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CORRELATION BETWEEN CONCEPT UNDERSTANDING AND ATTITUDES TOWARDS PHYSICS AND LEARNING

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Abstract :
This study aims to analyze students' understanding of Newton's laws and their Belief Attitude Towards Physics and Learning (BAPL) in terms of gender and school type. This study also analyzes the correlation between students' understanding of Newton's laws and their BAPL in physics learning. This study used a survey method on students in the even semester of the 2024/2025 academic year. The research population consisted of all 11th grade physics students in eight high schools in the Malang and Batu City areas. The sample consisted of 329 students, comprising 162 male students and 167 female students, selected through cluster random sampling. The data were analyzed using descriptive statistics, difference tests, and correlation tests using SPSS software. The results indicate that students' understanding of Newton's laws is still low based on both gender and school type. Students' BAPL results show moderate performance with variations based on gender and school type. The correlation between the two variables is very low and not statistically significant. The novelty of this study lies in its simultaneous analysis of conceptual understanding and BAPL based on gender and school type among high school students in Malang and Batu City. These findings suggest that improving students' conceptual understanding cannot rely solely on positive belief attitudes, highlighting the need for more structured and concept-based learning strategies in physics education.

Keywords: Belief Attitude, Conceptual Understanding, Physics Learning

INTRODUCTION

Conceptual understanding plays an important role in successful physics learning. Conceptual understanding is not only about recognizing and knowing, but also about restating a concept and applying it to problems in everyday life (Rose Amanda Puri dkk., 2023). Students can solve problems by connecting new knowledge with previous knowledge, as well as connecting relevant knowledge and distinguishing irrelevant knowledge (Saputra & Mustika, 2022). Conceptual understanding forms the basis for the formation of new knowledge and problem-solving skills (Novitasari et al., 2021). At the secondary school level, understanding important concepts is essential preparation for studying more complex physics concepts in college (Rahayu et al., 2019). Therefore, understanding concepts is the initial foundation for achieving learning success, especially in Newton's Laws concept (Azzahidah et al., 2024).

Newton's laws are an important foundation in physics education. The concept of force in Newton's laws is fundamental to academic programs in science and engineering (Prada Nuñez et al., 2022). This conceptual understanding enables students to apply Newton's laws in solving various concrete problems. In addition, a good conceptual understanding of Newton's laws will make it easier for students to learn advanced concepts such as buoyancy and electrostatic force (Rahayu et al., 2019).

Previous studies have shown that students' understanding of Newton's laws falls into the low category. The percentage of students who understand Newton's laws is 29.8%, while the average understanding of the concept among students is 5.38%, which falls into the low category (Maulidyah & Zainuddin, 2022; Rizkita & Mufit, 2022). In addition, prospective physics teachers' understanding of Newton's laws is also indicated to be low (Busyairi et al., 2022). This phenomenon shows that problems in understanding concepts do not only occur at the secondary school level but continue into college.

Belief attitudes toward physics learning are one of the factors that determine student learning success, especially in the context of lifelong independent learning. Belief attitudes that originate from within students can influence their way of thinking in facing the learning process (Aprilia et al., 2023). In physics learning, belief encompasses students' expectations and confidence in their ability to understand physics concepts and achieve optimal learning outcomes (Wandi et al., 2024). Students who have a positive attitude toward learning physics tend to like physics more and enjoy every process of learning physics (Kusuma et al., 2025).

Demographic factors and the learning environment also influence the formation of students' belief attitudes toward physics learning. Students' beliefs about physics determine how they understand and accept physics, thereby affecting their engagement in learning physics (Chen et al., 2019). Factors such as gender, grade level, study program, school origin, and background can influence the development of students' beliefs and attitudes toward physics (Diyana et al., 2024). In addition, beliefs and attitudes are also influenced by personality, type of school, age, and learning environment, which create variations in beliefs and attitudes among students (Aprilia et al., 2023).

Understanding concepts and belief attitudes play an important role in physics learning. The relationship between the two is very close and mutually influential in supporting student learning success. Students who have a positive attitude towards physics learning find it easier to understand physics concepts because they are active and enjoy the learning process (Astalini et al., 2019). Students' beliefs and attitudes also play a role in determining how they view and respond to learning materials (Ibrahim et al., 2022). In addition, students' success in understanding physics concepts will strengthen their confidence and positive attitudes. This condition increases students' motivation and engagement in learning, creating a mutually reinforcing learning cycle (Wandi et al., 2024).

Previous studies have shown that demographic factors such as gender and school type can influence students' conceptual understanding and belief attitudes toward physics learning. On average, male students' Force Concept Inventory (FCI) scores are higher than those of female students (Santoso et al., 2024). In general, male students are more interested in physics, while female students are more interested in biology (Ibrahim et al., 2019). Research using the Colorado Learning Attitudes about Sciences Survey (CLASS) instrument to determine students' beliefs about physics learning found significant differences in results based on gender and grade level (Chen et al., 2019). Other studies show that a sense of ownership of the school can influence students' attitudes toward physics (Smith et al., 2022).

Various studies have examined factors that influence physics learning. Gender differences in students' beliefs about physics have been studied, but without linking them to understanding Newton's laws (Chen et al., 2019; Ibrahim et al., 2019). Furthermore, the relationship between students' belief attitudes and their understanding of Newton's laws has not been thoroughly studied (Parno et al., 2023; Santoso et al., 2024). A sense of ownership of the school also plays a role in influencing student attitudes, although other demographic factors remain under-explored (Smith et al., 2022). Analysis of demographic factors that influence belief attitudes has been conducted, but its relevance to understanding Newton's laws is still limited (Aprilia et al., 2023). In addition, studies on the role of school background in influencing students' attitudes and beliefs toward physics learning have not been widely conducted (Diyana et al., 2024). Although previous studies have explored various factors in physics learning, there is a lack of analysis linking students' understanding of Newton's laws with their belief attitudes towards physics learning as a whole.

Based on the background and previous research, this study aims to analyze students' level of understanding of Newton's laws and their Belief Attitude Towards Physics and Learning (BAPL) in terms of gender and school type, as well as to analyze the correlation between students' understanding of Newton's laws and their BAPL in physics learning. To that end, this study formulates the following problems:

1. How well do secondary school students understand Newton's laws of motion in terms of gender and school type?
2. How does the level of Belief Attitude Towards Physics and Learning (BAPL) among secondary school students vary according to gender and type of school?
3. Is there a significant relationship between students' understanding of Newton's laws and BAPL, both in general and when viewed from the aspects of gender and school type?

RESEARCH METHOD

Research Design

This study is a quantitative descriptive study using a survey. The survey method was chosen because it enables systematic and efficient data collection from a large number of respondents through structured instruments. This method is relevant to this study as it allows simultaneous data collection on students' conceptual understanding of Newton's laws and their belief attitudes across different gender and school type groups. The quantitative approach was chosen because it allows for systematic and objective analysis of numerical data. The study aims to obtain an overview of the level of understanding of Newton's Law and BAPL concepts in terms of gender and school type, as well as the relationship between understanding of Newton's Law concepts and BAPL.

Research Target/Subject

The population in this study consisted of all 11th grade physics students in eight high schools in Malang and Batu during the even semester of the 2024/2025 academic year. These schools include 4 high schools (SMA) and 4 Islamic high schools (MA). This population was selected because all students had studied Newton's laws and represented the characteristics of students in both types of schools (public high schools and Islamic high schools). The sample was determined using the cluster random sampling method, which is a sampling method where the population is divided into groups (clusters). Several groups were selected randomly with equal probability, and then all members of the group were used as samples (Sugiyono, 2017). The total sample obtained consisted of 329 students, comprising 162 male students and 167 female students. Based on school type, there were 166 SMA students and 163 MA students.

Instruments

The instrument used in this study consisted of three main parts. First, questions on understanding Newton's laws using isomorphic questions developed by other researchers (Rahayu et al., 2019). There were 21 questions with seven indicators, where each indicator was represented by three questions with the same concept and solution but presented in different representations. Scores are given based on the number of correct answers on the indicators, namely a score of 2 if the student answers all three questions correctly, a score of 1 if they answer two questions correctly, and a score of 0 if only one or none of the questions are answered correctly. The students' level of understanding is then categorized as understanding (score 2), fairly understanding (score 1), and not understanding (score 0). The second instrument is the BAPL Survey developed by (Diyana et al., 2024). This instrument consists of 20 items in the form of a Likert scale with two main dimensions. The two dimensions are belief and attitude towards conceptual understanding and problem solving. The validity and reliability of the instrument have been tested so that it is suitable for use in this study. The third instrument is a research questionnaire designed to collect demographic data on students, such as gender and type of school (high school and Islamic high school). This questionnaire is used to group data and analyze demographic variables that could potentially influence the research results.

Table 1. Instrument specifications

Instrumen 1 - Newton's Law Conceptual Understanding Test			
Theme	Indicator	Item number	Total
T1	Analyze the magnitude of the force acting on an object with constant velocity	1, 8, 15	3
T2	The effect of force on the acceleration of an object	2, 9, 16	3
T3	Analyze the magnitude of the action-reaction force on two objects that touch each other	3, 10, 17	3
T4	Determine action-reaction force pairs in phenomena	4, 11, 18	3
T5	Analyze the relationship between force and the velocity of an object	5, 12, 19	3
T6	Analyze the forces acting on an object	6, 13, 20	3
T7	Analyze the amount of friction force on a stationary object on a rough floor	7, 14, 21	3
Instrument 2 - BAPL Survey			
Dimension	Indicator	Item Number	Total
Belief and Attitude toward Conceptual Understanding (CU)	Relationship of physics knowledge with personal benefit and real world connection (PBC)	1 – 7	7
	Sense making and effort in understanding content (SME)	8 – 13	6
Belief and Attitude toward Problem Solving (PS)	Perception and interest in problem solving (PI)	14 - 17	4
	Approach and effort in problem solving (AE)	18 - 20	3
Instrument 3 - Demographic Questionnaire			
Variable	Category		
Gender	Male, Female		
School type	Public High School (SMA), Islamic High School (MA)		

Table 1 shows the three instruments used in this study. Instrument 1 is a conceptual understanding test covering seven themes of Newton's Law with 21 items total, which allows researchers to measure students' understanding in a thorough and structured way. Instrument 2 is the BAPL Survey with 20 items that captures how students feel and think about learning physics, both in understanding concepts and solving problems. Instrument 3 is a demographic questionnaire to identify students based on gender and school type. With these three instruments combined, the study can examine not only students' conceptual understanding, but also the attitudes and background factors that may influence it. These instruments were then used in the data collection process described in the following section.

Research Procedure

Data collection was conducted directly in the classroom under the supervision of researchers, fellow researchers, and physics teachers. The data collection procedure was carried out in the following sequence of activities. First, researchers coordinated with the physics teachers at each school to schedule the data collection session. Second, prior to filling out the instruments, researchers confirmed that all students had previously studied Newton's Laws. Third, researchers explained the purpose of the study and provided instructions for completing each instrument. Fourth, students completed the demographic questionnaire, followed by the Newton's Law conceptual understanding test, and finally the BAPL survey within a total duration of 70 minutes. Fifth, researchers collected all completed instruments and checked for completeness. Each student only completed the instruments once to ensure consistency and accuracy of the data obtained. obtained.

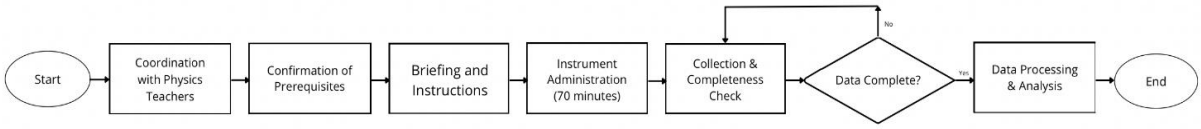

Figure 1. Research Procedure

Data Analysis Technique

The data obtained were analyzed using descriptive and inferential statistics. Descriptive statistics were used to determine the general overview of students' Newton's Law conceptual understanding and BAPL scores in each group, including the mean, standard deviation, minimum, and maximum values. The conceptual understanding results were also analyzed in the form of the percentage of students in each category for every indicator. Inferential statistics were used to test the research hypotheses, including prerequisite tests, difference tests, and correlation tests. The prerequisite tests were conducted using the Kolmogorov-Smirnov normality test and Levene's homogeneity test at a significance level of $\alpha = 0.05$. If the Sig. value > 0.05, the data were considered normal and homogeneous, whereas if the Sig. value < 0.05, the data were considered not normally distributed. Data that were normal and homogeneous were tested using the Independent Samples t-test, while data that were not normally distributed were tested using the Mann-Whitney U test. Both tests were considered significant if the Sig. (2-tailed) value < 0.05. The correlation between students' Newton's Law conceptual understanding and BAPL scores was analyzed using Spearman correlation. The correlation was calculated both overall and based on gender and school type groups at a significance level of $\alpha = 0.05$. The correlation results were interpreted based on the coefficient categories in Table 3, and the BAPL scores were interpreted based on the criteria in Table 2.

Table 2. BAPL Score Criteria

Score	Category	Interpretation
20 – 50	Low	Negative or unfavorable beliefs and attitudes
51 – 70	Moderate	Neutral or mixed beliefs and attitudes
71 – 100	High	Positive or supportive beliefs and attitudes

(Diyana et al., 2024)

Correlation analysis was used to examine the relationship between the scores for understanding Newton's laws and the overall BAPL scores, as well as scores based on gender and school type, using the correlation coefficients shown in Table 3.

Table 3. Correlation Coefficients

Coefficient Interval	Correlation Level
0,00 – 0,19	Very low
0,20 – 0,39	low
0,40 – 0,59	Moderate
0,60 – 0,79	High
0,80 – 1,00	Very high

(Sugiyono, 2017)

The correlation coefficient of the research data indicates the degree of relationship between the two research variables: students' conceptual understanding of Newton's laws and their BAPL scores. The higher the correlation coefficient, the stronger the relationship between the two research variables. Thus, the coefficient of variation can indicate whether a relationship exists and how strong it is between the variables.

RESULTS AND DISCUSSION

The general overview of the research results shows that most students still have difficulty understanding Newton's Law concepts. Based on Table 3, the average score for students' understanding of Newton's Law concepts is still low, with a relatively similar standard deviation in each group (gender and school type). No significant differences were found between student groups based on school type or gender separately. However, when viewed separately, male students tended to have a slightly higher average understanding than female students. In addition, the average differences between groups based on school type and gender were not statistically significant, except for the comparison between male and female students in MA schools, which showed a significant difference.

Table 4. Descriptive Statistics of Data

Parameters	Type of School		Gender			
	SMA	MA	Male SMA	Female SMA	Male MA	Female MA
N	166	163	102	64	60	103
Mean	1,1	1,1	1,1	1,1	1,4	0,8
Std deviation	1,2	1,3	1,1	1.3	1,6	1,0
Min	0	0	0	0	0	0
Max	6	6	5	6	6	5
Z	-0,3		-0,5		-2.2	
Sig. (2-tailed)	0,8		0,6		0,0	

Further analysis of student comprehension levels is shown in Table 5, which divides students based on their level of understanding of Newton's laws (understands - somewhat understands - does not understand). The results show that most students still fall into the "Does Not Understand" category. Meanwhile, the number of students in the "Understand" and "Somewhat Understand" categories is relatively small. Comparisons between groups based on gender and school type show very small differences, reinforcing the conclusion that students' overall level of understanding of Newton's Law concepts is still low. Students' level of understanding of Newton's Law concepts for each question indicator and group can be seen in Table 5.

Table 5. Percentage of Understanding of Newton's Laws

Category	Type of School (%)		Gender (%)			
	SMA	MA	Male SMA	Female SMA	Male MA	Female MA
Understand	2,4	3,7	2,1	2,9	5,2	2,8
Sufficiently understand	10,2	7,7	10,8	9,2	9,5	6,7
Not understand	87,4	88,6	87,1	87,9	85,2	90,6

Table 5 shows that most students in all groups fall in the 'not understand' category, both based on school type and gender. Female MA students show the lowest level of understanding compared to other groups, while Male MA students perform relatively better. This suggests that students' conceptual understanding of Newton's laws is still low across all groups.

Table 6. Percentage of Understanding of Newton's Laws on Each Indicator

Indicator	Category	Type of school (%)		Gender (%)			
		SMA	MA	Male SMA	Female SMA	Male MA	Female MA
Analyzing the magnitude of the force acting on an object at a constant speed	Understand	0,6	0	1,0	0	8,3	3,9
	Sufficiently understand	4,8	4,7	4,9	4,7	0	3,9
	Not understand	94,6	95,3	94,1	95,3	91,7	92,2
The effect of force on the acceleration of an object	Understand	14,5	7,4	11,8	18,8	11,7	4,9
	Sufficiently understand	16,3	8,6	18,6	12,5	11,7	6,8
	Not understand	69,3	84,0	69,6	68,8	76,7	88,3
Analyzing the magnitude of the action-reaction force on two objects that are in contact with each other	Understand	0	1,2	0	0	3,3	0
	Sufficiently understand	0,6	3,1	1,0	0	5,0	1,9
	Not understand	99,4	95,7	99,0	100	91,7	98,1
Determining the action-reaction pair in a phenomenon	Understand	1,8	6,1	2,0	1,6	3,3	7,8
	Sufficiently understand	27,7	16,0	26,5	29,7	18,3	14,6
	Not understand	70,5	77,9	71,6	68,8	78,3	77,7
Analyzing the relationship between force and velocity of an object	Understand	0	3,1	0	0	5,0	1,9
	Sufficiently understand	4,8	8,0	3,9	6,3	16,7	2,9
	Not understand	95,2	89,0	96,1	93,8	78,3	95,1
Analyzing the forces acting on an object	Understand	0	1,8	0	0	3,3	1,0
	Sufficiently understand	12,0	12,9	16,7	4,7	8,3	15,5
	Not understand	88,0	85,3	83,3	95,3	88,3	83,5
Analyzing the magnitude of friction on a stationary object on a rough floor	Understand	0	0,6	0	0	1,7	0
	Sufficiently understand	4,8	3,1	3,9	6,3	6,7	1,0
	Not understand	95,2	96,3	96,1	93,8	91,7	99,0

Based on Table 6, it can be seen that students' level of understanding of Newton's Law concepts varies across each question indicator. The highest level of student understanding is found in the indicator "The effect of force on the acceleration of an object." Furthermore, students have a sufficient understanding of the indicators "Determining the action-reaction force pair in a phenomenon" and "Analyzing the magnitude of the force acting on an object with constant velocity." In several other indicators, such as "Analyzing the relationship between force and velocity of an object" and "Analyzing the forces acting on an object," the level of student understanding is relatively lower.

The level of student understanding that shows low conditions is found in two indicators. The lowest level of understanding of Newton's Law concept is found in the indicator "Analyzing the magnitude of friction on a stationary object on a rough floor." This shows that students are not yet able to identify the forces acting on a stationary object. In addition, the level of student understanding on the indicator "Analyzing the magnitude of action-reaction forces on two objects in contact with each other" is also low. This shows that

students have difficulty understanding the concept of forces acting on objects during collisions and the concept of forces and masses interacting in such situations. In general, the level of understanding of Newton's Law for each question indicator and group is very low. The lowest level of conceptual understanding for these two indicators can be seen in the students' answers in Figure 2 and Figure 3.

Soal no 10
Andi "a" memiliki massa 95 kg, dan Budi "b" memiliki massa 77 kg. Mereka duduk di dua kursi yang identik seperti pada gambar. Jika Andi mendorong Budi, maka pada fenomena tersebut yang terjadi adalah …. (Adaptasi FCI)

a. Andi maupun Budi tidak saling memberikan gaya satu sama lain (1,52%)
b. Andi memberikan gaya kepada Budi, tetapi Budi tidak memberikan gaya pada Andi (30,09%)
c. Gaya yang diberikan Budi pada Andi lebih besar dibandingkan gaya yang diberikan Andi pada Budi (12,27%)
d. Gaya yang diberikan Andi pada Budi lebih besar dibandingkan gaya yang diberikan Budi pada Andi (50,76%)
e. Gaya yang diberikan Andi pada Budi sama besar dengan gaya yang diberikan Budi pada Andi (4,86%)

Figure 2. One of the questions analyzing the magnitude of the action-reaction force on two objects that touch each other

Soal no 14
Seorang siswa sekolah dasar yang memiliki massa 30 kg mendorong sebuah meja bermassa 60 kg yang terletak di atas lantai kasar dan datar. Meskipun siswa telah mengerahkan gaya dorong, meja tetap tidak bergerak. Hal ini dapat disebabkan karena …. (Adaptasi isomorfik Hukum Newton Pak Sentot)

a. Gaya dorong siswa lebih kecil dari gaya gesek balok dan lantai (60,18%)
b. Gaya dorong siswa lebih kecil dari berat balok (24.32%)
c. Berat siswa lebih kecil dari berat balok (10,03%)
d. Gaya dorong siswa sama dengan gaya

Figure 3. One of the questions analyzing the friction force on a stationary object on a rough floor

Based on Figure 2, only a small number of students were able to answer the question correctly. This shows that the majority of students still have difficulty understanding the concept of action-reaction forces in the interaction between two objects, as in the phenomenon between Andi and Budi. Many students assumed that the force exerted by Andi on Budi was greater than the force exerted by Budi on Andi, or vice versa. Some students even assumed that only one person exerted force. Based on Newton's Third Law, the forces exerted by both individuals should be equal in magnitude and opposite in direction.

Students also had difficulties with Figure 3, which relates to their understanding of Newton's Law in relation to stationary objects. In this question, only a small number of students were able to answer correctly. Most students assumed that a smaller pushing force compared to the friction force would cause the object to remain stationary. In general, the results of the students' belief attitudes can be seen in the descriptive statistics table in Table 6.

Table 6. Descriptive Statistics of BAPL Data

Parameters	Score
N	329
Mean	65,9
Std Deviation	6,7
Min	46
Max	87

Based on Table 4, in general, the average BAPL scores of students are in the moderate category. This indicates that students have neutral or mixed beliefs and attitudes towards physics learning. The minimum

BAPL score indicates that there are students who have unfavorable beliefs and attitudes, while the maximum BAPL score indicates that there are students who have favorable beliefs and attitudes. This wide range of scores indicates that there is variation in the level of students' belief attitudes towards physics learning. Details of students' belief attitudes based on groups can be seen in the descriptive statistics table in Table 7.

Table 7. Descriptive Statistics of BAPL Data for Each Student Group

Parameters	Type of school		Gender			
	SMA	MA	Male SMA	Female SMA	Male MA	Female MA
N	166	163	102	64	60	103
Mean	67,6	64,9	67,7	67,4	64,4	63,9
Std Deviation	6,2	6,8	6,4	5,9	7,5	6,3
Min	53	46	53	54	46	47
Max	87	85	87	81	85	79
t	4,9		0,4		0,5	
Sig. (2-tailed)	0,0		0,7		0,7	

Based on Table 7, there are differences in the average BAPL scores among student groups (gender and school type). In the group based on school type, high school (SMA) students have a higher average BAPL score than Islamic high school (MA) students, with the test results showing a significant difference between the two groups. Meanwhile, the comparison of BAPL scores based on gender in each school type did not show a significant difference. The lowest minimum score was found in the female MA group, while the highest maximum score was found in the male SMA group. To further determine the relationship between understanding of Newton's laws and student belief attitudes, a correlation analysis was conducted between the results of the Newton's laws comprehension test and the BAPL scores. The correlation between understanding of Newton's laws and BAPL can be seen in Table 8.

Table 8. Correlation between Conceptual Understanding and BAPL

Sig. (2 tailed)	Correlation Value	Category
0,10	0,09	Very low

Based on Table 8, the correlation between understanding of Newton's laws and BAPL scores is very low and insignificant. This very low correlation indicates that an increase in BAPL scores is not always accompanied by an increase in understanding of Newton's laws. Students who have a favorable belief attitude towards physics learning do not necessarily have a good understanding of Newton's laws and vice versa. The correlation between the concept understanding test results and BAPL scores based on groups can be seen in Table 9.

Table 9. Correlation between Conceptual Understanding and BAPL for each Student Group

Group	Type	Sig. (2 tailed)	Correlation score	Category
Type of school	SMA	0,85	-0,02	Very low
	MA	0,02	0,18	Very low
Gender	Male SMA	0.98	0,00	Very low
	Female SMA	0.66	-0.06	Very low
	Male MA	0.04	0.27	Low
	Female MA	0.22	0.12	Very low

Table 9 shows variations in correlation values between understanding of Newton's Law concepts and BAPL based on student groups (gender and school type). The correlation values obtained for all groups were in the very low category and were mostly insignificant. Significant correlations were found among MA students, although the values were still low. In addition, significant correlations with low correlation values were also found among male MA students.

Discussion

Most students have a low level of understanding of Newton's laws. A comparison of the understanding of Newton's laws between male and female high school students shows a significant difference. In addition, the highest percentage of students who do not understand Newton's laws is found in the female student group. These results are in line with previous studies that female students have lower average scores than male students (Abdikadyr et al., 2025). The relatively small differences in percentage scores between groups (gender and school type) indicate that students have not yet mastered Newton's laws well. These results are also in line with previous studies showing that students still lack understanding of Newton's laws (Suryadi & Astuti, 2022). Most students have difficulty solving Newton's Law problems, as indicated by their very low average scores (Azzahidah et al., 2024). Furthermore, almost all students did not understand Newton's Law well, as seen from the fact that 56.5% of students did not master Newton's Law in verbal representation questions (Maulidyah & Zainuddin, 2022).

Students' poor understanding of Newton's laws can be attributed to several factors. One of these is that students tend to simply memorize formulas without understanding the underlying concepts (Mufit & Syamsidar, 2022) . The lack of connection between Newton's laws and students' everyday experiences, as well as students' misconceptions that were not immediately corrected by teachers, also contributed to students' poor understanding of Newton's laws (Sundaygara et al., 2021). Internal factors such as students' mindsets based on personal understanding that are inconsistent with physics concepts also pose obstacles to understanding Newton's laws (Isra & Mufit, 2023). In addition, students' low interest in learning physics, difficulty in understanding questions, a curriculum that does not support concept learning, and limited learning facilities can also be factors that influence students' understanding of concepts (Syaidah et al., 2023).

Most student groups fell into the category of not understanding almost all question indicators. There were two question indicators that had the highest percentage of misunderstanding. The indicator "Analyzing the magnitude of friction on a stationary object on a rough floor" shows that most students have difficulty understanding the concept of static friction. Most students assume that the table remains stationary because the pushing force is smaller than the static friction between the block and the floor. However, when the table is stationary, the magnitude of the pushing force will be equal to the friction force holding it, so that the resultant force on the object is zero ($\Sigma F_X=0$). This difficulty may be caused by the students' lack of experience in observing and analyzing the forces acting on stationary objects. Therefore, the role of teachers is very important in utilizing free force diagrams in physics learning, especially in Newton's Law material, to improve students' analytical skills (Soleha et al., 2025). The next indicator, "Analyzing the magnitude of action-reaction forces on two objects in contact with each other," found in question number 10, shows students' difficulty in understanding the concept of action-reaction forces. Most students assume that the mass of an object will affect the magnitude of the force. This assumption is in line with the results of the analysis of students' difficulties with Newton's Law using FCI, where only 11 out of 86 students were able to answer correctly on questions and concepts similar to question number 10 (Azzahidah et al., 2024). In addition, students have a low level of conceptual understanding of action-reaction forces (Mufit & Syamsidar, 2022). These findings indicate that students do not fully understand Newton's Third Law.

In general, the average BAPL score of students falls into the moderate category. This shows that most students have a neutral or mixed belief attitude. These findings are in line with research showing that student attitudes fall into the moderate category and are significantly related to student learning outcomes (Tanjung et al., 2024). In addition, a high level of confidence and a positive attitude toward learning physics can be motivating factors in the learning process (Ibrahim et al., 2022). There are differences in the average BAPL scores based on gender and school type. High school students have a more favorable belief attitude than MA students. The difference in the belief attitude of high school and MA students can be attributed to the different characteristics and management of the two types of schools. High school and Islamic high school students have different characteristics because they are managed by different agencies, namely high schools are managed by the Ministry of Education and Culture, while Islamic high schools are managed by the Ministry of Religious Affairs. These differences in management affect administrative, curricular, and teaching aspects, especially Islamic high schools, which place greater emphasis on Islamic religious studies. These conditions influence the psychosocial development and belief attitudes of students in each type of school (Aprilia et al., 2023; Nurdiyani et al., 2020).

The lowest minimum score was found in the MA female group, while the highest maximum score was found in the SMA male group. This shows that there are variations in students' belief attitudes

based on gender and school type. This is in line with several previous findings that show that male students have more positive beliefs and attitudes than female students (Chala dkk., 2020; Dahal, 2025). Research using the CLASS instrument found that female students actually showed higher levels of confidence and attitude than male students (Diyana et al., 2024). These differences in results indicate that the instruments used can influence the measurement of students' belief attitudes.

There are several factors that can influence students' belief attitudes in physics learning. Physics material is often considered difficult and uninteresting by students, which can reduce their positive attitudes toward physics learning (Wandi et al., 2024). Lack of resources, inadequate teacher qualifications, and unsupportive education policies also hinder the development of positive attitudes among students (Wandi et al., 2024). Demographic factors such as gender, grade level, type of school, and age also influence students' beliefs and attitudes toward physics learning (Aprilia et al., 2023). In addition, the role of students themselves, teachers, and school culture has an influence in shaping students' beliefs and attitudes, both positively and negatively (Chala et al., 2020).

The correlation between understanding Newton's Law concepts and students' belief attitudes was very low and not statistically significant. This shows that belief attitudes are not enough to influence students' understanding of Newton's Law concepts. This finding is in line with research showing no significant relationship between student attitudes and understanding of physics concepts (Dini et al., 2021). Conversely, other studies show a significant relationship between attitude and conceptual understanding, although the correlation is relatively weak (Febriana, 2024). A similar finding was also found in a study that showed a significant relationship between students' attitudes and their understanding of physics concepts (Tanjung et al., 2024). These differences indicate that the relationship between understanding Newton's laws and students' belief attitudes may be influenced by other factors in the physics learning process.

The findings in this study show differences in the correlation between understanding of Newton's laws and belief attitudes toward physics learning based on gender and school type. The negative correlation value in the high school student group indicates that the higher the understanding of Newton's laws, the more unfavorable the students' belief attitudes toward physics learning tend to be, or vice versa. However, this correlation is not significant, so the negative relationship is not statistically reliable and may be due to chance. In contrast, the significant positive correlation value in the MA student group indicates a reliable relationship. This indicates that an increase in understanding of Newton's laws is followed by an increase in favorable belief attitudes towards physics learning, although the relationship is still relatively low. A similar relationship was also found in the male MA subgroup, where an increase in students' understanding of Newton's laws was followed by a favorable belief attitude towards physics learning. Meanwhile, other subgroups such as male and female high school (SMA) students and female Islamic high school (MA) students showed a very low and non-significant correlation between Newton's Law conceptual understanding and belief attitude, there was a very low and insignificant relationship between understanding of Newton's laws and belief attitudes. This shows that there is no relationship between understanding of Newton's laws and belief attitudes in these subgroups.

The difference in correlation results between high school and MA groups is due to differences in educational institution characteristics and teaching methods used. MA, which combines religious education with general knowledge in physics teaching and integrates attitudes with religious values, can provide deeper meaning. This approach encourages students to develop positive beliefs and attitudes while improving their understanding of physics concepts (Samsudin, 2020). In contrast, learning in high school focuses more on developing general academic potential. This condition can create pressure for students to achieve, so that their confidence and attitude towards physics tends to be negative even though their understanding of physics concepts improves (Pertiwi et al., 2021). Gender also plays a role in shaping the relationship between conceptual understanding and belief attitudes. Male students generally show greater interest in aspects of physics, while female students are more interested in biology and the environment (Ibrahim et al., 2022). Teaching Newton's laws of motion that focuses only on theory, formulas, and exercises without interactive learning support facilities can decrease students' motivation to learn (Ferdiman et al., 2023). In addition, the type of school also influences students' beliefs and attitudes toward physics learning. This shows that different learning environments and

approaches can affect the relationship between students' conceptual understanding and attitudes toward physics learning (Aprilia et al., 2023).

The novelty of this study lies in its simultaneous examination of high school students' conceptual understanding of Newton's laws and their belief attitudes (BAPL) in the cities of Malang and Batu, while considering gender and school type as distinguishing factors. The findings imply that improving students' conceptual understanding of Newton's laws is not sufficient if it relies solely on positive belief attitudes. Teachers need to implement more structured and concept-based learning strategies, particularly for the lowest-performing indicators such as static friction and action-reaction pairs.

CONCLUSION

This study obtained three main results related to the understanding of Newton's Law concepts and Belief Attitude Towards Physics and Learning (BAPL). The study shows that students' understanding of Newton's Law concepts is still low, both based on gender and school type. Then, students' BAPL shows moderate conditions, with variations in results based on gender and school type. This shows that factors such as gender and school type can influence students' belief attitude towards physics learning. Meanwhile, the correlation between understanding of Newton's laws and students' BAPL was very low and not statistically significant. This condition shows that belief attitude is not enough to influence students in understanding Newton's laws. To improve students' understanding, teachers need to evaluate and reflect on their teaching methods for Newton's laws. Schools also need to be aware of the influence of educational institution characteristics on students' belief attitudes and conduct a comprehensive evaluation of students' physics learning achievements. Further research can use qualitative or mixed-methods approaches, such as interviews or observations. The aim is to find out more about the reasons for students' low understanding of Newton's Law concepts, as well as other factors that may influence variations in students' belief attitudes.

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REFERENCES

Abdikadyr, B., Ualikhanova, B., Berdaliyev, D., Issayeva, G., & Maxutov, S. (2025). Reducing gender gaps in physics achievement: The role of constructivist methods. *European Journal of Science and Mathematics Education*, *13*(2), 58–76. https://doi.org/10.30935/scimath/16037

Aprilia, A., Kuswanto, H., & Dwandaru, W. S. B. (2023). Attitudes and beliefs toward physics: A mini review. *Revista Mexicana de Fisica E*, *20*(2). https://doi.org/10.31349/RevMexFisE.20.020212

Astalini, A., Darmaji, D., Pathoni, H., Kurniawan, W., Jufrida, J., Kurniawan, D. A., & Perdan, R. (2019). Motivation and attitude of students on physics subject in the middle school in Indonesia. *International Education Studies*, *12*(9), 15. https://doi.org/10.5539/ies.v12n9p15

Azzahidah, M. 'Abidah, Kusairi, S., Hanatan, A., & Hariyanto, H. (2024). Analisis kesulitan siswa SMA pada materi hukum Newton menggunakan instrumen force concept inventory (FCI). *Jurnal Penelitian Pembelajaran Fisika*, *15*(1), 7–17. https://doi.org/10.26877/jp2f.v15i1.14990

Busyairi, A., Harjono, A., Ardhuha, J., & Hikmawati, H. (2022). Analisis profil miskonsepi calon guru fisika pada konsep gaya gesek dan hukum III Newton ditinjau dari gaya kognitif. *Jurnal Ilmiah Profesi Pendidikan*, *7*(2c), 949–956. https://doi.org/10.29303/jipp.v7i2c.529

Chala, A. A., Kedir, I., & Wami, S. (2020). Secondary school students' beliefs towards learning physics and its influencing factors. *Research on Humanities and Social Sciences*. https://doi.org/10.7176/RHSS/10-7-05

Chen, L., Xu, S., Xiao, H., & Zhou, S. (2019). Variations in students' epistemological beliefs towards physics learning across majors, genders, and university tiers. *Physical Review Physics Education Research*, *15*(1), 010106. https://doi.org/10.1103/PhysRevPhysEducRes.15.010106

Dahal, B. K. (2025). Unraveling gender influences on students' attitudes in physics education. *Teacher Half-Yearly Journal*, *17*(1), 48–62. https://doi.org/10.3126/thj.v17i1.77839

Dini, M. R., Maison, M., & Darmaji, D. (2021). Sikap siswa terhadap fisika dan hubungannya dengan hasil belajar fisika di SMAN 6 Kota Jambi. *Pedagonal : Jurnal Ilmiah Pendidikan*, *5*(1), 15–18. https://doi.org/10.33751/pedagonal.v5i1.3251

Diyana, T. N., Sutopo, S., Koes-handayanto, S., & Kusairi, S. (2024). Demographic factors associated with students' belief and attitude towards physics and learning: A cross-sectional study from Indonesia. *Participatory Educational Research*, *11*(6), 75–93. https://doi.org/10.17275/per.24.80.11.6

Febriana, N. Y. (2024). The relationship between learning attitudes and learning outcomes on the material of Newton's law of gravity in public high school 2 Sungai Penuh City. *Journal of Learning and Technology in Physics*, *3*(1), 7. https://doi.org/10.24114/jltp.v3i1.57017

Ferdiman, B., Akbar, H. Al, Faturrahman, M. R., & Maulana, F. I. (2023). Development of augmented reality application in physics through Newton's laws and object interaction. *Procedia Computer Science*, *227*, 699–708. https://doi.org/10.1016/j.procs.2023.10.574

Ibrahim, N., A. Zakiang, M. A., & Damio, S. M. (2019). Attitude in learning physics among form four students. *Social and Management Research Journal*, *16*(2), 19. https://doi.org/10.24191/smrj.v16i2.7060

Ibrahim, N., Damio, S. M., Zulkipli, Z. A., Dalim, S. F., & Yusof, M. M. M. (2022). Epistemological beliefs and attitudes towards physics and physics learning among Malaysian STEM students in Selangor. *Asian Journal of University Education*, *18*(4), 919–932. https://doi.org/10.24191/ajue.v18i4.19999

Isra, R. A., & Mufit, F. (2023). Students' conceptual understanding and causes of misconceptions on Newton's law. *International Journal of Evaluation and Research in Education (IJERE)*, *12*(4), 1914. https://doi.org/10.11591/ijere.v12i4.25568

Kusuma, A., Handayani, D., Anita, A., & Nurussaniah, N. (2025). An analysis of students' scientific attitudes in physics learning. *JoPhRA: Journal of Physics Research and It's Application*, *1*, 14–22. https://jophra.uho.ac.id/index.php/journal/article/view/4

Maulidyah, R. L., & Zainuddin, A. (2022). Implementasi tes formatif berbasis multirepresentasi untuk analisis pemahaman konsep siswa. *Jurnal Penelitian Pembelajaran Fisika*, *13*(1), 1–8. https://doi.org/10.26877/jp2f.v13i1.11317

Mufit, F., & Syamsidar, S. (2022). Development of four-tier multiple choice test instrument to identify students' concept understanding of Newton's law material. *JIPF (Jurnal Ilmu Pendidikan Fisika)*, *7*(2), 134. https://doi.org/10.26737/jipf.v7i2.2369

Novitasari, D., Widyaningsih, S. W., & Sebayang, S. R. Br. (2021). Analisis pemahaman konsep fisika peserta didik kelas X IPA di SMA Negeri 1 Manokwari melalui pembelajaran online. *SILAMPARI JURNAL PENDIDIKAN ILMU FISIKA*, *3*(1), 39–57. https://doi.org/10.31540/sjpif.v3i1.1238

Nurdiyani, T. F., Ashari, A., & Fatmaryanti, S. D. (2020). Analisis pemahaman konsep fisika berbasis model pembelajaran group investigation-guided inquiry (GI-GI) peserta didik kelas X SMA. *Jurnal Inovasi Pendidikan Sains (JIPS)*, *1*(2), 56–61. https://doi.org/10.37729/jips.v1i2.796

Parno, P., Irawan, I. D. A., Basri, N. A., Harjuna, R., Salmah, U., & Pujiningrum, S. E. (2023). Analysis correlation of learning motivation and conceptual understanding in high school students on force and motion. *International Journal For Multidisciplinary Research*, *5*(6). https://doi.org/10.36948/ijfmr.2023.v05i06.10898

Pertiwi, M. K., Viki Dwi Wijayanto, A., & Nugroho Prasetyo, E. (2021). Peningkatan literasi bagi siswa SMA melalui pelatihan penyusunan literature review. *Jurnal Masyarakat Mandiri*, *5*(6). https://doi.org/https://doi.org/10.31764/jmm.v5i6.5837

Prada Nuñez, R., Hernández-Suarez, C. A., & Gamboa Suarez, A. A. (2022). Newton's law learning assessment: An experience with high school students. *Journal of Physics: Conference Series*, *2153*(1), 012020. https://doi.org/10.1088/1742-6596/2153/1/012020

Rahayu, P., Kusairi, S., & Khusaini, K. (2019). Student challenges in understanding Newton's law: An analysis using isomorphic multiple choice items. *Jurnal Pembelajaran Fisika*, *12*(2), 85–95. https://doi.org/10.23960/jpf.v12.n2.202402

Rizkita, N. I., & Mufit, F. (2022). Analisis pemahaman konsep dan sikap siswa terhadap belajar fisika pada materi hukum Newton tentang gerak. *JURNAL EKSAKTA PENDIDIKAN (JEP)*, *6*(2), 233–242. https://doi.org/10.24036/jep/vol6-iss2/599

Rose Amanda Puri, P., & Riki Perdana. (2023). Analisis kemampuan pemahaman konsep fisika peserta didik SMA di Bantul pada materi fluida statis dan upaya peningkatannya melalui model pembelajaran visualization auditory kinesthetic. *MAGNETON: Jurnal Inovasi Pembelajaran Fisika UNWIRA*, *1*(2), 93–101. https://doi.org/10.30822/magneton.v1i2.2463

Samsudin, S. (2020). Responses of madrasah to social change: A study on madrasah aliyah in Bengkulu City. *Madania: Jurnal Kajian Keislaman*, *24*(1), 83. https://doi.org/10.29300/madania.v24i1.3225

Santoso, P. H., Setiaji, B., Wahyudi, Syahbrudin, J., Bahri, S., Fathurrahman, Ananda, A. S. R., & Sodhiqin, Y. (2024). Exploring gender differences in the force concept inventory using a random effects meta-analysis of international studies. *Physical Review Physics Education Research*, *20*(1), 010601. https://doi.org/10.1103/PhysRevPhysEducRes.20.010601

Saputra, H., & Mustika, D. (2022). Analysis the conceptual understanding level and understanding model of pre-service physics teacher. *Jurnal Penelitian Pendidikan IPA*, *8*(5), 2367–2372. https://doi.org/10.29303/jppipa.v8i5.2246

Smith, T. J., Hong, Z., Hsu, W., & Lu, Y. (2022). The relationship of sense of school belonging to physics attitude among high school students in advanced physics courses. *Science Education*, *106*(4), 830–851. https://doi.org/10.1002/sce.21725

Soleha, N., Fadly, W., & David, M. (2025). Analysis of students' thinking styles in reading free-body diagrams and analytical thinking on Newton's laws. *EduFisika: Jurnal Pendidikan Fisika*, *10*(1), 75–86. https://doi.org/10.59052/edufisika.v10i1.42796

Sugiyono. (2017). *Metode penelitian kuantitatif, Kualitatif dan R&D*. Alfabeta.

Sundaygara, C., Gusi, L. A. R. P., Pratiwi, H. Y., Ayu, H. D., Jufriadi, A., & Hudha, M. N. (2021). Identification students' misconception using four-tier diagnostic test on Newton law subject. *Journal of Physics: Conference Series*, *1869*(1), 012157. https://doi.org/10.1088/1742-6596/1869/1/012157

Suryadi, S., & Astuti, Y. (2022). Analisis pemahaman siswa pada materi hukum Newton di SMAN 6 Muaro Jambi. *Schrödinger: Journal of Physics Education*, *3*(4), 71–73. https://doi.org/10.37251/sjpe.v3i4.510

Syaidah, L., Afgani, M. W., Sairi, A. P., & Info, A. (2023). Eksplorasi kesulitan belajar siswa dalam menyelesaikan masalah hukum Newton tentang gerak. *Jurnal Al'ilmi*, *12*(1), 1–5.

Tanjung, D. K., Sahara, L., & Ute, N. (2024). Analisis hubungan antara sikap peserta didik terhadap pembelajaran fisika dan hasil belajar fisika pada peserta didik SMA Negeri 1 Batuatas. In *Jurnal Penelitian Pendidikan Fisika*. https://doi.org/https://doi.org/10.36709/jipfi.v9i3.132

Wandi, W., Suwarma, I. R., Liliawati, W., Mardianti, F., & Amelia, R. (2024). Analysis of student attitudes and beliefs in physics education. *JIPF (Jurnal Ilmu Pendidikan Fisika)*, *9*(3), 368. https://doi.org/10.26737/jipf.v9i3.5473