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Interrelation of learning model and peer interaction through motivation on achievement

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Abstract

Mathematics is often seen as a complex subject by most students. This has caused their achievement and motivation to be low. This study aims to see whether there is a direct or indirect influence from the independent and intervening variables on the dependent variables. This research is quantitative. The population is grade VIII of one of the state junior hschoolshool, and the sample is class 8-B which consists of 28 students. The instruments used in data collection were questionnaires and tests. Data were analyzed using path analysis with the help of the Amos 25.0 program. The research result is that the P-value is 0.17<0.05. There is a direct effect of the learning approach on motivation; the P-value is 0.049<0.05. Peer interaction immediately affects achievement; the P-value is 0.035<0.05. There is a direct effect of the learning models on achievement; the P-value is 0.088>0.05. There is no direct effect of peer interaction on achievement; the P-value of 0.023<0.05 has a direct impact on motivation on achievement, the P-value of 0.444>0.05 motivation cannot mediate peer interaction on achievement, and a P-value of 0.024<0.05 with the conclusion that there is an indirect effect between learning model on achievement through motivation.

Keywords: learning models; peer interaction; motivation; achievement

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Introduction

The development of science and technology in the current era of globalization is very rapid. Increasing resources in the 21st century focus on the quality and results of human work, where professionally managed educational institutions produce quality resources (Wijayanti & Suhendri, 2017). In education, teachers, as the front line, must continue to make changes in various aspects, such as the quality of learning, attention, technology use, and other learning resources, likewise with mathematics teachers.

Mathematics is often viewed as a problematic subject by most students, which causes their learning motivation to be low (Acharya, 2017; Langoban & Langoban, 2020). Students' perceptions of mathematics are one of the causes of low student achievement (Chand et al., 2021). Based on several studies revealed that the factors that cause low student achievement include a lack of teacher competence and a lack of learning resources (Valente, 2019). Other causes of low student achievement are low levels of teacher motivation, teacher attitudes toward students and mathematics, less meaningful learning strategies, and low teacher mastery of the material (Mazana et al., 2018). Other factors are the exam system, poor teacher preparation in curriculum implementation, and learning management (Uysal & Banoglu, 2018). In addition, studies to see the effect of the causes of low student achievement were also carried out by Faulina and Fitria (2017), Kadarisma et al. (2019), Nurhasanah (2019), Wijayanti and Suhendri (2017), and Yunus et al. (2019). Based on the results of the research above, internal factors that arise from students are essential factors in fostering motivation in addition to external factors such as methods, methods and models applied by teachers (Arianti, 2019; Asmawati et al., 2021; Ikmawati, 2020).

Based on the phenomena that occur in mathematics, as stated above, several studies have looked at the causes of low student achievement from various factors, such as those carried out by Saraswati and Purnami (2017), looking at the effect of learning facilities, parental attention, and peer environment on students' mathematics learning achievement. Kurniawan and Wustqa (2014) looked at the influence of parental engagement, motivation, and social environment on junior high school students' mathematics learning achievement. Yuliany et al. (2022) looked at the impact of peers on achievement motivation and students' mathematics learning achievement. Ayu et al. (2022) studied the effect of peer interaction and self-regulation on achievement. Most of the above studies look at the direct impact of each variable. However, it differs from this study, which loses each variable's direct and indirect effects through the intervention variable.

The teacher plays a full role in managing learning, so the teacher can be said to be a motivator. Several indicators of the teacher are said to be motivators for students. Namely, the teacher must arouse the passion and desire of students to learn; the teacher encourages them to learn for students, associates learning, awards and sanctions to students and holds exciting and fun activities in learning, the teacher creates a conducive learning environment, develops competition and cooperation between students, and evaluates the implementation of student learning (Johnson, 2017; Murtafiah et al., 2021; Nurafrianti et al., 2020; Oktiani, 2017; Pagiling & Taufik, 2022). The eight indicators are a form of learning design that must be understood and implemented in the learning process to build, maintain, and increase motivation to learn. In addition, the selection of learning models is based on the characteristics of the subject matter, student characteristics, and learning support infrastructure.

In preparing learning designs, the concept of teaching and learning interaction is essential when selecting learning models. Therefore, learning design cannot be replaced with information design. Interaction is closely related to the diversity of students. This is what requires teachers to be able to come up with various learning designs based on the learning objectives to be achieved. Choosing suitable learning models in the learning process is the first step in preparing for learning (Khoerunnisa & Aqwal, 2020).

The learning model is generally a reciprocal process between teachers and students and between students and students. The selection of learning models can improve teaching and learning interactions, impacting student learning motivation. Therefore, for the teaching and learning process to run well, the teacher must selectively choose a learning model. This aims to create a conducive learning atmosphere; the interaction between students and students and between students and teachers in the learning process goes well, which will impact student achievement. Thus, this study aimed to see whether there was a direct or indirect effect of the exogenous variables on the intervention variable to endogenous variables. In this study, the exogenous variables consisted of learning models in the form of realistic mathematics education and peer interaction. Endogenous variables consist of achievement. The intervening variable consists of motivation.

Method

The type of research used in this research is quantitative research. This research is called causality research, which looks at the relationship between variables. Correlation studies determine whether the school between two or more variables involvininvolvesllection (Sukardi, 2011) This res.earch was conducted at junior high school 1 Aikmel in class VIII students, which consisted of four classes. The sample in this study was taken randomly using a simple random sampling technique with the lottery method. Based on the survey results, namely the fourth class, class VIII.B was obtained as a research sample, which totaled 28 students.

Variables in this research consist of 3 types: exogenous, intervening, and endogenous. Exogenous variables include model learning (X1) and interaction theme (X2). The intervening variable consists of motivation (Y1). Endogenous variable consisting of achievement (Y2). The learning model used is realistic mathematics education.

The instruments used were questionnaires and tests, where questionnaires were used to measure students' perceptions of learning models, peer interaction, and motivation, while tests were used to measure achievement. The questionnaire was a closed questionnaire using a Likert Scale comprising 15 statement items with four options: Strongly Agree, Agree, Disagree, and Strongly Disagree.

Furthermore, the variables of motivation, student discipline, and student perceptions of the teacher's teaching methods are classified into five variable tendencies: very high, high, moderate, low, and very low. The categorization of motivational movements to become teachers is based on five categories. Based on these calculations, it can be categorized into five types contained in the trend distribution in Table 1. The test is an essay consisting of five questions, with the highest score of 100.

Table 1. Distribution of model, interaction, and motivation category trends

Score intervals	Category
$X \geq 51$	Very high
$42 \leq X < 51$	High
$33 \leq X < 42$	Currently
$24 \leq X < 33$	Low
$X < 24$	Very low

Data were analyzed statistically with the help of the Amos 24.0 program. The initial test was the classical assumption test, namely the normativity and multicollinearity tests, to see whether the data would be analyzed using parametric statistics. If the assumptions are met, further tests are carried out with path analysis, with the path diagram as follows:

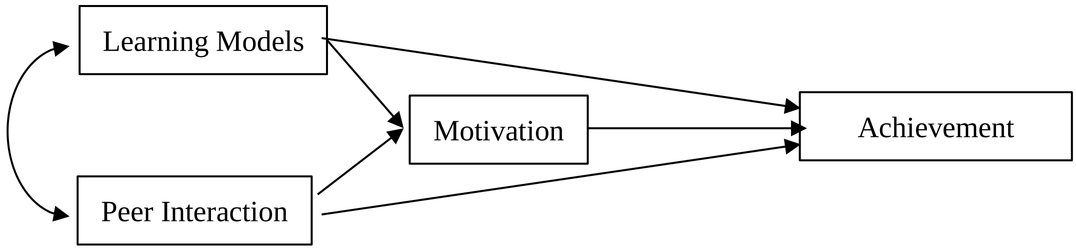

Figure 1. Causal models of exogenous, endogenous, and intervening variables

Based on Figure 1, we can formulate a general hypothesis proposed in path analysis. The prevailing hypothesis is the influence of learning models and peer interactions on motivation and their impact on achievement. Meanwhile, the hypotheses that will be tested one by one are (1) the effect of learning models and peer interactions on motivation; (2) the influence of learning models, peer interaction, and motivation on achievement; and (3) the influence of learning models and peer interaction through motivation on achievement.

Results

The results of the research are the answers to the formulation of the problems that have been described previously. The results of descriptive data analysis can be seen in the following in Table 2.

Table 2. Description statistics of research data results

Variable	Lowest score	Highest score	Average	Standard Deviation
Learning models	25	57	41.89	8.63
Peer interaction	26	56	42.1 1	8.3 7
Motivation	24	56	39.5 4	8.3 3
Achievement	44	92	70.1 8	11.71

Table 2 below shows the average for the aspect of the learning approach as high as 41.89 in the moderate category, the standard for interaction with friends and students as high as 42.11, and the average for motivation for students as high as 39.54 in the medium category.

Statistical assumptions

Before conducting a hypothesis test, the first step that must be taken is to see if the further test conditions have been met or not. The conditions that must be met are that the data is usually distributed and does not have multicollinearity.

Table 3. Assessment of normality (Group 1)

Variables	min	max	skew	cr	kurtosis	Cr
Interaction	26.000	56.000	-.356	-.770	-.561	-.606
Model	25.000	57.000	-.176	-.381	-.707	-.763
Motivation	24.000	56.000	.084	.181	-.665	-.718
Results	44.000	92.000	-.270	-.582	-.353	-.381
Multivariate					.482	.184

From the output of Amos above, it can be seen that the skewness value for all variables is less than 2.58 univariately. Likewise, when viewed multivariate, the value of c,r is less than 2.58. Thus, all data on these variables are normally distributed.

Table 4. Sample correlations (Group 1)

	Interaction	Model	Motivation	Results
Interaction	1.000			
Model	-.052	1.000		
Motivation	.177	-.237	1.000	
Results	.344	.118	-.092	1.000

Condition number = 2.378

Based on Table 4, it can be seen that the correlation value of each variable is less than 0.9. It can be said that there is no multicollinearity. Besides that, the condition number is 2.378, meaning that the condition number also supports no multicollinearity.

Hypothesis test results

After the classical assumptions or prerequisite tests are met, the hypothesis test uses path analysis using the Amos 24.00 program. Before interpreting the output from Amos, it is first seen whether the path analysis model is good. The path analysis image obtained is as follows in Figure 2.

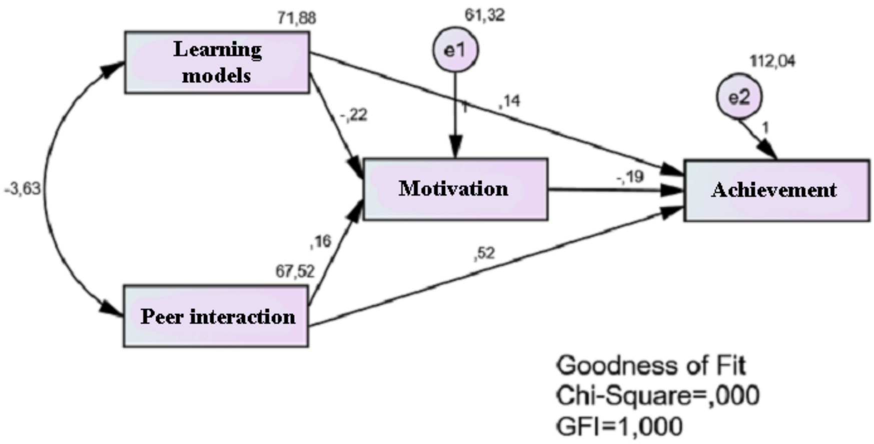

Figure 2. Path analysis output

Figure 2 shows that the chi-Square value of 0.000 is less than 0.05, and the GFI value 1.000 is more significant than 0.90. It can be concluded that the path diagram model meets the criteria of Goodness of Fit Statistics. Thus, the results of the following output can be interpreted to see how much the relationship of each variable is either partially or simultaneously.

Table 6. Regression weights: (Group 1 - Default model)

			Estimates	SE	CR	P	Label
Motivation	<---	Model	-.220	.178	-1.236	.017	par_1
Motivation	<---	Interaction	.165	.184	.896	.049	par_2
Results	<---	Model	.144	.247	.582	.035	par_3
Results	<---	Interaction	.522	.252	2.073	.088	par_4
Results	<---	Motivation	-.187	.260	-.718	.023	par_5

Based on the output above shows a direct effect on each variable 1) a realistic mathematics education directly affects motivation. This can be seen from the P value of 0.17, which is smaller than the significance level of 0.05; 2) peer interaction directly affects motivation. This can be seen from the P value of 0.049, which is less than the significance level of 0.05; 3) realistic mathematics education directly affects achievement. This can be seen from the P value of 0.035, less than the 0.05 significance level; 4) peer interaction does not directly affect achievement. This can be seen from the P value of 0.088, more significant than the significance level of 0.05, and 5) motivation directly affects achievement. This can be seen from the P value of 0.023, which is smaller than the 0.05 significance level.

Table 7. Correlations: (Group 1 - Default model)

			Estimates
Model	<-->	Interaction	.052

The output above shows that learning models and peer interaction correlate because the estimated value is $0.052 \leq 0.2$.

Table 8. Standardized regression weights: (Group 1 - Default model)

			Estimates
Motivation	<---	Model	.228
Motivation	<---	Interaction	.165
Results	<---	Model	.306
Results	<---	Interaction	.173
Results	<---	Motivation	.333

Table 8 shows the direct effect on each variable, namely: (1) the effect of realistic mathematics education on motivation has an effect of 22.8%; (2) the effect of peer interaction on motivation has an effect of 16.5%; (3) the effect of realistic mathematics education on achievement has an effect of 30.6%; (4) the influence of peer interaction on achievement has an effect of 17.3%, and (5) the influence of motivation on achievement has an effect of 33.3%.

Table 9. Standardized indirect effects (Group 1 - Default model)

	Interaction	Model	Motivation
Motivation	.000	.000	.000
Results	.022	.080	.000

Table 9 shows that peer interaction through motivation has an indirect effect of 0.022 on achievement, and a realistic mathematics education to learning mathematics through motivation has an indirect result of 0.080 on achievement. It can be seen in the following table 10 to see whether it is significant.

Table 10. Standardized indirect effects - two-tailed significance (BC) (Group 1 - Default model)

	Interaction	Model	Motivation
Motivation	...	...	...
Results	.444	.024	...

Table 10 shows that the indirect effect of peer interaction through motivation on achievement is 0.444, more significant than the significance level of 0.05. It can be concluded that motivation cannot mediate peer interaction on achievement. While the indirect effect of realistic mathematics education through motivation on achievement is 0.024, which is smaller than the significance level of 0.05, it can be concluded that motivation can mediate practical mathematics education to achievement.

Discussion

Table 1 shows the average aspects of the learning models and motivation in the medium category; however, the moderate peer-to-peer interaction of students is classified as high, while the achievement is the same as the standard. Some of the achievements are classified as current. By looking at the categories of each variable, the average student interaction score obtained from filling out the questionnaire by respondents is in the high class, meaning that students do not experience problems interacting with their peers.

From the output of the path analysis results in Figure 2, it can be seen that the chi-Square value is smaller when compared to the value at the significance level. The Goodness of fit indices (GFI) value is more significant than 0.90; it can be concluded that the path diagram model meets the Goodness of Fit Statistics criteria. Thus, the results of the following output can be interpreted to see how much the relationship of each variable is either partially or simultaneously.

Partially, Amos's output in Table 5 above shows the results of a direct influence on each variable, namely: (1) there is a direct effect of realistic mathematics education on motivation; this can be seen from the P-value which is smaller than the 0-significance level 0.05; (2) there is a direct effect of peer interaction on motivation. This can be seen from the P-value, which is smaller than the significance level of 0.05; (3) realistic mathematics education has a direct effect on achievement. This can be seen from the P-value less than the significance level of 0.05; (4) there is no direct effect of peer interaction on achievement. Please provide evidence of the importance of peer interaction and its influence on academic achievement. The results of this study indicate that peer interaction will have a positive effect if the interaction has a positive impact on the learning process, and (5) there is an influence of motivation on achievement. This can be seen from the P-value, which is smaller than the 0.05 significance level. Meanwhile, the reciprocal relationship between realistic mathematics education and peer interaction has a positive correlation where the estimated value is less than the critical value of 0.2.

The magnitude of the influence of the relationship between each variable, namely: (1) the effect of realistic mathematics education on motivation has a significant influence, with a percentage above 20; (2) the influence of peer interaction on motivation has a negligible effect with a percentage of less than 20; (3) the effect of realistic mathematics education on achievement has a significant influence with a percentage of more than 30; (4) the effect of peer interaction on achievement has a negligible effect with a percentage below 30, and (5) the influence of learning motivation on achievement has a significant influence with a percentage of more than 30.

Based on the results of the analysis in Tables 9 and Table 10 show that peer interaction through motivation has a small, indirect, and insignificant effect because the p-value is more significant than the significance level of 0.05, so it can be concluded that motivation cannot mediate peer interaction on achievement in mathematics. In contrast, a realistic mathematics education to learning mathematics through motivation has a significant enough indirect effect on achievement in mathematics, and the P-value of a realistic mathematics education to learning mathematics through motivation is smaller from a significance level of 0.05, it can be concluded that motivation can mediate realistic mathematics education to achievement.

Conclusion

There is a direct effect of realistic mathematics education on motivation, there is a direct effect of peer interaction on motivation, there is a direct effect of realistic mathematics education on achievement, there is no direct effect of peer interaction on achievement, and there is a direct effect of motivation on achievement as well as a reciprocal relationship between realistic mathematics education, and peer interaction has a positive correlation, indirect impact of interaction peers through motivation has a small and insignificant effect so that it can be concluded that motivation cannot mediate peer interaction on achievement. In contrast, a realistic mathematics education learning mathematics through motivation has a large enough influence indirectly on the results of learning mathematics. It can be concluded that motivation can mediate realistic mathematics education to achievement.

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Conflicts of Interests

The authors declare no conflict of interest regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, misconduct, data fabrication and falsification, double publications and submissions, and redundancies, have been completed by the authors.

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Author Contributions

Rody Satriawan: Conceptualization, methodology, data collection, and writing. **Lalu Muhammad Fauzi:** Conceptualization, process, data collection, and writing. **Sri Supiyati:** Data Collection and writing. **Muhammad Halqi:** Conceptualization and reviewing. **Malik Ibrahim:** Data collection and writing.

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