

## Students' attitude and motivation in mathematical physics

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### ABSTRACT

Attitude is one aspect that needs to be considered both for learning activities or learning objects. This study aims to determine the attitudes and motivations of students in mathematics physics subjects. The sample used was 100 students who had studied the Mathematics Physics course. This study employed quantitative research methods with correlational research design. Respondent was gathered by purposive sampling method. The research instruments used were attitude questionnaires in mathematical physics and motivational questionnaires. The study found that there is a significant relationship between attitudes and motivation of students in mathematics physics learning.

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## 1. INTRODUCTION

In learning, attitude is also an aspect of being essential [1]. Process attitude is necessary [2, 3]. Because, students who have this view will have different attitudes, with students who have positive opinions views during the learning process [4]. One of them is motivation [5]. In other words, someone who believes that doing behavior will lead to positive results will have a favorable attitude towards doing this behavior. Noble attitude is as a tendency to learn, positive or negative emotional tendencies from someone to objects, people, places, events, and ideas [6, 7]. The attitude of students towards Mathematics Physics subjects in the subject of Physics Education can be said to be less good. This can be seen from the average student learning outcomes of physics education in low mathematics subjects and in learning activities also only requires an explanation of learning so that it cannot be done optimally. [8]; the purpose of mathematics learning in lectures in order to formulate various physical processes in the integrity of mathematics and to be able to handle them analytically, quantitatively and predictively based on the criminal model formulated. The lack of achievement of the goals of physics learning in lecture activities is caused by various problems.

One of the problems faced was student attitudes and students' views on mathematics physics subjects. Students have a bad attitude towards mathematical physics subjects, this is because students view mathematics subjects as difficult subjects and require a good understanding of concepts to be able to achieve learning achievements. [8] there are many behaviors or attitudes of students that are not good so that it affects learning achievement, namely students who do not want to train themselves to work on the questions in the book, students tend to rely on explanations from lecturers, students only use one textbook and hanging material from the lecturer powerpoint, and the behavior of students who do not want to learn independently looking for reference sources that support mathematics physics courses. Physics is considered difficult learning for students from high school to university as well as for postgraduate education. [9]; if students

have a negative attitude towards science, they also do not like physics subjects and physics teachers. This factor causes students to dislike physics, and has a negative attitude towards physics learning and does not like teachers who teach physics.

A very important attitude is possessed by educated people, both at the level of primary education or in higher education. Attitudes will also affect one's success in achieving the desired learning achievement. [10] Is one of the factors that influence one's learning outcomes? [11] Attitudes not only include feelings of dislike, but also positive attitudes that include our attachment and loyalty to people, things and ideas. Attitudes in learning activities can help students develop knowledge in the future and can work in the field of physics. [12] Thus it can be concluded that a positive attitude towards learning Science will improve achievement in Science. A positive attitude towards learning mathematics physics can improve student achievement in learning mathematical physics. [13] A positive attitude creates the basis of effective learning. In the case that students have a positive attitude towards learning, they are much more willing to put forward their best efforts, and they can get better learning outcomes. On the other hand, if students have a negative attitude towards learning, they just give up or don't want to learn anymore. Where a person's positivity in learning activities will foster motivation and passion for learning, with a good attitude so students will be able to improve their achievements and learning objectives will be achieved optimally.

Mathematical physics is very closely related to mathematical solutions because it requires a good attitude in learning mathematical physics. Attitudes towards mathematical physics not only like or dislike to study mathematical physics but also included the attitudes [14]. Attitudes towards science can be defined as feelings, beliefs, and values held about science and technology. The attitude of students in the Mathematics Physics course is not good enough. This is indicated by the presence of several students who contracted Mathematics Physics subjects more than once because they obtained poor results or in the category of not graduating. Because many students consider Mathematics Physics difficult and require mastery of concepts and mathematical skills to be able to understand and follow lectures well, while facts in the field show that students' ability to understand the material is low when many students experience difficulties and are not active during Learning Activities [9]. Physics is considered a difficult program for students from high school to university and also for adults in postgraduate education. Physics is considered a difficult concentration that causes students to have a bad attitude towards mathematics physics subjects.

Dimensional attitudes to measure include spending some time in learning mathematics, the social implications and the normality of physicist's theory. The instrument used refers to TOSRA (Test of Attitude Related Science) that has been adjusted and tested for validity and reliability. Dimensions of attitude assessment are as follows [15]. The attitude of students in learning cultural values is based on the feelings or interests of students in learning mathematics physics [16]. In addition to feeling happy students can also emulate a scientist who is very skilled in his field and discover new things. Instead of assuming that scientists are ugly, dull, there isn't even time for their families [17]. In addition, if students behave negatively towards physics, then the student has no interest in increasing his study time in mathematical physics. Positive attitudes and interests in mathematical physics will lead students not to study [18].

Attitudes of being or a state of mind to think critically consider problems and subjects that come in a variety of one's experiences [19]. Attitudes are closely related to one's critical thinking abilities. By having the right attitude, someone will be able to develop critical thinking skills. Critical thinking can grow from one's experience. This is related to Human Development Index (HDI), [20] Human Development Index (HDI) is a single composite indicator that measures three basic dimensions of human development and is considered capable of reflecting necessary abilities. The three essential skills are long and healthy, knowledgeable, and skilled, and access to the resources needed to achieve a decent standard of living.

HDI is needed to deal with the MEA (ASEAN Economic Community). HDI is one of the backgrounds of students because students as human resources influence the quality of a nation. The Indonesian people must have human resources who have good attitudes and critical thinking, in order to face the ASEAN Economic Community (AEC) in the future. By having the attitude and critical thinking, students as future teachers can face the big challenges of the MEA (ASEAN Economic Community). [21] Characteristics of other students, critical thinking dispositions, and characteristics of critical thinking is to have a good attitude so that they can achieve learning achievement. The characteristics that must be possessed by students as qualified prospective teachers are having critical thinking skills, which are related to attitudes and learning achievements. To be able to improve students' critical thinking skills in mathematical physics subjects, it is necessary to know how students behave towards mathematics physics subjects. Therefore, the purpose of this study is to see whether there is a relationship between students' attitudes and motivation in learning mathematics physics in Jambi University physics education.

## 2. RESEARCH METHOD

A quantitative research method with a correlational research design was employed. Associative quantitative research is a relationship between two or more variables [22]. According to [23, 24], "Correlation Design in quantitative research that is used to measure the degree of association (relationship) between two variables using statistical analysis correlation procedures."

One hundred students obtained a sample of the students from the Physics Education Study Program in Jambi. The sample technique uses purposive sampling with a questionnaire as the instrument. The attitude questionnaire on mathematical physics was adopted from [15] with the Cronbach alpha value of 0.93 with 61 valid statements and seven indicators. Then for a motivational questionnaire adapted from [25], 23 valid statements and Cronbach's alpha values of 0.86. In this study, researchers used six process skill indicators.

Descriptive and inferential statistics using SPSS. In the form of mean, minimum score, and maximum score [22]. Statistical inference from mathematical procedures for using probabilities and information about samples to conclude the population from which the sample is presumably was drawn [26]. This study uses product moment correlation to see the relationship between variables. Indicators of student attitudes to mathematical physics used are social implications of physics, normality of scientists, and interest in increasing the time to study mathematical physics.

Below are categories of motivation and attitude questionnaires in mathematical physics, among others, very good, good, sufficient, not good, and not very good, as shown in Table 1.

Table 1. Characteristics of motivation and attitude in mathematical physics

Category	Motivation	Interval		
		Social Implications of Physics Mathematics	Interest Increases Learning Time in Physics Mathematics	Norlamity of Scientists
Very Not Good	23.0 - 41.4	8.0 - 14.4	8.0 - 14.4	10.0 - 18.0
Not Good	41.5 - 59.8	14.5 - 20.8	14.5 - 20.8	18.1 - 26.0
Enough	59.9 - 78.2	20.9 - 27.2	20.9 - 27.2	26.1 - 34.0
Good	78.3 - 96.6	27.3 - 33.6	27.3 - 33.6	34.1 - 42.0
Very Good	96.7 - 115.0	33.7 - 40.0	33.7 - 40.0	42.1 - 50.0

## 3. RESULTS AND DISCUSSION

### 3.1. Social implications of mathematical physics

The results of indicators of social implications of physics mathematical will be further elaborated in the Table 2.

Table 2. Results from indicator of social implication physics mathematical

Interval	Category Attitude	Total	Mean	Min	Max	%
8.0 - 14.4	Very Not Good	0				0.0
14.5 - 20.8	Not Good	0				0.0
20.9 - 27.2	Enough	15	29.0	16	37	15.0
27.3 - 33.6	Good	48				48.0
33.7 - 40.0	Very Good	37				37.0
TOTAL		100				100

From Table 2, from 100 respondents and processed results using the SPSS, the result is a good category of 48.0% for 100 students, very good at 37.0% for a total of 37 out of 100 students, and enough at 15.0% for a total of 15 out of 100 students. Based on Table 2, it is known that out of the 100 respondents studied for indicators of Social Physics Implications, it can be seen that the distribution of respondents in each category of attitudes is uneven. Where the proportion of respondents was found only in 3 categories of attitudes, namely quite good, good and very good, for the other 2 categories there were no other respondents included in it. So it can be concluded that student attitudes toward indicators the social implications of Physical Sciences are included in the category of a good attitude.

Indicator of the Social Implications of [15] explains that the social implications of physics include attitudes towards social benefits and problems related to scientific progress and research. The attitude of students to this indicator is included in a good attitude. This is supported by the results of the interview: "What do you think about the social implications or effects of physics? Is that dangerous or not?" "I have a good view of the impact of physics so I grow my own learning spirit. I think physics provides many benefits to everyday life. With physics we feel many benefits, for example, we can enjoy incandescent lights

from the invention of Thomas Alfa Edison. I became more enthusiastic about learning because physics has many positive effects on life.”

The results of the interview explained that students had good attitudes and visions of the social implications of physics. By having the belief that physics has many benefits in life; students will have the desire to learn. [27] Positive students who have high self-confidence and know the interest of science in life will be an encouragement for him to achieve learning goals, in addition to influencing the willingness to learn and increase student mastery to achieve academic achievement. Conversely, if students have negative views about the social implications of physics it will reduce students' enthusiasm. [28]; a student who lacks an understanding of nature, benefits, beauty, and work that can be generated from physics studies causes weakness in the motivation to learn Physics. For learning physics to be more fun, the benefits of learning physics need to be understood by students. If students do not understand the nature of physics, it will not foster the spirit of learning to study physics.

### 3.2. Normality of scientist

The questionnaire results obtained from indicator the normality of scientists are further elaborated in the Table 3.

Table 3. Results from indicator of normality of scientists in physics mathematical

Interval	Category Attitude	Total	Mean	Min	Max	%
10.0 – 18.0	Very Not Good	0				0.0
18.1 – 26.0	Not Good	1				10.0
26.1 – 34.0	Enough	62	30.0	20	41	62.0
34.1 – 42.0	Good	37				37.0
42.1 – 50.0	Very Good	0				0.0
TOTAL		100				100

From Table 3, from 100 respondents and the results of using the SPSS, the result is a enough category for 62.0% for a 62 total of 100 students, good at 37.0% for a total of 37 out of 100 students, and not good at 10.0% for a total of 10 out of 100 students. Based on Table 3, it is known that out of 100 respondents examined for the theoretical indicators of Normality of Physics, it is seen that the distribution of respondents in each category of attitudes is uneven. Where the proportion of respondents is only found in 3 categories of attitudes, which are quite good, good and bad, for the other 2 categories there are no other respondents included in it. It can be concluded that the attitude of respondents to the Normality indicator of the Physician Theory is included in the category of a good attitude.

Indicators of Normality of Scientists, This scale measures how students perceive scientists as individuals and students' perceptions of scientists who have a normal lifestyle [15]. The results of the study indicate that this indicator is included in the category of fairly good attitudes. This is supported by the results of the interview:

“What do you think about scientists or experts in the field of theoretical physics?”

“I have a pretty good view of scientists. I appreciate what they find especially in the field of physics. I think scientists have a different mindset than other people in general, scientists are able to think to produce something that can be utilized by many people.”

“Do you think scientists or theoretical physicists have the same style as people in general?”

“I think scientists have the same life as people in general, which only distinguishes more resilient scientists and finds more discoveries that can be exploited by the masses. But sometimes scientists spend more time alone and rarely socialize with people.”

The results of the interview explained that students had an attitude towards the theoretician of normality. Students who are good enough will have good views and argue that scientists are intelligent and have many bright ideas that can experiment and get results that can be felt by many people. But on the other hand, students also feel that scientists are people who socialize with people because they are too busy with their work. [29] Scientists are seen as important to our national life and the world; he is a great, brilliant and dedicated human being, with his strength far beyond ordinary people, whose patients research regardless of the fame of money lead to medical treatment, provide technical progress and protect us from attacks. Students' views of scientists or physicists influence the desire to learn. [30]; in many studies, it was stated that the characteristics of scientists influence student attitudes and achievements. Effects of teacher age, experience, and gender are considered as factors that influence student attitudes and achievements in physics.

The attitude that students must have regarding the views of scientists is a good attitude. By having a good attitude it will foster the spirit of learning in students to study physics.

### 3.3. Interest increases when learning mathematical physics

The questionnaire results obtained from indicator of Interest Increases When Learning mathematical physics are further elaborated in the Table 4.

Table 4. Results from indicator of interest increases learning time in physics mathematic

Interval	Category Attitude	Total	Mean	Min	Max	%
8.0 – 14.4	Very Not Good	1				1.0
14.5 – 20.8	Not Good	10				10.0
20.9 – 27.2	Enough	61	24.0	9	37	61.0
27.3 – 33.6	Good	20				29.0
33.7 – 40.0	Very Good	3				3.0
TOTAL		100				100

From Table 4, from 100 respondents and the results of using the SPSS, the result is a enough category for 61.0% (61 of 100), good at 29.0% (29 of 100), very good at 3.0% (3 of 100), not good at 10.0% (10 of 100), and very not good at 1.0% (1 of 100). Based on Table 4, it is known that from 100 respondents who study for indicators spending time studying Mathematics Physics II shows that the distribution of respondents in each category of attitudes is uneven. Where the proportion of respondents mostly found in the attitude category is quite good and the proportion of respondents who are the least in the not too good attitude category. So, it can be concluded that the attitude of students to this indicator included in the category of attitude is quite good.

Interest increases when studying mathematical physics, student attitudes on this indicator are included in a fairly good attitude. The results of the interview students say:

“Do you spend time studying mathematics outside of physics class?”

“I don't take special time, because there are many other tasks to do.”

“When did you spend your time studying mathematics physics?”

“I only take the time to do my assignments and I will take the exam. I am also not interested in reading math physics books because of foreign languages and difficult to understand. Actually, I don't like to study mathematical physics because the material is too difficult and requires mathematical analysis in solving problems.”

Interview results show that students do not take the time to study mathematical physics outside of school hours, taking the time to study in connection with one's enjoyment of the subject. [31] Students will feel happy and happy to learn a subject if students like the subject. The fact that students do not like mathematics physics subjects because the material studied is too difficult and requires mathematical abilities to solve problems related to mathematical physics. [32], learning attitudes in Physics are an important element for studying Physics which has been considered a difficult subject for most students.

Attitudes in learning physics are important in studying physics which has been considered a difficult subject for most students. It should be able to get good learning outcomes; the attitude of students in taking time outside of the course hours must be good. Willingness to spend time studying mathematical physics relates to students' interest in learning. This is because, with an interest in learning, students will have enthusiasm and coldness to study mathematical physics.

The interest in learning is desire or willingness that is accompanied by deliberate attention and activeness which ultimately gives birth to pleasure in behavior change, both in the form of knowledge, attitudes, and skills [33]. The greater the interest of students to spend time studying mathematical physics, the students will tend to pay more attention to the object being studied until the desired goal is achieved. Other factors that affect students do not take the time to study mathematical physics because students cannot share time with other coursework. If students have a negative attitude towards science, they also don't like physics subjects, homework physics, and physics teachers [6]. It can be concluded that the main factor that causes students not to spend time is because students do not have fun in mathematical physics. The pleasure or interest of students to learn is something that must be embedded in students, with fun and interest in learning can improve student achievement. [32] Explains that someone's pleasure in physics will also affect learning achievement. This is because there is a relationship between attitudes and learning achievements. Learning attitude is an important factor for determining student achievement. Students who have more pleasure in a subject will achieve good grades in these subjects. The fun of students can be shown how to spend time

studying mathematical physics will affect student learning outcomes. Students must be more interested in mathematical physics to be able to obtain maximum learning outcomes.

### 3.4. Motivation

The results of the questionnaire are described in the Table 5. From Table 5, which came from 100 respondents from physics education program in Universitas Jambi and processed results using the SPSS, the result is a good category of 47.0% (47 of 100), enough at 35.0% (35 of 100), very good at 11.0% (11 of 100), and not good at 7.0% (7 of 100).

Table 5. The result of Motivation students

Interval	Category Attitude	Total	Mean	Min	Max	%
23.0 – 41.4	Very Not Good	0				0.0
41.5 – 59.8	Not Good	7				7.0
59.9 – 78.2	Enough	35	85.0	43	113	35.0
78.3 – 96.6	Good	47				47.0
96.7 – 115.0	Very Good	11				11.0
TOTAL		100				100

### 3.5. The relationship between attitude and motivational in mathematical physics

The results from attitude and motivational in mathematical physics are described in Table 6.

Table 6. The relationship motivation and attitude on mathematical physics

		Motivation	Attitude in Mathematical Physics
Motivation	Pearson Correlation	1	.697*
	Sig. (2-tailed)		.026
	N	100	100
Attitude in Mathematical Physics	Pearson Correlation	.697*	1
	Sig. (2-tailed)	.026	
	N	100	100

We can see that the sig value of 0.026 is smaller than 0.05, it can be concluded that there is a relationship with an r-value of 0.697 and positive. If the sig value  $< 0.05$  then there is a relationship [26]. Finding such bias can produce attitudes that are somewhat more negative than attitudes that will be reported without motivation [1]. From this research, we can conclude that motivation is essential for attitudes, so motivation and attitudes are interconnected.

## 4. CONCLUSION

The results of the study show that students' attitudes and motivations in the mathematical physics course affect the learning outcomes and enthusiasm of students. Especially in the indicator of interest increasing time in studying mathematical physics and indicators of the normality of scientists, on this indicator the attitude of students is categorized quite well, this is because students do not take time to study outside the lecture so that the student's learning goals are not fully achieved. The attitude that must be possessed by students is a good attitude, having a good attitude is needed in mathematical physics to be able to achieve learning goals. The indicators of social physics implications are included in the category of a good attitude. Having a good attitude towards the social implications or impacts of physics makes students have high self-confidence and knowing the interests of physics in life besides influencing the willingness to learn and can improve students' mastery to achieve academic goals. Conversely, if students have negative views about the social implications of physics it will reduce students' enthusiasm. From that attitude has a relationship with the motivation of the students which is indicated by the level of the relationship it self of 0.697.

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