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Analysis Correlation of Learning Motivation and Conceptual Understanding in High School Students on Force and Motion

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Abstract

The research aims to determine the correlation between learning motivation and high school students' conceptual understanding of Force and Motion material. The research uses a quantitative approach to correlational analysis. The research was conducted at Malang City State High School with 33 students using purposive sampling. The instrument uses test instruments to measure students' understanding of concepts and non-test instruments in the form of questionnaires to measure students' learning motivation on Force and Motion material. The results of the analysis show that concept understanding is in the low category with an average score of 47.25. The student's learning motivation score shows 70.3 and is in the high category. The normality test shows that the concept understanding data is not normally distributed so the analysis uses Spearman correlation. The correlation test results obtained sig = 0.874 so there is no correlation between learning motivation and understanding of physics concepts in Force and Motion material.

Keywords: *correlation, conceptual understanding, learning motivation, force and motion*

1. Introduction

Learning motivation is one of the important aspects that students have in the learning process. Learning motivation is the strength or drive that exists within students to try to learn and understand the subject matter [1]. Students' learning motivation is greatly influenced by the environment, because an active learning environment is definitely supported by an active learning process[2]. Good learning motivation will give students a good understanding of concepts in a subject matter.

Learning motivation and conceptual understanding has a strong connection. To develop a good understanding of concepts, students must have strong learning motivation[3]. Learning motivation and conceptual understanding are basic abilities that must be developed by students in the learning process. Conceptual understanding is the initial aspect that students use to be able to think critically so they can solve problems according to procedures[4]. So that the results of students' problem solving are in accordance with the expected learning objectives.

The relationship between learning motivation and understanding of concepts should be comparable[5]. When students' learning motivation is high in a subject matter, then these students should also have a

good understanding of the concept. Several studies have produced comparable data between learning motivation and concept understanding. However, there are also research results that are not comparable between learning motivation and students' understanding of concepts. Research from Damayanti & Rufiana (2020) produced data that learning motivation influences students' understanding of spatial building material. In this research, when students' learning motivation increased, the assessment results on spatial building material increased. Similar research was conducted by Alifia & Pradipta (2021) which stated that when students' learning motivation was around 84%, there was an increase in learning outcomes by 82%. Research that shows disproportionate results between learning motivation can improve students' understanding of concepts was carried out by Anggraini et al (2023) on physics students. The results obtained from this research are that there is no correlation between learning motivation and students' understanding of concepts in rectilinear motion material. Another similar study was also conducted by Zuleni & Marfilinda (2022) which found that there was no significant interaction between learning motivation and understanding of science concepts.

Motivation for learning cannot always be at the top or bottom level[9]. Learning motivation is greatly influenced by the student's environment. Therefore, teachers must try to maintain and increase students' learning motivation so that it does not decline. The way to find out students' learning motivation is through a student response questionnaire regarding learning motivation, distributing concept understanding test questions, and can be done directly through oral tests.

In this research, a conceptual understanding test will be carried out on force and motion material based on the FCI (Force Concept Inventory). The material of force and motion is the material most widely discussed in kinematics and dynamics. The discussion of kinematics and dynamics is a basic concept that is used as a basis for understanding other physics material[10]. Several studies have revealed that students often face difficulties in understanding the concept of force within the framework of Newton's Laws due to the abstract nature of the concepts of force and motion[11]. Newton's Law material has unique characteristics that require special attention in learning, but students often experience difficulties and even misconceptions if they do not understand it well[12].

Looking at previous research, it turns out that there are still research results that show there is no correlation between students' learning motivation and understanding of concepts. In this research, a more specific re-analysis will be carried out regarding the correlation between these two variables. The material of force and motion is essential material, therefore it will be analyzed whether learning motivation influences this material. In this research, a test of understanding the concept of force and motion will be distributed first, then students will be given a learning motivation questionnaire, and a short question and answer will be conducted regarding the material on force and motion. The results of this research will be analyzed to find out how students' learning motivation correlates with their understanding of the concepts of force and motion. Therefore, it is important to carry out research with the title Correlation Analysis of Learning Motivation on High School Students' Conceptual Understanding of Force and Motion Material.

2. Research Methods

This research is research with a quantitative approach using correlational analysis. The research aims to determine the correlation between learning motivation and students' understanding of physics concepts in Force and Motion material. The research was conducted at SMA Negeri Malang City in November 2023. The research was conducted on SMA students specializing in MIPA class XI. The research sample

was taken using a purposive sampling technique and 33 students were selected. The research instrument uses test and non-test instruments. The test instrument used to measure students' conceptual understanding of Force and Motion material consists of 30 questions and is an instrument developed by Hestenes et al (1992). The non-test instrument is in the form of a questionnaire that adapts the instrument of İnce et al (2020) to measure students' learning motivation on Force and MOTION material. The learning motivation questionnaire uses a Likert scale consisting of 22 items with five levels of answers. To determine the achievement of students' understanding of concepts, they are categorized based on table 1.

Table 1. Categories of students' conceptual understanding

Interval	Category
$0\% \leq x \leq 30\%$	Low
$30\% < x \leq 60\%$	Enough
$60\% < x \leq 100\%$	High

Students' learning motivation is also categorized according to table 2 as follows.

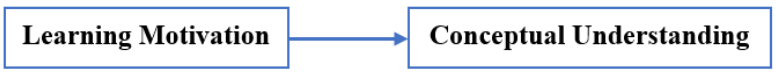
Table 2. Categories of student learning motivation

Interval	Category
0 - 20	Very Low
21 - 40	Low
41 - 60	Enough
61 - 80	High
81 - 100	Very High

The research data was analyzed using product moment correlation to determine the relationship between the two variables, namely between learning motivation and students' conceptual understanding. Before correlation analysis, a prerequisite test is carried out to find out and determine whether the research data can be analyzed parametrically or non-parametrically. The prerequisite tests carried out are normality and homogeneity tests using the IBM SPSS 24 program.

Research design for Product Moment correlation test (Yusuf et al., 2017):

Figure 1. Pearson Product Moment Correlation Research Design



3. Result and Discussion

Result

Research data from concept understanding tests is presented on a ratio scale and learning motivation data is presented on an interval scale. The first analysis was carried out by presenting a profile of concept understanding in the form of frequency diagrams and graphs. Learning motivation is presented in the average overall motivation of students. The profile of students' conceptual understanding of Force and Motion material is presented in Figure 2.

Figure 2. Profile of students' conceptual understanding of Force and Motion material

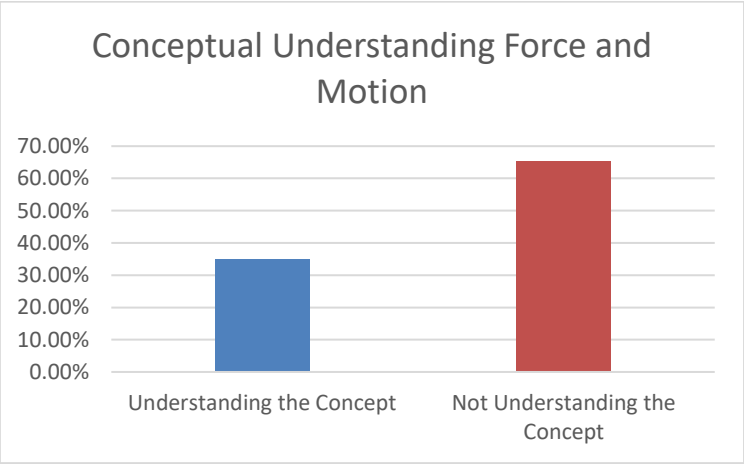
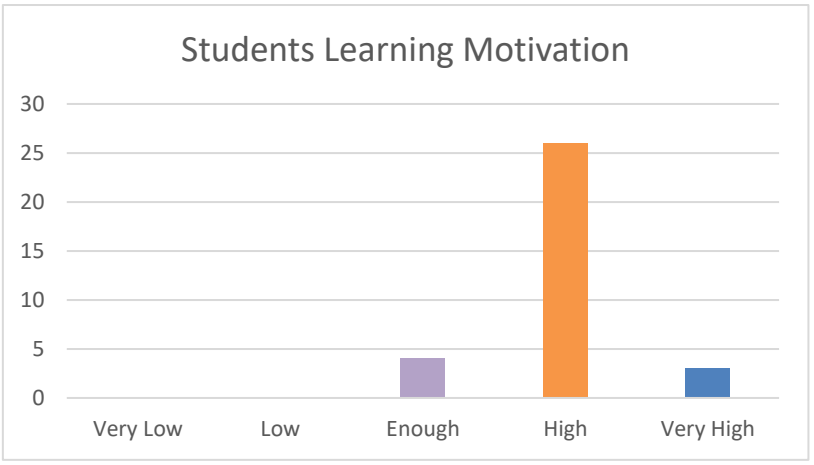


Figure 2 shows that students' conceptual understanding of Force and Motion material is in the medium category with a percentage achievement of 34.75%. This result is in accordance with research conducted by Taqwa et al (2020) which also shows that understanding of physics concepts in Force and Motion material is in the low category at 30.35. In addition to the profile of students' conceptual understanding, data analysis was also carried out on the results of students' learning motivation tests and is presented in Figure 3.

Figure 3. Profile of students' learning motivation



The outcomes of the learning motivation questionnaire indicate that students' learning motivation ranks within the high category, boasting an average score of 70.3, aligning with the delineations in Table 2. These findings correspond with Selvia's research (2021), underscoring that students' intrinsic motivation towards learning physics resides in the high category. The robust learning motivation among students concurs with their responses in the questionnaire. Specifically, 4 students fall within the moderate category, 26 students fall within the high category, and 3 students fall within the very high category. These results distinctly illustrate that no student falls within the very low or low categories in terms of learning motivation.

The next analysis is to test the correlation between learning motivation and students' understanding of concepts. Before carrying out a correlation test, it is necessary to carry out a prerequisite test because the correlation test used is a parametric statistical test. The prerequisite test carried out is the normality test and is presented in the following figure

Normality Test

Figure 4. Normality test results

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Motivation	.115	33	.200*	.942	33	.079
Understanding	.165	33	.023	.925	33	.025

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

The outcomes from the Shapiro-Wilk normality test reveal a significance value of 0.025 for the concept understanding data. This value, being less than 0.05, indicates that the data is not normally distributed. Conversely, the normality test for learning motivation data displays different findings, indicating a normal distribution with a significance value of 0.079, which exceeds 0.05. In summary, the normality test results imply that the concept understanding data deviates from normal distribution, while the learning motivation data adheres to it. Moving to the second prerequisite test, the homogeneity test results are as follows.

Figure 5. Homogeneity test results

Tests of Homogeneity of Variances

		Levene Statistic	df1	df2	Sig.
Nilai	Based on Mean	.192	1	64	.662
	Based on Median	.102	1	64	.751
	Based on Median and with adjusted df	.102	1	60.413	.751
	Based on trimmed mean	.186	1	64	.667

The homogeneity test shows that the data on conceptual understanding and learning motivation have a homogeneous distribution. This result is because the sig value. 0.662 and more than 0.05. Based on the prerequisite test results, the normality and homogeneity test analysis show that there is concept understanding data that is not normally distributed so it cannot be tested using parametric statistical analysis. An alternative test that can be carried out is non-parametric analysis with the Spearman correlation test. Spearman correlation analysis was carried out with the help of SPSS and the following results were obtained.

Figure 6. Spearman correlation test results

Correlations

			Motivation	Understanding
Spearman's rho	Motivation	Correlation Coefficient	1.000	-.029
		Sig. (2-tailed)	.	.874
		N	33	33
	Understanding	Correlation Coefficient	-.029	1.000
		Sig. (2-tailed)	.874	.
		N	33	33

Decision making based on the Spearman correlation test is carried out by comparing the sig values. (2-tailed). If sig. (2-tailed) is less than 0.05, so there is a correlation between learning motivation and students' conceptual understanding. On the other hand, if sig. (2-tailed) is more than 0.05, namely 0.874, so there is no correlation between learning motivation and students' conceptual understanding.

Discussion

The results of the analysis carried out on students' conceptual understanding and learning motivation scores show that there are differences in data distribution. It can be seen from the students' learning motivation scores that they are in the high category but have low conceptual understanding. Statistically, the average motivation is 70.3 and the average understanding of concepts is 34.75. This difference shows a mismatch in students' learning motivation and conceptual understanding. The correlation test results also strengthen the results that there is no correlation between learning motivation and concept understanding. This is proven by the sig value = 0.874, where this number is greater than 0.05.

Several previous research results also show that there is no correlation between learning motivation and students' understanding of concepts as explained by Anggraini et al (2023) in the material Straight Changes Regular MOTION. Another result was also explained by Aulia (2021) in her research that there was no correlation between learning motivation and understanding of concepts in expansion material. Apart from GLBB and expansion material, general research results in science subjects do not show a significant interaction effect between learning motivation and understanding of science concepts Zuleni & Marfilinda (2022). Several previous research results show that the lack of correlation between learning motivation and understanding of concepts does not only occur in Force and Motion material like the findings in this research, but also occurs in GLBB material, expansion, and even science concepts in general.

The lack of correlation between learning motivation and understanding of this concept is certainly caused by several factors. According to Aulia (2021), several influencing factors are because students do not yet have a complete understanding of the physics concepts and material being tested. The second cause is students who are not serious enough in working on the questions given so that the results obtained are less than optimal. The causal factor that might influence is the suitability of students' answers in filling out the learning motivation questionnaire to the actual situation. Students may not write down what is actually so that it does not show appropriate results. The level of intelligence is also an important factor because students who have high motivation but tend to have low intelligence will also have low understanding of concepts [3].

The findings in this research can provide new information for teachers in schools to be able to increase students' conceptual understanding achievements through innovative efforts in learning methods that are more effective and able to build better understanding. Learning innovations that can be carried out are by using technology-based media and increasing students' active role in learning. Teachers can also apply formative assessments as carried out in Kusairi (2020) research in order to identify student achievements and make improvements to any deficiencies in understanding. This research applies web-based formative feedback to improve students' mastery of concepts.

4. Conclusion

Learning motivation is an important aspect that influences the physics learning process. Students who have high learning motivation will be more serious in studying physics. The results of the analysis using

the Spearman correlation test obtained sig = 0.874, which shows that there is no correlation between learning motivation and students' understanding of concepts. The cause of the absence of correlation is that students do not have a complete understanding of the concept of Force and Motion, the lack of serious attitude of students in completing the test, and the lack of suitability of the motivational questionnaire answers given by students to actual conditions.

5. Suggestion

Teachers or education administrators in schools can try to innovate learning methods that are more effective and able to build better understanding, for example by implementing technological developments in various media and using formative feedback to improve students' understanding of concepts.

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