UEJTL: Universal Education Journal of Teaching and Learning
Vol. 1, No. 1, pp. 18~24
E-ISSN: XXXX-XXXX, DOI: XXX

Analysis of the Correlation Between Learning Motivation and Critical Thinking Skills of Students on the Subject of Particle Dynamics

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Article Info

Article history:

Received 02 02, 2024
Revised 02 23, 2024
Accepted 03 13, 2024

Keywords:

correlation
particle dynamics
critical thinking skills
motivation

ABSTRACT

This research uses descriptive qualitative-quantitative research which aims to describe critical thinking skills on particle dynamics material. The population used was physics students at Malang State University and this sample was chosen randomly using a random sampling technique. This study uses an instrument and a questionnaire. The instrument used was as many as 5 elaboration questions about particle dynamics based on critical thinking indicators according to Ennis and the learning motivation questionnaire. From the research that has been done, it is obtained that the critical thinking skills of Malang State University students are sufficient with a total percentage value of 68.30%. The highest percentage average score of each indicator is the second indicator that determines the basis for decision making by 87.7%, then the fourth indicator is 76.4%, the third indicator is 70.7%, the first indicator is 58.5% and the lowest percentage is the average score the average of each indicator is the fifth indicator with a percentage of 48.1%. So, it can be concluded that the first and fifth indicators are still relatively low. Students' motivation in learning at the State University of Malang is quite sufficient at 72.71%. The percentage of each aspect on average reaches almost 50%.

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1. INTRODUCTION

Physics is a learning material that has an important role in achieving national education goals. Physics learning always consists of two things, namely process and product. According to the Ministry of Education and Culture [1], Regulation of the Minister of National Education No. 23 of 2006, concerning Graduation Competency Standards, it is explained that the Science and Technology subject group has the aim of developing students' logic, thinking, and analysis skills. Therefore, students must have positive attitude competencies with critical thinking skills and creative thinking skills, be able to collaborate and be able to speak honestly and openly between students based on the potential of physics processes and products after following the learning process.

One of the difficulties in learning physics is the result of conceptual errors in students [2]. This misconception can arise in students' thinking that comes from daily experiences when interacting with nature around them. Before studying physics, students already have experience of physics events that occur in

everyday life, such as free-falling objects, the movement of pushing tables, collisions, and others. So with that experience, an understanding and theory formed is not necessarily true. If the understanding formed was wrong, it will usually be more difficult to correct, because without them realizing this wrong understanding has become a guide in his life.

One of the physics concepts that require a high level of understanding of concepts and is mathematical in nature is particle dynamics. The concept of particle dynamics is the basis of other science concepts [3], [4]. Based on this, many students say that particle dynamics material is difficult to understand. Whereas this particle dynamics material only uses the logic and critical thinking skills of students. By using critical thinking skills, students will be helped in the process of solving problems in particle dynamics material.

In the physics learning process, teachers often make students objects in learning rather than subjects in learning. Teachers usually present formulas and calculations that are difficult to understand by students in physics learning, so students are less interested and consider physics boring and difficult to understand. Weak motivation to learn physics students is due to a lack of understanding of the utilization and results that can be generated from learning physics [5]. To face difficulties when studying physics, learning motivation is the main capital to understand physics properly and correctly.

The word motive is often interpreted as the ability within a person to do something. Starting from the word motive, then motivation can be interpreted as the ability of a person to be more active in learning [6]. Where motivation and learning are two things that influence each other. It can be said that learning is a relatively permanent change in behavior as a result of experience while motivation is an encouragement from within students to do something. So it can be said that learning motivation is an encouragement from within students to carry out learning activities to achieve the goals of learning.

In essence, learning motivation is in the form of internal and external encouragement in students who are learning to make changes in behavior. According to Ulya [7] there are several indicators that can show learning motivation in students. These indicators are described as follows, 1) having a desire to succeed. 2) have encouragement and needs in learning. 3) have hopes and aspirations for the future. 4) have appreciation in learning. 5) have interesting activities in learning. 6) have a conducive learning environment.

In addition, education aims to prepare students to be able to meet their life needs and foster a sense of responsibility, learning in schools must be able to help students develop an understanding of the dynamics of motion and familiarize critical thinking, so that students are able to overcome problems about the dynamics of motion. Abdullah [8] explains that thinking is a mental activity that aims to gain knowledge. Therefore, thinking is a cognitive process that cannot be seen physically because there is no physical change that can show that someone has thought. However, the results can be ideas, knowledge, procedures, arguments, and decisions. Meanwhile, critical is defined as a person's condition to determine whether or not a problem is true. So it can be concluded that critical thinking is a process that aims to make a decision that aims to solve a problem.

Some previous studies that examine critical thinking skills include research by Rahayu et al, [9] which emphasizes that the learning process should apply and hone critical thinking skills. In addition to this research, research conducted by Duron [10] explained that in the learning process, students should always emphasize their critical thinking skills in order to produce learning experiences that are beneficial to themselves. Currently, many studies examine critical thinking skills. The study, of course, requires a measurement test in order to measure critical thinking skills appropriately.

Related to the above problem, it is necessary to analyze critical thinking skills to describe an aspect and examine in depth as an evaluation in learning and learning motivation is needed to increase students' desire to learn physics, especially in motion dynamics material. In this study, researchers chose learning motivation and critical thinking skills of students on the material of motion dynamics by using a test developed in the form of a critical thinking skills description test. The purpose of this research is to develop a critical thinking ability test for students on the material of motion dynamics and determine the validity and reliability of the developed test. Based on this background, researchers are interested in identifying the level/category of critical thinking and learning motivation possessed by high school students. Therefore, this study discusses "Analysis of the Relationship between Learning Motivation and Critical Thinking Skills of Students on the Subject of Motion Dynamics".

2. METHOD

This research is a qualitative-quantitative descriptive type of research, where this study uses survey methods and correlational techniques that describe several variables studied. The survey method is a research method that takes samples from a population and uses a questionnaire as the main data collection tool. In this study, the data collection media used were student learning motivation questionnaires and particle dynamics question instruments. In this study, the population used was Malang State University (UM) students, with an

offering sample selected using a random sampling technique and a total of 53 students. The instrument used in this study is 5 description questions about particle dynamics material based on critical thinking indicators, according to Ennis, and has been validated by 2 teams of experts in terms of language and suitability for critical thinking indicators. according to Ennis, besides that it has also been validated through SPSS calculations. The survey method used serves to sharpen the data that has been obtained by filling out the learning motivation questionnaire, which will use the correlation between the questionnaire and the validated instrument.

Through empirical trials, the instrument reliability level was obtained at 0.618 with sufficient criteria, according to Arikunto [11]. This article will discuss the relationship between student learning motivation and their critical thinking skills. There is 1 question that has a high level of validity and reliability and a relatively high level of difficulty based on Ennis' indicators because it can only be answered perfectly by three students. Measurement of the validity and reliability of an instrument using SPSS.

3. RESULTS AND DISCUSSION

This article will discuss the critical thinking skills and learning motivation of Malang State University students using 5 particle dynamics questions along with a learning motivation questionnaire. With a sample of 53 students. Of the 5 particle dynamics questions that use critical thinking indicators according to Ennis, there is only 1 question that has a high level of difficulty and can only be answered by 3 students.

3.1. Motivation

The observation data obtained is then analyzed descriptively. At the beginning of the observation, we collected data using a questionnaire, for what was observed through 20 aspects given to students. The statement sheet given to students is in the form of positive statements and negative statements. Positive statements will get a score of 4 if they choose to strongly agree, a score of 3 if they choose to agree, a score of 2 if they choose to disagree, and a score of 1 if they choose to disagree. As for the negative statement, it will get a score of 4 if you choose to disagree, a score of 3 if you choose to disagree, a score of 2 if you choose to agree, and a score of 1 if you choose to strongly agree. Researchers get the results and then percentage the results. The results of the percentage calculation are then qualified by Rahma [12] as Table 1.

Based on the results of the questionnaire analysis of learning motivation of Malang State University students, as shown in Figure 1. From the diagram, it can be concluded that the learning motivation of Malang State University students is quite high, with 72.71%. The average percentage of each aspect is almost 50%. The twelfth aspect, namely, I worry if my exam scores go down (bad), is the lowest percentage. Many students are worried that their exam scores go down due to a lack of student motivation in learning so these students lack confidence in the results they have done [13].

Table 1. Criteria for Learning Motivation Assessment Results

No	Percentage	Category
1	76% - 100%	Very High
2	51% - 75%	Fair
3	26% - 50%	Less
4	0% - 25%	Very Low

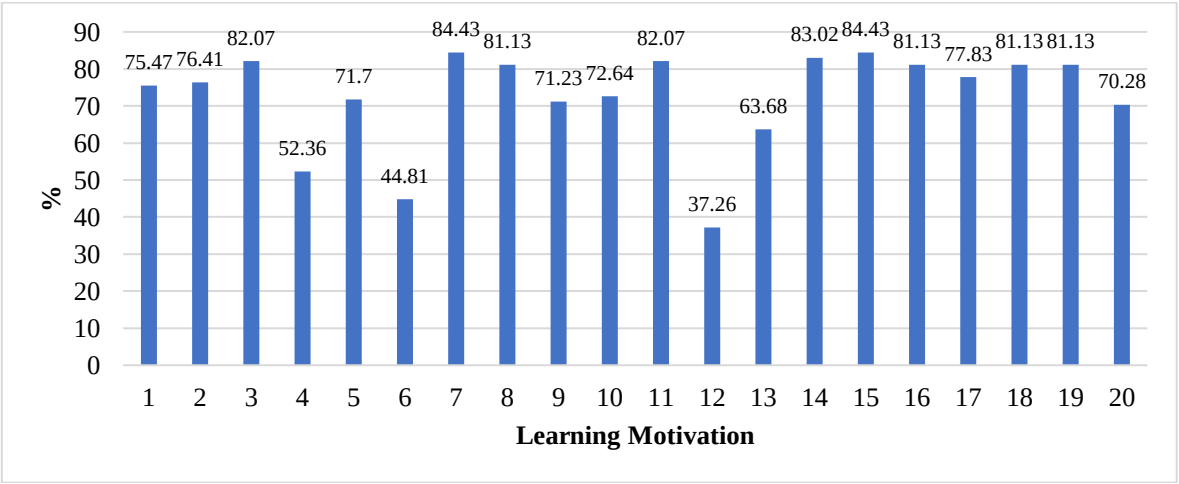

Figure 1. Average of each aspect of learning motivation

3.2. Critical Thinking Skills

Ennis in Amir [14] defines critical thinking as reflective thinking that is reasoned and focused on determining what to believe or do. It can be concluded in general that critical thinking is a process that aims to make a decision that is directed to be able to decide on a solution that can be taken in solving the problem at hand. This critical thinking skill will be a continuous, active, and thorough process. In addition, a person's skills in critical thinking can be known based on the indicators of critical thinking he has. One of the indicators used is the indicator of critical thinking according to Ennis. According to Ennis in Ermayanti & Dwi [15], there are 12 indicators of critical thinking skills that are summarized into 5 stages, as shown in Table 2.

The percentage scale of critical thinking skills categories according to Hasibuan [16] is presented in Table 3. Based on the results of data analysis and management of average scores, the critical thinking skills of Malang State University students on the subject of particle dynamics as shown in Figure 1.

Table 2. Stages of Critical Thinking skills

No	Stages of Critical Thinking Skills	Indikator
1	Elementary Clarification	Focusing or formulating the question.
		Analyzing the argument.
		Clarifying by asking and answering questions.
2	The Basis for The Decisions	Considering the veracity of sources.
		Make observations and assess observation reports.
3	Inference	Make deductions and consider the results.
		Make inductions and consider the results.
		Making and determining self-considerations.
4	Advances Clarification	Identify and consider them.
		Identify assumptions.
5	Supposition and Integration	Consider reasons.
		Combining information or integrating in decision making.

Table 3. Interpretation of Critical Thinking Ability Categories

Percentage	Category
$89 < X \leq 100\%$	Very high
$79 < X \leq 89\%$	High
$64 < X \leq 79\%$	Medium
$54 < X \leq 64\%$	Low
$X \leq 54\%$	Very low

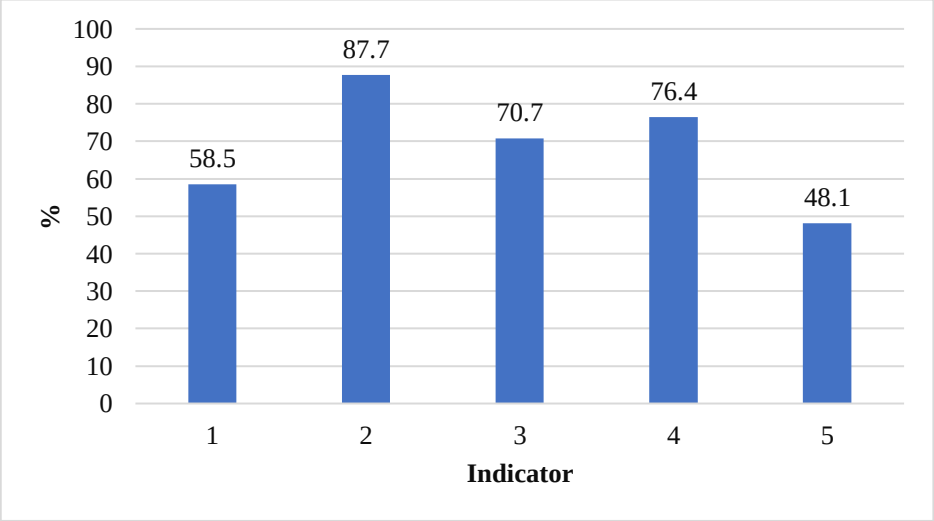

Figure 1. The average percentage of each indicator

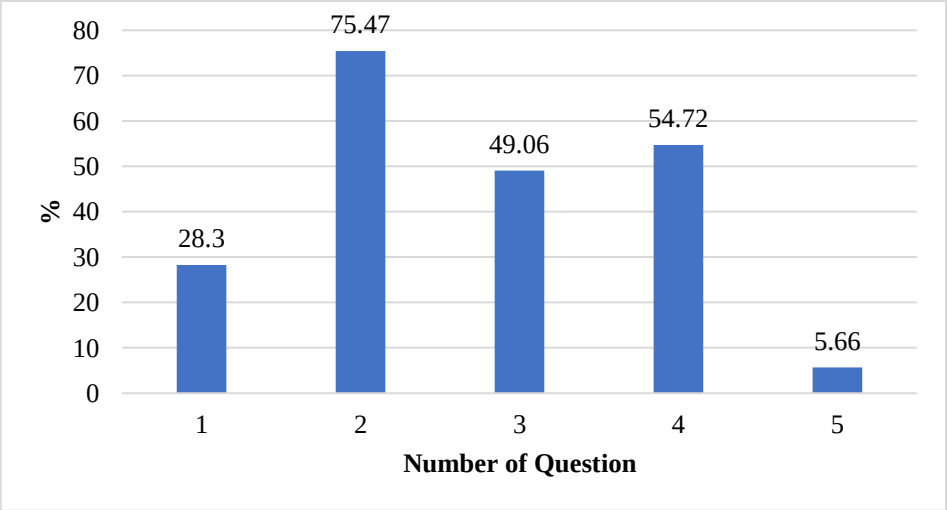

Figure 2. The percentage of Correct Answers for Each Question

Based on Figure 1, it can be concluded that the critical thinking skills of Malang State University students are classified as a moderate category with a total percentage value of 68.30%. The highest percentage of the average score of each indicator is the second indicator, namely determining the basis for decision making at 87.7%, followed by the fourth indicator of 76.4%, the third indicator of 70.7%, the first indicator of 58.5% and the lowest percentage of the average score of each indicator is the fifth indicator with a percentage of 48.1%. So, it can be concluded that the first and fifth indicators are still relatively low. Furthermore, students' ability to answer questions is shown in Figure 2.

From Figure 2, it can be seen that the average percentage of students who answered correctly was 42.64%. From the data above, it can also be concluded that in the first indicator question, only 28.3% of students were able to analyze the argument by explaining the concept of Newton's Law in everyday life. The second indicator question has the highest percentage of 75.47% of students who can make deductions by analyzing the relationship between the motion of objects and the friction force of objects. The third indicator question has a percentage of 49.06% of students who can determine an action by analyzing the relationship between friction and drag to the mass and acceleration of an object. The fourth indicator question has a percentage of 54.72% of students who can make inductions by analyzing and concluding the effect of acceleration on the force of an object. The fifth indicator question has a very low percentage of 5.66% of students who can ask and answer clarifying questions or questions by suggesting the relationship of quantities on the concept of effort. The fifth indicator question is only 3 out of 53 students who can answer the question correctly.

From the results of the average percentage of each indicator, it can be concluded that the level of critical thinking skills of students on particle dynamics material is classified as sufficient in accordance with the percentage scale table of critical thinking skills categories according to Hasibuan [16]. Based on the analysis of the score of each indicator, the researchers found that students had difficulty in asking and answering clarification questions or questions by suggesting the relationship of quantities to the concept of effort. In addition, the lack of maximizing students' critical thinking skills is due to the lack of opportunities to practice critical thinking skills. Therefore, to obtain maximum results, students should practice their critical thinking skills by working on various kinds of HOTS problems, doing practicum, and solving a problem. This is in line with research conducted by Ariyati, Haryono, & Masykuri [17].

3.3. Correlation

The product-moment correlation test (r) is used to state whether or not there is a relationship between the critical thinking skills variable and the learning motivation of Malang State University students. The r value between critical thinking skills and student learning motivation is calculated using SPSS and there is a correlation of 0.345 with a significant value of 0.011. Where critical thinking skills and learning motivation have a high correlation because the requirements for two variables to be correlated are that the significant value must be less than 0.05 or 5%, it can be said that there is a significant correlation between learning motivation and critical thinking skills.

Enhanced critical thinking abilities are a significant factor that students themselves consider when defining their learning motivation. Furthermore, these skills do promote understanding of information presented in a more meaningful way and its application. From educational standpoint students with critical

thinking skills tend to be more actively involved in the learning process since they are able to apply the theories they learn to their real life experience. This factor also arouses students' motivation for knowledge, as they know that they will be challenged to find answers, to search, analyze, and synthesize. When critical-thinking students solve problems or grasp complex concepts and processes, they become more confident in themselves and derive intrinsic satisfaction, which enhances their motivation for learning. Furthermore, critical thinking enables students to understand why something is necessary for them, which makes them more motivated to study. From an education approach, critical thinking in learning ensures that students are properly challenged but are also fully supported, making it more likely that they will continue to be interested and want to learn. Thus, developing critical thinking ability along with other cognitive processes within education significantly enhances the motivation to learn among students.

4. CONCLUSION

This research attempts to demonstrate the connection between critical thinking and learning motivation of Malang State University learners especially on the particle dynamics material context. It was found that students' cognitive skills in Sorensen problem solving were average; only quite strong in decision processes and inference, but severely weak in articulation and formulation of questions. The critical thinking indicators that had been integrated suggest the need for more practice and more chances to acquire skills like answering HOTS questions, engaging in problem-solving, and doing practical work. Purple motivational strategies utilize technology so enthusiastically expressed such as active polite turn-taking lectures and collaborative questioning of quite high so that students' learning motivation can be said to be high.

The researchers have established strong linkages between critical thinking and learning motivation, stating that if a student decides to think critically, he/she will enhance his/her understanding, participation and self-worth. When students are able to bridge theories to real world practices and handling real-life problems, they get internally motivated and the 'satisfaction' the students derive in such cases further increases their commitment to learning. This deepens the interaction between students and emphasizes also application of critical thinking in schoolwork as one of the central issues to be addressed in the research work. Hence, it tells us if teachers promote critical thinking with students, it is helpful for enhancing both cognitive and motivational level, resulting in more engaging and effective learning.

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