This was revealed in the Ministry of Education and Culture where it was explained that the purpose of learning physics in high school / MA is as a means to train students in mastering physics knowledge, concepts and principles, scientific skills and science process skills, as well as critical and creative thinking skills. In physics there are materials that require scientific processes in solving problems, one of which is optical geometry. To solve optical problems, students must be able to analyze solutions based on available information and critical thinking plays an important role in this regard.

Problem of Research

The problem in the process of developing critical thinking is the need for physics teachers who are competent and have the ability to think critically. Not all teachers are capable and have the ability to think critically. Saragih (2019) assert that the behavior of teachers in managing learning has led to efforts to encourage and develop students' critical thinking skills, but not yet optimal.

In this case universities have an important role in producing quality human resources and are able to think critically. Thomas in Utami (2017) says that critical thinking ability can and should developed from the first year of university in order for students to cope with their future studies and to be of most use to future employers. Therefore students are expected to be able to master the ability to think critically as a qualified HR candidate and be able to be competent in the era of the industrial revolution 4.0, especially physics education students who will become educators.

The results of previous studies indicate that students' critical thinking skills are still low. One of them is Pradana's research (2017) which shows that the average value of students' critical thinking skills in optical geometry is still in the low category of 27.20 out of 100. Based on the description above, the researcher decides to conduct research on physics education students at Faculty Of Teacher Training and Education Unsyiah with the aim to know the ability of students to think critically in solving problems in optical geometry.

Research Focus

In this reasearch, the problem that raised by author is how ability of physics student solving geometrical optic problem using critical thinking skill.

METHODOLOGY OF RESEARCH

General Background of Research

This research was conducted in Syiah Kuala University in Banda Aceh, located at Tgk. Hasan Krueng Kalee street, Kopelma Darussalam, sub-district Syiah Kuala, Banda Aceh city. This research is included in the type of descriptive research using a quantitative approach.

Subject of Research

Subject of this research is 40 physics education students of 2016 generation in Syiah Kuala University. The sample was chosen with the criteria already following the wave and optical courses.

Instrument and Procedures

To collect the data, the instrument used consisted of tests that had been validated with the test questions category between C4 to C6 in the form of essay questions arranged based on critical thinking indicators that were expected to be obtained by the sample. This is the following table describes the problems and indicators of critical thinking skills

Table 1. The Problems and Indicators of Critical Thinking Skills

Indicators of Critical Thinking Ability	Sub-Indicators of Critical Thinking	Question Number	Cognitive Level Questions
Elementary Clarification	Ask and answer questions about an explanation or challenge	1	C4
Basic Support	Observe and consider the results of observations	2	C4
Inference	Perform deductions and consider the results of deduction	3	C4
Advance Clarification	Identifying assumptions	4	C5
Strategy And Tactics	Determine the action	5	C5

Source : Adaptation from Ennis (2019)

Data Analysis

Data obtained from the results of the study were analyzed using the following percentage formula:

$$P = \frac{\text{Average number}}{\text{Maximum number of scores}} \times 100\%$$

After obtaining the percentage results for each critical thinking indicator obtained from the test, the results are then analyzed to see the ability of FKIP Unsyiah physics education students in critical thinking currently using this tables and the data obtained from the study are presented in graphical form.

Table 2. Criteria for Percentage of Critical Thinking Ability Test Scores

No.	Percentage	Criteria
1.	81% - 100%	Very Critical
2.	66% - 80%	Critical
3.	56% - 65%	Pretty Critical
4.	41% - 55%	Less Critical
5.	0% - 40%	Uncritical

Source : Nurchasanah (2012)

RESULTS AND DISCUSSION

The graph in the following figure shows the average percentage of test scores achieved by students for each indicator based on tests conducted on 40 students of physics education Teacher Training and Education Faculty Unsyiah class of 2016 generation.

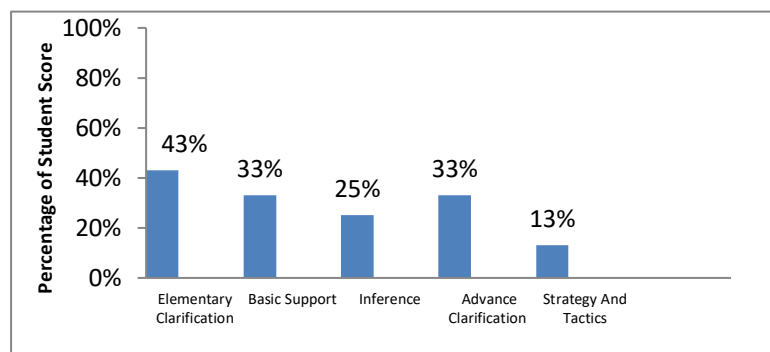


Figure 1. Graphic results on the percentage of critical thinking skills

In the first indicator the average score obtained by students is 3.45 or 43% of the maximum score of 8 with the less critical category. These results are comparable with the results of Pradana research (2017) which shows the average test scores in this indicator category are low, 25.33% of the maximum score of 100 which shows the ability of students is still lacking.

In the second indicator, the average score obtained by students is 2 or 33% of the maximum score of 6 in the uncritical category. These results are comparable to the results of Pradana research (2016) which shows that in this indicator, the average score obtained by students in solving problems is 2.10 from a scale of 10 and this result is classified as low.

In the third indicator, the average score obtained by students on this indicator is 4 or 33% of the maximum score of 12 in the uncritical category. This result is different from Wiyoko's research (2019) which shows that in this category the average percentage of scores obtained is quite high at 66.30% of the maximum value.

In the fourth indicator, the average score obtained by students for the questions on the indicator concluded is 1 or 25% of the maximum score of 4 in the uncritical category. This result is different from Nuraini's research (2017) which shows that in this skill students get a score of 84.17 which is included in the excellent category. In the fifth indicator, the average score obtained on the questions for this indicator is 1.05 or 13% of the maximum score of 8 with the uncritical category.

The main obstacle of students in solving problems in a test is that students already know the theory but have not been able to apply it to the maximum. This is consistent with Carson's statement in Wiyoko (2019) which states "Even though students know a concept, it is not certain that students can know how to apply it".

CONCLUSIONS

Based on the results of the study concluded that the critical thinking skills of students in the low category. The average percentage of scores obtained by students in solving optical geometry problems for each critical thinking ability is 43% with less critical categories on the ability to provide simple explanations, 33% with non-critical categories on the ability to build basic skills, 25% with non-critical categories on the ability to conclude, 33% with the uncritical category on the ability to provide further explanation, and 13% with the uncritical category on the ability to formulate strategies and tactics.

With the results of this study, it is hoped that readers will gain knowledge about the level of critical thinking skills of prospective teachers, especially for physics education students. Besides that, writer also hope that with this research prospective teachers will be more eager to improve the quality of critical thinking in order to be able to improve the quality of Indonesian education and produce a generation capable of advancing the nation.

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