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The Relationship Between Students' Perceptions of the Role of Peers, Teaching Styles and Learning Motivation on Natural Science Learning Outocomes in Secondary School

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ABSTRACT

This study was conducted with the aim of knowing and analyzing the relationship between students' perceptions regarding the role of peers, teacher teaching style, and learning motivation towards students' science learning outcomes using the correlation method. Data collection was carried out by distributing questionnaires as a research instrument. This study is a quantitative study using path analysis. The data analysis technique in this study was carried out with the help of the Smart PLS version 4.0 application. The population in this study were 180 students in 8 grade at one of the State Secondary Schools in Pasuruan City, with a random sampling technique, so that a sample of 124 students was obtained. Based on the analysis of the findings, it shows that students' perceptions of the role of peers do not have a significant effect on learning outcomes, while students' perceptions of teacher teaching styles and learning motivation have a significant effect on learning outcomes. The results of this study provide important implications in the world of education, especially related to factors that influence student learning outcomes. Further research is expected to identify other factors that can also influence student learning outcomes

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1. INTRODUCTION

Learning outcomes are an important indicator used to assess the success of students during the learning process, and are a reference for educators in determining whether learning outcomes are good or bad (Hartono, 2019). Learning outcomes can be in the form of assessments obtained through evaluations conducted by teachers. Each student certainly has different learning outcomes, because this will be influenced by the efforts of each individual in studying the material. Learning outcomes play an important role in measuring student understanding during the learning process (Sarumaha & Harefa, 2023). The importance of these learning outcomes is in line with Law of the Republic of Indonesia No. 20 of 2003 concerning the National Education System Article 1 Paragraph 1 states that Education is a conscious and planned effort to create a learning and teaching atmosphere so that students actively develop their potential to have spiritual religious strength, self-awareness, personality, intelligence, noble morals and skills needed by themselves, society, nation and state (Indonesia et al., 1991). Students will develop this behavior after completing their learning process by interacting through learning resources and learning environments. According to Slameto, internal and external factors are two factors that need to be considered in influencing the success of the learning process. Internal factors are factors that originate from individual students, while external factors are factors that influence the external environment on students.

Internal factors include physical and mental development, knowledge, intelligence, skills, interests, motivation, and other personal characteristics, while external factors include the teacher's teaching style, supporting facilities, and the surrounding environment, including peer influence and other factors (T. Simamora et al., 2020). These two factors interact with each other and contribute to being able provide an approach to support optimal development for students during the learning process. Learning motivation is also one of the factors that impact student learning outcomes. Learning motivation is a factor that appears in students that can affect student learning outcomes. Learning motivation is one of the things that has a very big influence because it can encourage students' enthusiasm for learning, besides that motivation is useful for determining actions in achieving goals (Sidabutar, 2020). Students who do not understand the purpose of their learning tend to have low learning motivation (Andriani & Rasto, 2019). Learning motivation encourages students to be more enthusiastic in participating in learning and understanding the material given, if students do not have motivation in themselves then students tend to lose interest and quickly feel bored, which ultimately has an impact on achieving less than optimal learning outcomes. So it can be said that learning motivation will greatly determine learning efforts which will later increase student learning outcomes, besides that the role of peers is also related to student motivation because social interaction tends to motivate students to learn.

The role of peers also has an important relationship as one of the external factors that can affect student learning outcomes, because interaction with peers has an important role in the process of student personal development. Students' dependence on peers is often greater than their dependence on teachers or parents (Tu & Chu, 2020). The role of peers is a very important part of adolescent life and has a major influence on their learning process. Adolescence is a time when there is a transition process to experience developmental changes in each individual. This is because in their learning they learn, play and meet their peers. It is undeniable that peers in this context have a major impact on a person's life during their development (Oktariani et al., 2020), if the peer environment is good, it will influence a person to be better. Bad peers can affect the student's learning process, which results in a lack of understanding of the material that has been taught, but this can be minimized if students can control themselves and manage their time effectively (Kurniawan & Sudrajat, 2020). In addition, the teacher's teaching style can play an important role. With an interesting and interactive teaching approach, it can encourage students to remain enthusiastic in learning so that they can focus on their academic goals.

Teacher teaching style is one of the external factors that can influence student learning

achievement. Teacher teaching style reflects the personality of a teacher while teaching. Basically, a teacher teaches by guiding students to achieve learning objectives based on provisions (Rahmawati & Sartika, 2022). Teachers have a very important role in the world of education, namely being responsible for student development, fostering good attitudes and behaviour to achieve educational goals (Ahmad Juaini, Naelud Darajatul Aliyah, 2016). Each teacher has their own teaching style which is a characteristic. The four types of teacher teaching styles include: classical, technological, personalized and interactive teaching styles (Suciyati et al., 2023). Learning is said to be successful when teachers use the right teaching style, such as collaborative methods, demonstrative, open discussion or the use of technology, can create a fun and interesting learning atmosphere, while encouraging students to be active in understanding the material taught in depth. For teachers who teach natural sciences, it is important for them to use an approach that can integrate scientific concepts with practical experiments in everyday life, so that it can make it easier for students to master the subject matter and be able to think critically and analytically in solving problems. These three factors are thought to have a close relationship with student learning outcomes, especially in science subjects which are often considered difficult by some students. Therefore, it is important to conduct research that specifically examines the relationship between student perceptions of the role of peers, teacher teaching styles and learning motivation towards secondary school science learning outcomes.

Based on previous research, it states that the learning outcomes obtained by students, especially in science subjects, show significant results between the learning environment and learning motivation (Maulidah et al., 2022). Other research results state that the interaction between peers can directly influence students significantly on learning outcomes (Nurul Fadhilah & Mukhlis, 2021). Furthermore, according to other research, it states that the existence of a learning environment and teacher teaching methods can have a good influence on student learning achievement (Salasavira & Sartika, 2024). According to research results (Putri et al., 2024), it states that peers have a significant influence on student learning motivation and learning outcomes because positive support from peers will increase students' interest and learning motivation.

The results of interviews conducted by researchers with science teachers at one of the public junior high schools in Pasuruan City showed that although the student learning environment was considered quite good, in the learning process students tended to be less focused because they were more interested in interacting with their peers. This condition caused students to be passive when given questions by teachers related to the material that had been taught, and only a few were active in answering. As a result, teachers often had to repeat the material so that it could be understood again. In addition, students also had difficulty in completing science assignments, especially those related to concepts and calculations. Based on teacher statements, around 55% of students scored below the Minimum Completion Criteria (KKM) with an average score of 60, while the KKM set was 71. This finding indicates that student learning outcomes in science subjects are still not optimal, so efforts are needed to identify factors that influence the achievement of these learning outcomes. Based on interviews in teaching, teachers have used several learning methods such as lectures, discussions, questions and answers, and assignments, however, the results achieved have not been optimal. The dominant lecture method makes students tend to be passive, while discussions and questions and answers have not been able to encourage maximum active participation. Assignments also experience obstacles, especially on the material conceptual and calculation questions. Based on these findings, it is suspected that the role of teachers also influences factors that have an impact on learning outcomes such as social interaction, learning interest, student learning motivation, especially in science subjects. Given the limited research that examines these factors at the secondary school level, this topic is important to be studied further in order to design more effective learning strategies.

Based on the explanation of the problems that have been presented, there are several novelties in this study, namely from the

subjects and objects of research conducted at one of the State Secondary Schools in Pasuruan City. In addition, the analysis technique used uses the SEM-PLS method using Smart PLS 4.0 software. Smart PLS aims to make it easier for researchers to find out based on each indicator. The objectives of this study are: 1) to analysis the relationship between student perceptions of the role of peers on learning outcomes, 2) to analysis the relationship between student perceptions of teacher teaching styles on student learning outcomes, 3) to analysis the relationship between student perceptions of learning motivation on student learning outcomes 4) to analysis the relationship between student perceptions of the role of peers, teacher teaching styles, learning motivation on student learning outcomes. It is suspected that in addition to the role of peers, teaching styles and learning motivation, several other factors also affect student learning outcomes, such as student interest, difficulty of questions given, learning facilities and emotional intelligence and so on (Ahmad Juaini, Naelud Darajatul Aliyah, 2016).

2. RESEARCH METHODS

The research method used by the researcher is quantitative, with a correlation research type. Correlation research aims to determine the relationship between two or more variables to the variable (Syafnidawaty, 2020). The population was 180 grade VIII students with a total sample of 124 students. The researcher used a random sampling technique (*simple random sampling*) without considering certain characteristics. Sampling is done by referring to Krejcie and Morgan's Sample Table. This research aims to find out the relationship between the independent variables, namely students' perceptions of the role of peers (X_1), students' perceptions of teacher teaching style (X_2) and students' perceptions of learning motivation (X_3) with the dependent variable, namely learning outcomes (Y).

The data collection technique was carried out using a questionnaire on science subjects adapted from previous research. The instruments and statements in the questionnaire were described based on indicators that had been developed, including: The role of peers, teacher teaching style, learning motivation and learning outcomes. The Likert scale was used as a questionnaire measurement method with questionnaire options. This study used answer options to collect data with answer options: Strongly Agree, Agree, Disagree, Strongly Disagree. To measure learning outcomes, questions on the respiratory system material were used which were arranged based on Bloom's taxonomy in the cognitive domains C1 to C4. The technique used to analysis directly based on each indicator to test 1) the relationship between students' perceptions of the role of peers and learning outcomes, 2) the relationship between students' perceptions of learning styles teaching teachers towards learning outcomes, 3) the relationship between students' perceptions about learning motivation and learning outcomes, 4) the relationship between students' perceptions about the role of peers, teacher teaching style, learning motivation and student learning outcomes using *Smart* PLS version 4.0 with 2 calculation stage models, namely, *Outer Model* And *Inner Model.* The relationship between research variables is described through the research paradigm below:

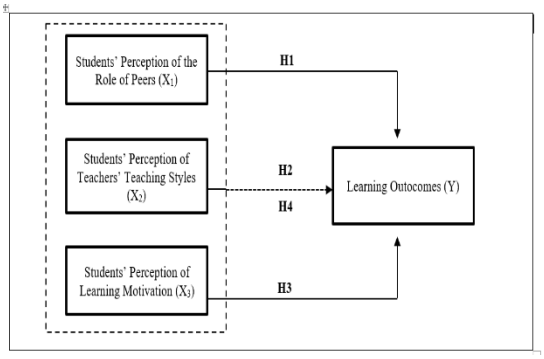

Figure 1. Research Design

Tabel 1. Indicator Variable

Variable	Indicator	Question Item	Code

Students' Perceptions About The Role of Peers. (X_1)	There is communication interaction or opinion.	a. My friend and I both like natural science lessons.	X1.1
		b. My friends and I exchange opinions when discussing natural science lessons.	X1.2
		c. I don't help my friends who have difficulty working on questions.	X1.3
		d. My friend will help me in solving the problem.	X1.4
	Mutual respect for each other.	e. I will help my friends when there is a problem.	X1.5
		f. Accept my friends' opinions well.	X1.6
		g. I am interested in learning when my friends are learning.	X1.7
	Exchange feeling and overcome problems.	h. I depend on friends when it comes to studying.	X1.8
		i. I do schoolwork together with my friends.	X1.9
		j. My friend reminded when there is a problem me to.	X1.10
		k. My friend gives me encouragement when I am lazy to study.	X1.11
		l. I don't care if a friend is having trouble.	X1.12
	Adaptation or familiarity	m. I feel comfortable asking friends rather than teachers.	X1.13
		n. I easily make friends with anyone.	X1.14
		o. I motivate my friends who have difficulty studying to be enthusiastic.	X1.15
Students' Perception of Teachers Teaching Style (X_2)	There is motivation given to teachers in learning	a. The teacher provides motivation first before starting the lesson.	X2.1
		b. The teacher gives a warning when someone gets a bad mark.	X2.2
	Learning resources (teachers deliver material by telling stories or giving lecture)	c. Teachers provide learning materials by relating them to real events that are happening in the surrounding environment that are easy to understand	X2.3
		d. The teacher delivers the material orally continuously until the lesson ends.	X2.4
	Learning resources are delivered through group discussion	e. The teacher directs students to collaborate in groups, to find learning resources independently.	X2.5
		f. Teachers encourage students to be active in discussions and respond to questions and opinions that are in accordance with the students' views.	X2.6
	Learning Resources is delivered using digital media	g. Teachers invite students to study outside the classroom or in nature so they don't get bored.	
		h. The teacher explains the material in detail using more than one media (white board, *Power Point*, audio visual media, and so on).	X2.7
		i. Teachers guide students to use the internet as a learning resource and use more interesting	X2.8

		internet-based applications.	
	Teacher evaluation give rewards to students for all their achievement Teachers prioritize good communication for student activity act as good listeners.	j. The teacher provides motivation for the results obtained by students with low scores. k. The teacher will not improve grades by giving students remedial questions. l. Teachers are able to convey material in language that is easy for students to understand. m. The teacher uses a discussion method and the students listen to the explanation given by the teacher. n. The teacher does not guide students until they can and understand the material. o. The teachers listen to every opinion to the students well and provides a solution to a problem.	X2.9 X2.10 X2.11 X2.12 X2.13 X2.14 X2.15
Students' Perceptions of Learning Motivation (X_3)	Passion and desire to succeed The drive, the persistence used in learning There is an effort or ambition to be successful in the future Having a comfortable and conducive learning environment Activities that can attract students in learning	a. I did my science assignment on time b. I will do my science assignment when the submission deadline approaches. c. I don't give up easily when I get low marks in natural science lessons. d. I am not ashamed to ask when I don't understand the science material. e. I pay close attention when the teacher explains the natural science learning material. f. I easily give up on natural science assignments g. I am always enthusiastic in achieving my dreams h. study natural science seriously so that it will be easy to achieve my dreams. i. I get bored easily with learning natural science. j. I enjoy studying natural science in a calm atmosphere. k. I prefer to work on natural science problems by discussing them. l. feel disturbed by the noisy atmosphere around the class. m. I enjoy natural science learning through games and also learning outside the classroom. n. I am lazy to follow natural science lessons when given practice questions o. I discussed with the group to solve natural science problem	X3.1 X3.2 X3.3 X3.4 X3.5 X3.6 X3.7 X3.8 X3.9 X3.10 X3.11 X3.12 X3.13 X3.14 X3.15

Learning Outocomes (Y)	Mention the organs of the organ system breathing (C1)	a. I can understand the organs in the respiratory system well	Y.1
		b. I am confident that I can explain the function of the alveoli well.	Y.2
	Explain the function of one of the organs (C2)	c. I understand the gas exchange that occurs in the alveoli.	
		d. I can apply the system concept breathing in everyday life	Y.3
			Y.4
	Apply breathing concept in real situations (C3)	e. I can explain faster breathing while running	
		f. I am able to explain how to maintain a healthy respiratory system	Y.5
		g. I am able to explain the steps to prevent disorders of the respiratory system	Y.6
	Differentiate human respiratory system (C4)	h. I can differentiate the human and fish respiratory systems correctly	Y.7
		i. I understand the difference between chest breathing and abdominal breathing	Y.8
		j. I feel confident in my understanding of the overall respiratory system material.	Y.9
			Y.10

Sources : Modified from Fatmawati (F. Saguni, 2019) , Annisaa (ANN, 2023) (Role of eers), Mauliddiyah and S. S. Wulandari (Mauliddiyah & Wulandari, 2022). (Teaching Style), (Learning Motivation) and Bloom's Taxonomy approach (learning outocomes)

3. RESULTS AND DISCUSSION

Before the research instrument was used in the trial to students, the researcher first validated the instrument by experts to ensure that each statement item in the research questionnaire had appropriate content. The research instrument has been validated by 2 lecturers who are experts in their fields. Based on the results of expert validation, it was assessed that most of the questions and questions were declared appropriate and feasible to use.

Outer Model Test

Initial research using Outer Model, Outer Model is a depiction of the relationship between latent variables and their indicators. This model aims to test validity which includes convergent validity, discriminant validity and reliability testing through AVE criteria, namely composite reliability and The Cronbach's Alpha. Here is the display of the results on Smart PLS:

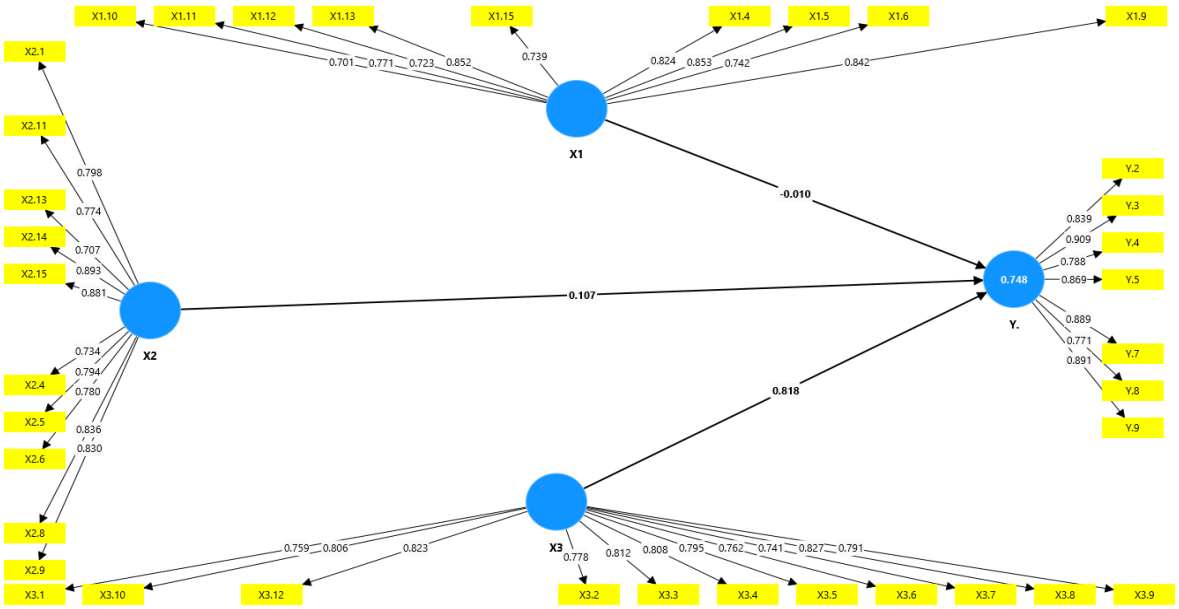

Figure 2. *Loading Factor*
Source: (Research data processed with Smart PLS 4, 2025)

Convergent Validity namely a measurement that aims to test the validity of each relationship between n the indicator and its latent variable. Value loading factor on each variable must be > criteria or valid. If the indicator has a correlation > 0.7 then the value of the loading factor can be said to be high (Hair et al., 2019). The following are the results of the calculation:

Table 2. Test results Convergent Validity

Item	Role of Peers (X_1)	Teacher's Teaching Style (X_2)	Learning Motivation (X_3)	Learning Outcome (Y)
Valid	X1.4; X1.5; X1.6; X1.9; X1.10; X1.11; X1.12;X1.13; X1.15	X2. 1; X2. 4; X2. 5; X2. 6; X2. 9; X2. 11; X2. 13; X2. 14; X2. 15	X3. 1; X3. 2; X3. 3; X3. 4; X3. 5; X3. 6; X3. 7; X3. 8; X3. 9; X3. 10; X3. 12	Y. 2; Y. 3; Y. 4; Y. 5; Y. 7; Y. 8; Y. 9
Invalid	X1.1; X1.2; X1.3, X1.7; X1.8; X1.14	X2. 2; X2. 3; X2. 7; X2. 8; X2. 10; X2. 12	X3. 11; X3. 13; X3. 14; X3. 15	Y. 1; Y. 6; Y. 10

Source: (Research data processed with Smart PLS 4, 2025

Calculation results of Convergent Validity in table 2. it can be seen overall that the value loading factor on each variable is greater than 0.7, which means that the indicator has a high level of validity, so it can be said to meet the requirements. Where if the indicator correlates > 0.7, then the value on loading factor is said to be high (Henseler et al., 2015). From the validity test of 15 indicator questions for the variable Role of Peers (X_1) there are 9 indicator question items used, while from the validity test of 15 indicator question items for Teacher Teaching Style (X_2) there are 9 indicator question items used, then in the validity test of 15 indicator question items for Learning Motivation there is (X_3) 11 indicator question items used, and the validity test of 9 indicator question items for Learning Outcomes (Y) there are 7 indicator question items used. So that in table 3 it shows that there are 6 indicator question items for peer role variables, 6 indicator question items for teacher teaching style variables, 4 indicator question items for learning motivation and 2

indicator question items for learning outcomes are said to be invalid. Thus, most of the indicator question items from the measurement the structural value of the four variables studied has a value above 0.7, which indicates that the indicators are convergently valid.

In addition, convergent validity can also be seen through the value Average Variance Extracted (AVE), where a construct is considered valid if it has a minimum value ≥ 0.5. The following table presents the results of the AVE test:

Table 4. Test Results Average Variance Extracted (AVE)

Construction	AVE
Role of Peers	0.616
Teacher's Teaching Style	0.647
Learning Motivation	0.627
Learning Outcome	0,726

Source: (Research data processed with Smart PLS 4, 2025)

Based on the results in the table above, it can be seen that each variable or construct has an AVE value ≥ 0.5, which means that the convergent validity test through the AVE test is said to be valid or has been fulfilled.

In addition, the test results discriminant validity also tested using the values Hetero Trait Mono Trait (HTMT) ratio. To state that the reflective construct meets discriminant validity, the value HTMT must be < 0.9 (Hair et al., 2019). The following are the results of the HTMT test:

Tabel 5. Results of Test Discriminant Validity HTMT

Latent Variables	Role of Peers (X_1)	Teacher's Teaching Style (X_2)	Learning Motivation (X_3)	Learning Outocomes (Y)
X_1				
X_2	0.538			
X_3	0.856	0.492		
Y	0.778	0.514	0.854	

Source: (Research data processed with Smart PLS 4, 2025)

After testing the construct validity, the next step is the validity test. Composite Reliability and Cronbach's Alpha, both of these tests are measurements based on reliable constructs. If a construct is said to have good reliability then the value Composite Reliability and Cronbach's Alpha has a value > 0.7. The test results are presented in the following table:

Table 6. Test Results *Composite Reliability*

Variable	*Composite Reliability*	*Cronbach's Alpha*	Information
X_1	0.922	0.921	Reliable
X_2	0,940	0.939	Reliable
X_3	0,944	0.940	Reliable
Y	0,939	0.937	Reliable

Source: (Research data processed with Smart PLS 4, 2025)

The results in table 6. of the test show that the data in the table above was tested through Composite Reliability and Cronbach's Alpha all constructs have a value > 0.7. Thus, the test results above can be said to be valid and reliable.

Inner Model

The second test is a test of inner model. According to Ghozali and Latan (2015), testing inner model can be done by analysing the relationship between constructs. The relationship is assessed based on the significance value and the R-value square on each independent variable used as a reference in predicting the model:

Table 7. Test Results R-*Square*

	R-*square*	R-*square adjusted*
Y	0.748	0.742

Source: (Research data processed with Smart PLS 4, 2025)

Based on table 7. R-square shows the combined effect between X_1, X_2, and X_3 against Y is 0.748. This means that the three exogenous constructs (X_1, X_2, and X_3) collectively influence the Y variable by having a value of 0.748 or 74.8% in this study. While the rest, namely 0.252 or 25.2%, is influenced by other variables outside this study. If the R-square < 0.5, this indicates that the exogenous variable has a low or weak influence on the endogenous variable. Conversely, if R-square > 0.5, meaning there is a strong influence between the independent variables (Sarstedt et al., 2021).

Based on the results of the R-Square value calculation above, the next step is to carry out a calculation test. Predictive relevance (Q^2), so that a value of 0.748 or 74.8% can be obtained, which means that the model has good predictive relevance to the endogenous variable, namely learning outcomes. Thus, it can be concluded that 74.8% of the variation in student learning outcomes can be explained by the variables in this research model, while the remaining 25.2% is influenced by other factors outside the model studied.

Criteria test value Goodness of Fit (GoF) is used to assess the feasibility of a structural model and measurement model. Based on the calculation results, overall based on the calculation, a value of 0.705 is obtained, indicating that the research model is included in the strong or high category, so that it has a good fit model. The next step is that researchers can take the proposed hypothesis after obtaining the results of the (R-Square) R value.^{2}, Q^2, and GoF.

Path coefficient is used to describe how much influence the independent variable has on the dependent variable. Where the T-statistics that are larger or > 1.96 and P Value the smaller or < 0,05. If these two conditions are met, then it can be concluded that the hypothesis in the study has a statistically significant influence. There are three direct influence relationships on each of the variables studied. This test aims to determine whether the intended influence is truly significant in explaining the dependent variable based on the data obtained. Here are the test results:

Table 8 . Test Results Path Coefficients

Hypothesis Path	Original Sample (O)	T-Statistic	P-Value	Information	Decision
$X_1 > Y$	-0,010	0,119	0,906	Not Significant	Rejected
$X_2 > Y$	0,107	2,156	0,031	Significant	Accepted
$X_3 > Y$	0,818	10,867	0,000	Significant	Accepted

Source: (Research data processed with Smart PLS 4, 2025)

Based on table 8, hypothesis testing can be tested through test analysis. Path Coefficient which is used to determine the influence of the independent variable (X) on the dependent variable (Y). Based on the provisions, if the value T- statistic > 1.96 and P-Value < 0.05, at a significance level of 5% it can be said to be significant or accepted. So in testing the first hypothesis (H_1) the results obtained show that the variable of students' perceptions of the role

of peers is said to have no significant influence on learning outcomes. The test results Path Coefficient shows that the value *T- statistic* of 0.906 > 0.05 which means it has no positive effect or is rejected. While the *P-Value* 0.119 < 1.96, also said to have no positive effect or rejected. The role of peers did not show a significant influence on improving student learning outcomes. This is thought to be due to the lack of individual student attitudes in establishing effective interactions with their peers. Based on an in-depth interview with one of the science teachers at a public junior high school in Pasuruan City, the influence of peers does not always have a positive or negative impact on learning outcomes. The teacher revealed that students tend to be easily influenced by friends and feel more comfortable asking friends than teachers. However, the results of observations in class showed that although students were more active in discussing in small groups with peers (68% of students were active in discussing in groups), this participation did not contribute significantly to improving students' grades or overall learning achievement.

This is also supported by student grade data which shows that 55% of students still get grades below the Minimum Completion Criteria (KKM), with an average grade of 60, while the KKM set is 71 Peers who have good learning habits, such as helping each other in completing assignments or discussing subject matter, can improve the understanding and enthusiasm of other students to learn. Conversely, if peers are more involved in activities that do not support the learning process, such as the habit of spending time on unproductive things, this is not in accordance with research conducted by interactions between students and peers have a significant influence on learning outcomes. Based on the findings of Simamora, it states that the peer environment will experience intensive interactions that can have positive and negative impacts (D. Simamora et al., 2023). Where peers are a group that has the same age, status, and mindset that can affect the development of student learning. This study is also inversely proportional to (Wurdaningrum, Kumala Wibowo, sigit Surayanah, 2025), that the role of peers has a very strong influence on motivation and learning outcomes, this proves that the role of peers significantly influences student learning outcomes. Interactions that occur between peers can be a source of motivation and learning support, where students who have peers with good learning habits tend to be more motivated and active in learning. Conversely, if peers engage in unsupportive behaviour, this can reduce focus and reduce learning motivation. Therefore, the role of peers is very important in forming students' behavioural patterns and learning habits, where socializing has an important role in children's perceptions and can motivate them to learn because peers can form students' character well (Rihardes et al., 2023).

The results of the second hypothesis test (H_2) to find out the influence of X_2 towards Y, then students' perceptions of the teacher's teaching style have a significant influence on learning outcomes. The test results Path Coefficient shows that the value T- statistic of 2.156 > 1.96 which means that there is a positive or acceptable influence. While the P-Value 0.031 > 0.05 is also said to have a positive or acceptable effect. This shows that there is a significant relationship between teacher teaching style and student learning outcomes. Teacher teaching style plays a very important role in the student learning process, where teachers must be able to create a supportive learning atmosphere by communicating well with students so that they can undergo various learning activities effectively (Lestari et al., 2024). A high level of professionalism and responsibility is needed from teachers in managing the learning process in order to create an effective interactive relationship in achieving learning goals. An innovative and interesting teaching style can motivate students to learn and can achieve optimal learning. The results of an interview with one of the science teachers at a public secondary school in Pasuruan City showed that students tend to prefer learning that is done outside the classroom, and involves games in the learning process. This can motivate students to be more enthusiastic in learning. In addition, effective teaching strategies have also been applied in the context of science subjects, which aim to improve student understanding. The use of varied and fun methods is expected to encourage students to be more active and creative in participating in learning. This statement is supported by research (Gulo & Telaumbanua, 2024). that

the teacher's teaching style has a significant influence where it can provide important insights to improve effective teaching strategies through the development of interactive and participatory teaching styles. Furthermore, the teacher's teaching style is said to have a strong influence where with the teacher's teaching creativity it can motivate students (Rahmat & Jannatin, 2018). This is also supported by (Abrar & Syahputra, 2021) stating that the effectiveness of teacher teaching, emotional intelligence, and skills in managing the class have a significant impact on student learning outcomes. These three factors play an important role in creating a conducive learning atmosphere, which in the end can improve student academic achievement. Therefore, the researcher concluded that the teacher's teaching style can affect the success of learning. A varied teaching style that is in accordance with student needs can increase their involvement in the learning process, improve understanding of the material, and support the achievement of optimal learning outcomes.

Furthermore, the results of testing the third hypothesis (H_3) to find out the influence of X_3 towards Y then the students' perception of learning motivation towards learning outcomes from the test results Path Coefficients shows that the value T- statistic of 10.867.>1.96 which means there is a positive or acceptable influence. While the P-Value 0.000 < 0.05. also said to have a positive or acceptable effect. So this finding indicates that learning motivation has a positive or unidirectional relationship with student learning outcomes, the higher the student's learning motivation, the better the positive contribution to the quality of their learning. Motivation in learning is very necessary so that students do not feel bored and are more enthusiastic in learning. In other words, students can grow motivation in themselves and go through the learning process well, so that they can optimize their learning outcomes. Student learning motivation must continue to be improved because it will affect the level of student learning outcomes (Bella Cantika Putri et al., 2022). Based on the results of observations of class VIII students, they seem to have a high curiosity in understanding the material presented by the teacher. This can be seen from the activeness of students in the learning process, such as being critical, actively discussing, and daring to ask questions. This statement is supported by research conducted by Romadhoni which states that motivation in learning has a very positive and significant effect on student learning outcomes (Romadhoni et al., 2019). When students have high learning motivation, this will encourage them to be more active in learning activities and be able to carry out learning with full confidence and responsibility, when compared to students who have low learning motivation. Based on these findings, researchers concluded that learning motivation has a positive impact on student learning outcomes. Learning motivation encourages students to have the will to do something so that it has a big role in a student's success (Nugroho & Attin Warmi, 2022). Learning motivation is very necessary so that students can try to get maximum learning outcomes. Strong motivation encourages students to be more active in the learning process, because of the great desire to succeed that comes from within them. With this motivation, students will continue to learn with enthusiasm and determination, without feeling forced or bored, so that they can achieve optimal results and achieve learning goals.

Testing R- Square conducted to determine the extent of the combined influence of the independent variables X_1, X_2, X_3 on the dependent variable Y. This test also functions to evaluate how much the regression model contributes to the explanation of the variability of the dependent variable (Y). Based on the test results, the value R- Square can be used as support to answer the hypothesis (H_4), as listed in table 7, the values R square shows the combined effect between X_1, X_2, and X_3 against Y was obtained as 0.748, this finding indicates that the combination of the three exogenous constructs, namely X_1, X_2, and X_3 collectively able to explain 0.748 or 74.8% of the variation that occurs in the Y variable. Meanwhile, 25.2%, (0,252) of the research results are influenced by other factors that are not included in this research model. Thus, the table above shows that the independent variables have a fairly strong influence on the dependent variable. This also strengthens the validity of the model used to test the relationship between variables. Furthermore, the Y variable, namely learning outcomes, can

be measured based on learning achievements compiled from the Bloom Taxonomy framework. This taxonomy groups learning achievements into several cognitive levels, including: C1 (remembering), C2 (understanding), and C3 (applying), C4 (analysing), C5 (assessing) and C6 (creating). At the secondary school level, the appropriate cognitive level in measuring learning achievements is at levels C1 to C4 in Bloom's Taxonomy. This is in line with the guidelines in the Independent Curriculum which emphasizes the importance of formulating Learning Objectives based on Learning Achievements and using operational verbs that are appropriate to the cognitive level.

Based on the calculation results in tables 2 and 3, the cognitive aspect C1 consists of two items, namely Y_1 (not valid because it has a value below 0.7) and Y_2 (valid because it has a value above 0.7). Aspect C2 consists of Y3 and Y_4, both are valid with values above 0.7. Aspect C3 has three items consisting of Y_5, AND_6, AND_7 all of which have values above 0.7 and are said to be valid. In aspect C4, Y_8 and Y_9 valid, while Y_{10} invalid because it is below 0.7. Therefore, the researcher used learning achievement indicators at the four levels to compile a science evaluation instrument on the human respiratory system material. Furthermore, the results of working on the questions were used as the basis for compiling reflective questions. These questions were aimed at students to explore their perspectives on understanding and achieving the learning outcomes that had been obtained. This approach aims not only to assess cognitive aspects, but also to encourage students to reflect on their thinking processes and understanding of the material that has been studied. With this approach, the learning process becomes more structured and is able to encourage students to develop optimally in terms of knowledge and skills

4. CONCLUSION

Based on the research results obtained using the approach through the Smart PLS 4.0 application, it can be concluded that (1) Students' perceptions of the role of peers do not significantly influence students' learning outcomes. This is due to other factors such as factors within oneself and the lack of peer interaction. This means that the role of peers is not strong enough to influence student learning outcomes. (2) Student perceptions of teacher teaching styles can have a positive and significant effect on learning outcomes. Teacher teaching style is very important where effective teacher teaching styles and creative learning methods can motivate students to learn. (3) Student perceptions of learning motivation have a significant effect on learning outcomes, the higher the level of motivation, the greater the possibility of achieving optimal learning outcomes. (4) Student perceptions of the role of peers, teacher teaching styles and learning motivation have a positive effect on student learning outcomes. The positive effect is shown because the better the peers, and the effectiveness of the teacher's teaching style will affect student learning motivation and learning outcomes in natural science learning.

In this study, students' perceptions of the role of peers did not show a positive and significant relationship to natural science learning outcomes. This finding contradicts previous theories which state that the role of peers has a significant effect on student learning outcomes. This indicates the possibility of factors that influence student learning outcomes. Teachers also need to continue to develop varied and enjoyable teaching strategies in order to increase student motivation and involvement in learning. In addition, for further researchers, it is recommended to conduct further studies by adding other relevant variables in order to gain a more comprehensive understanding of the factors that influence learning outcomes, especially in science subjects.

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