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It Doesn't Mean that Students Don't Have Mathematics Anxiety: A Case Study of Mathematics Learning with Path Analysis

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Abstract: Mathematics anxiety has always been an interesting topic to study and discuss in the world of education. This study aimed to (1) investigate the impact of teacher roles, mathematics content, and mathematics anxiety on learning motivation, and (2) explore how students manage mathematics anxiety as a stimulus in learning motivation. This research used mixed methods with embedded concurrent design. The research sample was 100 respondents. The questionnaire instrument was arranged based on a Likert scale with 5 answer choices. This study used a structural equation model and confirmatory factor analysis as data analysis methods. The research findings indicated that: (1) a significant direct impact emerged between mathematics anxiety and students' learning motivation, and there was an indirect impact between the teacher's role and mathematics content on learning motivation; (2) students could manage mathematics anxiety when they were in optimal anxiety or positive anxiety so that they could overcome mathematics anxiety as a stimulus for achievement and deconstruct anxiety into motivation according to experience and personal resources. Results of this study confirmed that the statements about mathematics anxiety which always has a negative impact on motivation and learning achievement is not universal, because mathematics anxiety does not always have a negative impact on motivation and learning achievement if this anxiety is managed effectively.

Keywords: *Learning achievement, mathematical anxiety, motivation, path analysis.*

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Introduction

The importance of learning mathematics cannot be separated from its role in various lives. Many information and ideas are communicated in mathematical language, and many contextual problems can be presented in mathematical models (Frejd & Bergsten, 2018). Given the importance of mathematics, mathematics is a compulsory subject from elementary school to high school.

What comes to your mind when you hear the word mathematics? You will probably say it is difficult, scary, very serious lessons, and too many formulas. Then, what do you imagine when you hear a profession called mathematics teacher? You probably will spontaneously come up with answers “fierce, unfriendly, stiff, or some other negative words”. In the framework of education, learning mathematics could help students develop their reasoning skills, critical thinking, or responsiveness in analyzing a problem and solving it (Cresswell & Speelman, 2020). However, it is often unrealized that teachers demands for students to excel and the abstract nature of mathematical objects have caused anxiety for students (Kusmaryono et al., 2020).

In many countries (including the United States, Canada, Estonia, Indonesia, Spain, and Taiwan), mathematics anxiety has become a serious problem (Brewster & Miller, 2020; Cooper et al., 2018; Guzman et al., 2020; Prahmana et al., 2019; Rozgonjuk et al., 2020; Su, 2017). Therefore, it has become an interesting area for researchers and education observers to conduct investigation (Cooper et al., 2018; Dowker et al., 2016). Discussion of the problem of mathematics anxiety cannot be separated from its influence on students' motivation and learning achievement (Herges et al., 2017; Marticion, 2021; Olango, 2016; Ramirez et al., 2013; Suren & Kandemir, 2020). Meanwhile, the emergence of mathematics anxiety in students can be influenced by teacher performance and mathematics content (Doño & Mangila, 2021; Ramirez, Hooper, et al., 2018; Shehayeb & Anouti, 2018).

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Considerable amount of previous studies reported that mathematics anxiety affects student learning achievement (Brewster & Miller, 2020; Dowker et al., 2016; Irhamna et al., 2020; Lai et al., 2015; Musa & Maat, 2021; Olango, 2016; Prahmana et al., 2019; Suren & Kandemir, 2020; Zhang et al., 2019). They argue that the relationship between mathematics anxiety and learning achievement is a linear relationship with a strong negative direction, meaning that an increase in mathematics anxiety could cause a decrease in students' mathematics achievement.

Moreover, some studies argue that mathematics anxiety also affects the affective aspect, such as the decrease in students' learning motivation in mathematics class (Cooper et al., 2018; Musa & Maat, 2021; Olango, 2016). Low student motivation will affect mathematics learning achievement (Irhamna et al., 2020; Suren & Kandemir, 2020). Likewise, some other earlier studies added that anxiety does not always have a negative impact on students' learning mathematics (Jiang et al., 2021; Marticion, 2021; Wang et al., 2015).

From the earlier studies about the effect of math anxiety, we learned there is a gap between the two camps. First, the ones who believed that mathematics anxiety had a negative impact on students' motivation and achievement (Brewster & Miller, 2020; Dowker et al., 2016; Irhamna et al., 2020; Lai et al., 2015; Musa & Maat, 2021; Olango, 2016; Prahmana et al., 2019; Rozgonjuk et al., 2020; Suren & Kandemir, 2020; Zhang et al., 2019). Second, the ones who believed that mathematics anxiety did not always have a negative impact on those two aforementioned aspects (Cooper et al., 2018; Dowker et al., 2016; Jiang et al., 2021; Marticion, 2021; Wang et al., 2015). For us, this second opinion is very interesting to study. The research question we posed was "How do students manage math anxiety so they can stay motivated to excel."

The advantages of previous research results include; (1) providing valuable input to teachers about the negative impact of mathematics anxiety on motivation, mathematical disposition, and student learning achievement (Capinding, 2022; Musa & Maat, 2021; Olango, 2016; Prahmana et al., 2019; Ramirez, Hooper, et al., 2018; Rozgonjuk et al., 2020; Zhang et al., 2019); (2) encouraging teachers to understand the factors that cause mathematics anxiety and try to increase students' learning motivation (Shehayeb & Anouti, 2018; Suren & Kandemir, 2020); (3) improving teacher performance through the implementation of various innovative and creative learning models to reduce mathematics anxiety in students (Cooper et al., 2018; Jiang et al., 2021). Weaknesses in the research results, among others, were that they still focused on quantitative data rather than qualitative data; the researchers have not explored the mathematics anxiety which students with high learning achievement have. Moreover, the research findings have not provided a solution for how students manage mathematics anxiety as a challenge for achievement.

Literature Review

Definition of mathematics anxiety has been widely defined by experts in various scientific literatures (Brewster & Miller, 2020; Dowker et al., 2016; Jiang et al., 2021; Luttenberger et al., 2018; Marticion, 2021; Musa & Maat, 2021). Based on the literature review, mathematics anxiety is a person's feelings of depression, worry, anxiety, anxiety, dislike, or fear of anything related to mathematics. More specifically, math anxiety is a psychological condition in which a person experiences a stressful state of learning in math class or in situations that require mathematics or avoid scary mathematics situations (Lai et al., 2015). Mathematics anxiety generally comes from students' negative experiences when learning mathematics with previous teachers (Ramirez et al., 2013; Rozgonjuk et al., 2020).

Currently, teacher's role as a facilitator begins to be less than optimal in guiding student (Nugroho & Sakhiyya, 2022). During the period of distance learning (online) due to the pandemic of COVID-19, students feel that teacher's role has changed to that of giving orders, giving teaching doctrine, and learning inspection. Teachers put more pressure on math assignments and asked students to study independently at home (Capinding, 2022; Ulia & Kusmaryono, 2021). The shift in teacher's role from a learning facilitator to "learning inspector" is not realized by mathematics teachers (Lodge et al., 2018). The change in teacher's role has triggered a decrease in mathematical disposition and caused an emergence of mathematics anxiety in students (Kusmaryono et al., 2021). This problem continues when the content of mathematics books, which involves many complex formulas and calculations, psychologically affects students' learning motivation and levels of mathematics anxiety (Shehayeb & Anouti, 2018; Zhang et al., 2019). Students who experience mathematics anxiety do not mean passive, thus, learning nothing. Anxiety in fact interferes with an individual's ability to learn and participate in math classes (Al Majali, 2020; Brewster & Miller, 2020; Lai et al., 2015).

Learning motivation is a person's drive, desire, need to learn both internally and externally (Thohir, 2017). The relationship between anxiety and learning motivation can be explained by the logic. When someone has anxiety, it creates an attitude to avoid situations where they have to learn mathematics. Students who experience anxiety tend to be less enthusiastic and less active (low learning motivation) during the learning process in the classroom and feel tense while facing mathematics problems. Students who experience mathematics anxiety and a decrease in learning motivation must immediately find causative factors and solutions. Therefore, teachers in schools, including mathematics teachers, must be sensitive to such a condition.

Students' mathematics learning achievement is influenced by many factors and not only mathematics anxiety. Meanwhile, several factors that trigger the emergence of mathematics anxiety cannot be separated from teacher's performance when teaching mathematics (Capinding, 2022; Doño & Mangila, 2021; Ramirez, Hooper, et al., 2018), students' self-confidence (Das et al., 2014; Jiang et al., 2021), the content of mathematics textbooks (Zhang et al., 2019), and a non-conducive learning climate (Radišić et al., 2015). Mathematics anxiety is often seen as the main factor to cause failure to student. Mathematics anxiety has a direct impact on learning motivation. It should also be noted that the emergence of mathematics anxiety may stem from teacher's ineffective role in learning (Ramirez, Hooper, et al., 2018) and the complex nature of the mathematics content (Zhang et al., 2019).

"Mathematics anxiety is a factor causing low motivation and student achievement," this statement cannot be denied as many experts have studied on it (Capinding, 2022; Musa & Maat, 2021; Olango, 2016; Prahmana et al., 2019; Ramirez, Hooper, et al., 2018; Rozgonjuk et al., 2020; Zhang et al., 2019). In fact, the authors found a unique case where some students experienced mathematics anxiety but still managed to collect high achievement. The authors consider it a challenge to examine this case more in-depth.

This study is based on a curiosity about a research that claims that mathematics anxiety did not always have a negative impact on student's motivation and learning achievement (Cooper et al., 2018; Dowker et al., 2016; Jiang et al., 2021; Marticion, 2021; Wang et al., 2015). We strongly suspect that students with high achievement are able to manage mathematics anxiety quite well. On the other hand, the direct or indirect impacts from teachers' role and mathematics content on the level of mathematics anxiety and student motivation still needs more exploration.

This study aims to (1) determine the effect of the teacher's role, mathematics content, and mathematics anxiety on learning motivation, and (2) to explore how students manage mathematics anxiety as a stimulus to achieve better outcome of learning. This research was conducted with a mixed approach between quantitative and qualitative so that the findings can cover the weaknesses of previous studies.

Recalling in previous studies (Capinding, 2022; Musa & Maat, 2021; Olango, 2016; Prahmana et al., 2019; Ramirez, Hooper, et al., 2018; Rozgonjuk et al., 2020; Zhang et al., 2019), the researchers put their most focus only on mathematics anxiety experienced by students with low academic achievement. The researchers have not found any research that specifically explored the mathematics anxiety experienced by students with high academic achievement. Even though they (students) also had mathematics anxiety, some of them even had a high level of mathematics anxiety. According to Lailiyah et al. (2021), each student has a different level of mathematics anxiety whenever in a mathematics learning environment. Therefore, mathematics anxiety should not be avoided but needs to be managed effectively.

The results of this study are expected to be useful to (1) provide important insights for mathematics teachers to control the factors that influence mathematics anxiety, and (2) help students manage mathematics anxiety as a useful stimulus and a challenge to increase motivation and achievement in learning mathematics. Thus, the results of this study can be a solution to manage mathematics anxiety effectively.

Methodology

Research Design

This research employed concurrent mixed methods with concurrent embedded design (Creswell, 2014). The weight of this method relies more on quantitative methods (surveys) which aim to investigate the effect of the teacher's role, mathematics content, and mathematics anxiety on students' mathematics learning motivation. Qualitative (descriptive) was selected as another method to analyze the issues to support the research results.

Participants

Participants of this study were 100 students (43 men and 57 women) from elementary, middle, and high school levels in the city of Semarang, Indonesia aged between 10 to 17 year old, had a high level mathematics anxiety category based on the questionnaire, and had a high learning achievement with an average value of more than 80.00. All respondents were selected purposively based on the above criteria. The students with high mathematics learning achievement (mean value more than 80.00) were selected to develop a hypothesis (students with high learning achievement also have mathematics anxiety). Other than students, mathematics teachers with 4 years of teaching experience were also selected as respondents of the study.

Table 1. Number of Respondents

No.	Level of Education	Number of Respondents
1.	Primary School	26
2.	Junior High school	40
3.	Senior High School	34
	Total	100

Variable Identification

In this study, the exogenous (independent) variables were the teacher's role (X1), math content (X2), and math anxiety (Y1). Meanwhile, the endogenous (dependent) latent variable is learning motivation (Y2). See Table 2 for identification of research variables.

Table 2. Identification of Research Variables

Latent Variable	Code	Manifest Variable	Supporting Theory
Teacher Role (X1)	X1.1	Aspects of teaching style	(Aydin et al., 2010; Finlayson, 2014; Marticion, 2021; Shehayeb & Anouti, (2018))
	X1.2	Aspects of teaching quality	
	X1.3	Aspects of counseling guidance	
	X1.4	Aspects of teacher competence	
	X1.5	Aspects of giving assessment and feedback	
Mathematics Content (X2)	X2.1	Aspects of language and readability	(Rozgonjuk et al., 2020; Shehayeb & Anouti, 2018)
	X2.2	Aspects of the level of complexity of the material	
	X2.3	Aspects of systematic material presentation	
	X2.4	Aspects of material density	
	X2.5	Aspects of graphic illustration	
Mathematics Anxiety (Y1)	Y1.1	Cognitive domain	(Brewster & Miller, 2020; Luttenberger et al., 2018; Marticion, 2021; Mutlu, 2019)
	Y1.2	Affective domain	
	Y1.3	Conative domain	
	Y1.4	Behavior domain	
	Y1.5	Psychological domain	
Learning Motivation (Y2)	Y2.1	Desire to succeed	(Herges et al., 2017 ; Marticion, 2021) (Suren & Kandemir, 2020)
	Y2.2	Learning drive and need	
	Y2.3	Future hopes and aspirations	
	Y2.4	Appreciation in learning	
	Y2.5	Interesting and conducive learning activities	

Data Collection Instruments

Quantitative data were collected through documentation and questionnaire methods. Documentation was used to collect data about the age, gender, and students' mathematics learning achievement scores at each level of education according to the sample criteria. Questionnaires were used to obtain data on students' mathematics anxiety, motivation, mathematics content, and the role of teachers in supporting students' success in learning mathematics. All questionnaires were designed according to the indicators of each research variables and the results will be converted through Likert scale measurements (see Table 2).

Questionnaires were given to respondents through a survey method. In the main questionnaire (closed questions), namely mathematical anxiety, respondents stated their level of anxiety through a Likert scale with 5 answer options: 1 = not at all anxious or equivalent to strongly disagree (SDA), 2 = very little anxiety or equivalent with disagree (DA), 3 = quite anxious or equivalent to doubtful (N), 4 = very anxious or equivalent to agree (A), and 5 = very anxious or equivalent to strongly agree (SA) (Marticion, 2021). The higher the score obtained, the higher the level of mathematics anxiety experienced by the respondents.

The mathematical anxiety questionnaire in this study consisted of 40 questionnaire items taken from the revised mathematical anxiety rating scale (RMARS) instrument developed by previous experts (Alexander & Martray, 1989). This study makes a simplified version of RMARS for reliability and validity information on the new version. The results of the instrument test obtained that the Cronbach's alpha coefficient value of 0.96 indicated high internal consistency, and the questionnaire instrument had convergent validity from the RMARS: $r = 0.90$ ($p < 0.05$). The results of this measurement confirm that RMARS has the same level of effectiveness as the original MARS (Akin et al., 2011; Carey et al., 2017; Marticion, 2021).

Instruments to measure motivation, teacher's role, and mathematics content each consist of 20 items with 5 choices of Likert scale responses. The 20 academic motivation scale (AMS) instrument was developed by an expert (Al Majali, 2020) with internal consistency (Cronbach's alpha = 0.84) with convergent validity ($r = 0.90$, $p < 0.05$). The teacher role scale (TRS) and mathematics content scale (MCS) instruments were developed by the researchers according to the indicators in Table 2. The results of the evaluation of the TRS and MCS instruments respectively showed internal consistency (Cronbach's alpha = 0.76 and 0.88) and convergent validity. ($r = 0.90$, $p < 0.05$ and $r = 0.85$, $p < 0.05$).

Data Analysis Technique

Data from the questionnaire were analyzed initially based on the total score of the questions answered by the respondents. Then the measurement scores were tabulated on each research variable to be processed and presented in the form of a descriptive statistical table. Structural equation modeling (SEM) (Jirangkul, 2020; Viloria et al., 2019) and confirmatory factor analysis (CFA) (Herwin & Nurhayati, 2021; Schreiber et al., 2006; Willmer et al., 2019; Zakariya, 2018) were used as research data analysis techniques to determine the influence between exogenous and endogenous variables. According to experts (Cho & Kim, 2015; Fan et al., 2016; Schreiber et al., 2006), SEM is used to determine the relationship of independence of variables through the integration of linear equations. This SEM method was chosen because it can explain the relationship between observed variables and latent variables through its indicators as a unit (Jirangkul, 2020; Schreiber et al., 2006).

This study used SEM as path analysis and statistical description through the goodness of fit index (GFI) to verify reliability and validity. The criteria for this statistical value were Chi-square/df $\leq$ 2.00; The root mean square error of approximation (RMSEA) $\leq$0.08; goodness of fit index (GFI) $\geq$0.90; adjusted goodness of fit index (AGFI) $\geq$ 0.90; tucker lewis index (TLI) $\geq$0.90; comparative fit index (CFI) $\geq$0.90 (Jirangkul, 2020).

The CFA test was used to determine whether the indicators in the questionnaire could really explain a construct (Jirangkul, 2020; Schreiber et al., 2006). In CFA there are 2 tests, the first is to test the questions in the questionnaire whether they are representative (valid) by using the t-test. Then the second is to measure consistency or accuracy by using construct reliability testing. The criteria used to test the validity are t-value 1.967 with p-value $< \alpha = (0{,}05)$, standard loading factor (SLF) $\geq$0.50, and for reliability, criteria are construct reliability (CR) > 0.70, and variance extracted (VE) > 0.50 (Dilekli & Tezci, 2019; Jirangkul, 2020; Schreiber et al., 2006).

Respondents' answers to open-ended questions were analyzed using an interactive method (Ananth & Maistry, 2020; Busetto et al., 2020) through the stages of collecting data, presenting data (coding), reducing data, and interpreting it according to the findings to draw conclusions. Data validity was carried out through triangulation of data sources and methods (expert opinions, respondents, and supporting theories) which were used as comparisons in making final conclusions.

Research Hypothesis

This research began from the assumptions as mentioned in the form of hypotheses which would then be tested for truth through statistical tests. See the followings for the research hypotheses.

Ho_1 : *The teacher's role had no effect on math anxiety*

Ha_1 : *The teacher's role affected math anxiety*

Ho_2 : *Math content had no effect on math anxiety*

Ha_2 : *Math content affected math anxiety*

Ho_3 : *The teacher's role had no effect on learning motivation*

Ha_3 : *The teacher's role affected learning motivation*

Ho_4 : *Mathematical content had no effect on learning motivation*

Ha_4 : *Mathematical content affected learning motivation*

Ho_5 : *Mathematics anxiety had no effect on learning motivation*

Ha_5 : *Mathematics Anxiety affected learning motivation*

To clarify the hypothesis above, an estimation model for the causal relationship between variables is made as shown in Figure 1.

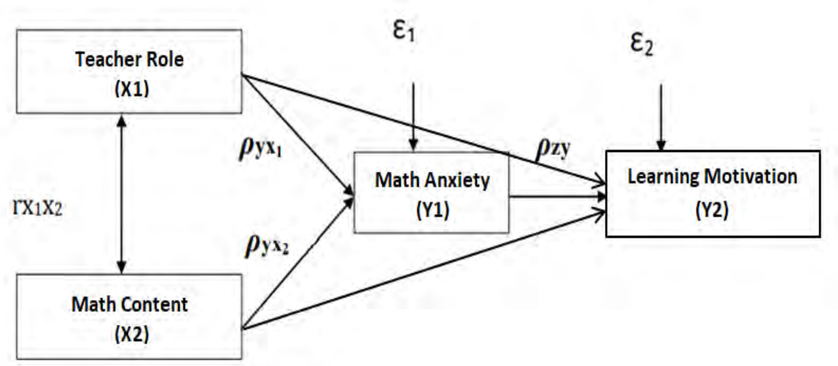


Figure 1. Causality Relationship Path Model Estimated

Research Procedure

The procedures carried out in conducting this research were as follows: (1) identified the problems for analyses; (2) determined the research objectives; (3) determined the variables that are thought to affect learning motivation; (4) compiled the research instruments; (5) conducted the survey of respondents; (6) performed the descriptive statistical analysis; (7) performed the multivariate normal assumption test; (8) performed the CFA; (9) performed the SEM analysis, namely (a) developed the appropriate research concepts and theories, (b) made the modeling of the conceptual framework with hypotheses, (c) compiled the path diagrams to explain the pattern of relationships between the latent variables and the manifest variables, (d) converted the path diagram into the structural equation, (e) assessing the goodness of fit to see the goodness of the model based on existing criteria, and (g) modified the model if there was a model that was not fit and did not meet the requirements to get the appropriate model; (10) interpreted the best model of SEM; and (11) drew conclusions.

Findings

Survey Results

The survey in this study was conducted for 3 months considering a large number of research respondents. The researcher confirmed in the survey that the questionnaire had been filled out by 100 respondents. The statistical description of the questionnaire results is presented in Table 3.

Table 3. Statistical Description of Questionnaire Data

Latent Variable	Number of questions	Min.	Max.	Mean	SD
Teacher Role (X1)	20	62	81	70.03	12.380
Math Content (X2)	20	61	76	65.96	9.615
Math Anxiety (Y1)	40	65	87	76.24	6.189
Learning Motivation (Y2)	20	73	90	83.10	7.474

In addition to Table 3, the results of the questionnaire are also presented in Figure 2 which is data from the questionnaire for each indicator variable. The variables studied included: teacher's role (X1), mathematics content (X2), mathematics anxiety (Y1), and learning motivation (Y2).

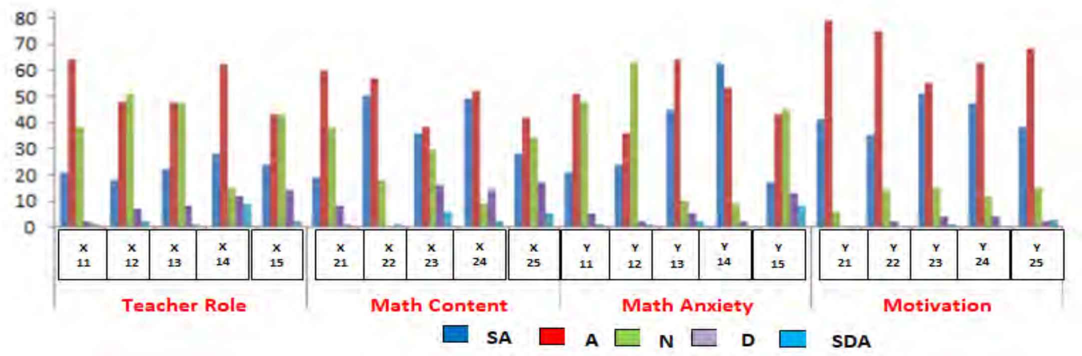


Figure 2. Graph of Questionnaire Results for Each Variable Indicator (X and Y)

Assumption Check

In the analysis of research data that involves the analysis of SEM, there are several assumptions that must be met, namely the sample size and data with multivariate normal distribution. For the sample size, it was known that the sample size of 100 respondents had met the assumptions (Kyriazos, 2018; Wolf et al., 2013). For the assumption of multivariate normal distribution of data, it will be done by calculating the squared distance for each observation. The results of testing the assumption of a multivariate normal distribution can be seen in Figure 3.

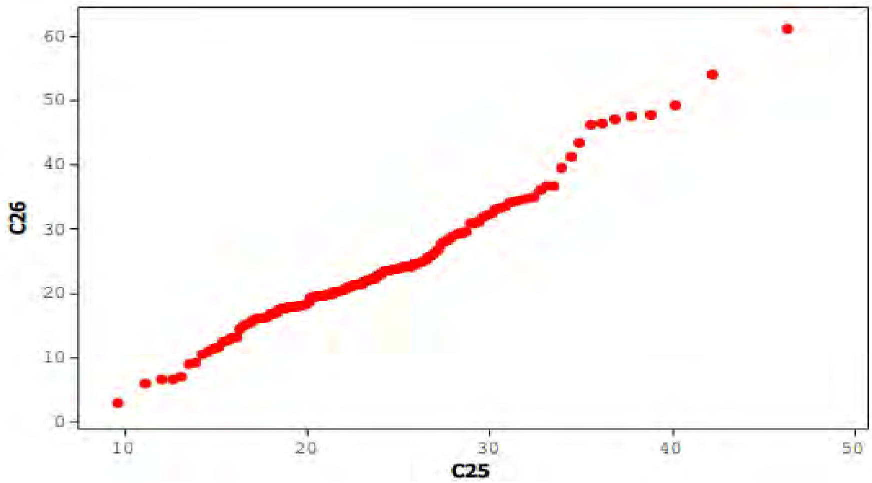


Figure 3. Scatterplot Multivariate Normal Assumption Test

Figure 3 shows; most data distribution forms a straight line. It means the data distribution follows the normal line. From the results of the calculations, it was found that the proportion of the squared distance (d_j^2) which was less than $\chi^2_{(p=0.05)}$ (67.15%) where the value was in the range of values between 30 - 70% (it is said normally distributed) which means that the data fitted into the contour, thus fulfilling the assumption of a multivariate normal distribution (Kyriazos, 2018; Wolf et al., 2013).

Confirmatory Factor Analysis (CFA)

How well the measured variables could represent the constructor factors formed could be tested by CFA with the following results.

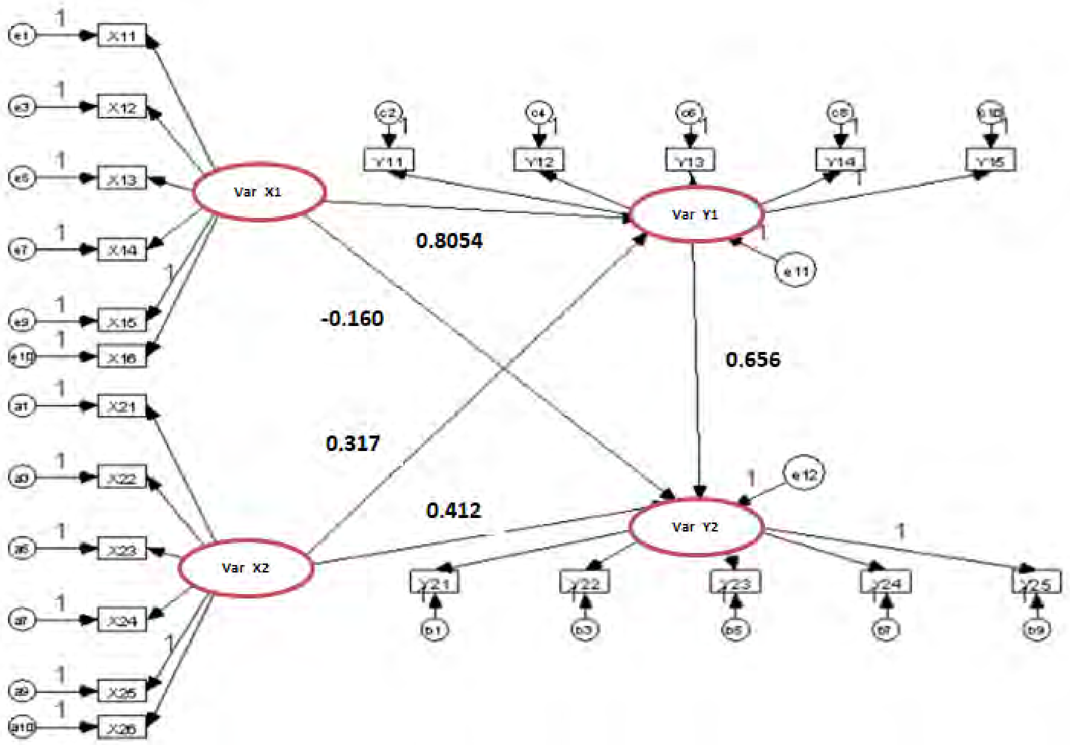
Table 4. Confirmatory Factor Analysis Test

Latent Variable	SLF	t-value	p-value	CR	VE
Teacher Role	0.625	5.802	0.035	0.931	0.640
Math Content	0.596	6.613	0.009	0.853	0.592
Math Anxiety	0.813	7.478	0.018	0.906	0.637
Learning Motivation	0.545	7.569	0.024	0.894	0.781

In Table 4 it is known that each latent variable is declared valid as a measurement instrument because it produced an SLF value of more than 0.50, the value of t count > t table = 1.967 and p-value < = (0.05). This Table 4, all latent variables have good model reliability because CR > 0.70 and VE > 0.50 (Dilekli & Tezci, 2019; Jirangkul, 2020; Schreiber et al., 2006).

Structural Equation Model (SEM)

The next step is to determine the path coefficients for the direct effect, indirect effect, and total effect which are presented in the following full path diagram with SEM (Tarka, 2018; Viloria et al., 2019) in Figure 4.



Description:

Var_X1 = Teacher's Role

Var_X2 = Math Content

Var_Y1 = Math Anxiety

Var_Y2 = Learning Motivation

Figure 4. Full Path Diagram with SEM

To measure the "correctness" of the proposed model, it is necessary to test several fit indices. Here are some conformity indices and their boundary values to test whether a model is rejected or accepted. The results of testing the complete model with the AMOS program are in Table 5.

Table 5. Model Feasibility Test Index

Goodness of Fit Index	Result	Cut – off Value	Criterion	Supporting Theory
Chi – Square (χ^2)	0.084	$p \geq 0.05$	Good Fit.	(Cho & Kim, 2015) (Dilekli & Tezci,
Relative Chi Square: χ2/df	1.236	≤ 2.00	Good Fit.	2019)
RMSEA	0.045	≤ 0.08	Good Fit.	(Hassneen et al., 2019) Jirangkul
GFI	0.921	≥ 0.90	Good Fit.	(2020)
AGFI	0.973	≥ 0.90	Good Fit.	(Kornpitack & Sornsaruht, 2019)
TLI	0.965	≥ 0.90	Good Fit.	(Schermelleh-Engel et al., 2003)
CFI	0.957	≥ 0.90	Good Fit.	(Tarka, 2018)
Cronbach's alpha	0.80–0.91	≥ 0.70	Passed.	(Tavakol & Dennick, 2011)

The results of statistical testing in Table 5, it is known that the overall evaluation results of the model with AMOS are appropriate. The decision to accept the null hypothesis (Ho) is correct because of the value of χ2 counts (118.75) < χ2 tables (124.3) with a significance level (prob.) of 0.084 0.05. These results can be interpreted that the conceptual model developed has been supported by empirical data. From Table 5 it can be said that all the criteria used to assess are feasible or the criteria are met. This means that there is a match between the model and empirical data and thus the model can be accepted (Hassneen et al., 2019; Jirangkul, 2020; Kornpitack & Sornsaruht, 2019; Tavakol & Dennick, 2011). The results of the statistical description in Figure 4 and Table 5, show that this model is the best model. Through these data, a SEM can be structured as follows.

Structural Equation

Math Anxiety = -0.24*teacher + 0.38*content, Errorvar, = 0.71 , R² = 0.475
(0.014) (0.029) (0.018)
0.805 0.317 0.222

Motivation = 0.59*math anxiety - 0.24*teacher + 0.38*conten, Errorvar, = 0.32 , R² = 0.682
(0.002) (0.037) (0.010) (0.18)
0.656 -0.160 0.412 0.151

Figure 5. Output of SEM

The results of the study using the SEM method obtained 2 structural equation models which were improved as follows.

$Y_1 = 0.805\ Y_1X_1 + 0.317Y_1X_2 + 0.222$ ………………………... substructure equation (1)

$Y_2 = 0.656\ Y_2Y_1 - 0.160\ Y_2X_2 + 0.412Y_2X_1 + 0.151$……… substructure equation (2)

Influence between Variables

Based on Figure 4, the standard coefficient of direct influence (DE), indirect effect (IE), and total effect (TE) of the independent variable on the dependent variable are obtained. The independent variables of this study were the content of mathematics (MC) and the role of the teacher (TR). The dependent variables of this study were mathematics anxiety (MA) and learning motivation (LM). The total effect (TE) is the sum of the direct effect (DE) and indirect effect (IE) which can be seen in Table 6.

Table 6. Standard Coefficient of Effect of Independent Variable on the Dependent

Dependent Variables	**R^2**	**Effect**	**Independent Variables**		
			TR	**MC**	**MA**
Mathematics Anxiety (MA)		DE	0.805	0.317	-
	0.475	ID	-	-	-
		TE	0.805	0.317	-
Learning Motivation (LM)		DE	-0.160	0.412	0.656
	0.682	ID	0.528	0.208	-
		TE	0.368	0.630	0.656

Note: Sig. < 0.05*

Table 6 shows that for the direct effect and the largest total effect is the influence of the teacher's role on mathematics anxiety with a weight of 0.805; then the largest indirect effect is occupied by the influence of the teacher's role on learning motivation with a weight of 0.528; while the biggest weight for the total effect is the effect of mathematics anxiety which also has an effect on motivation with a total effect of 0.656. Furthermore, Table 7 will show the effect of each variable through testing the research hypothesis.

Table 7. The Results of Testing the Research Hypotheses

Hypotheses	**Coef.**	**Prob.**	**Decision**
Ha1: TR has a direct effect on MA	0.805	0.029	Accepted
Ha2: MC has a direct effect on MA	0.317	0.014	Accepted
Ha3: TR has a direct effect on LM	-0.160	0.010	Accepted
Ha4: MC has a direct effect on LM	0.412	0.037	Accepted
Ha5: MA has a direct effect on LM	0.656	0.002	Accepted
Ha6: TR has an indirect effect on LM	0.528	0.029	Accepted
Ha7: MC has an indirect effect on LM	0.208	0.014	Accepted

Table 7 can be explained as follows. (1) The first hypothesis (Ho1) is rejected with (prob.) 0.029 < 0.05 thus accepted (Ha1), which means that the teaching role and mathematics content has an effect on mathematics anxiety with a coefficient of 0.805; (2) The second hypothesis (Ho2) is rejected with (prob.) 0.014 < 0.05 and thus accepted (Ha2), which means that mathematics content has an effect on mathematics anxiety with a coefficient of +0.317; (3) The third hypothesis (Ho3) is rejected with (prob.) 0.010 < 0.05 and thus accepted (Ha2), which means that the teaching role has an effect on learning motivation with a coefficient of -0.160; (4) The fourth hypothesis (Ho4) is rejected with (prob.) 0.037 < 0.05 and thus accepted (Ha2), which means that mathematics content has an effect on learning motivation with a coefficient of 0.412; (5) The fifth hypothesis (Ho5) is rejected with (prob.) 0.002 < 0.05 and thus accepted (Ha5), which means that mathematics anxiety affects learning motivation with a coefficient of 0.656; (6) The sixth hypothesis (Ha6) shows that there is an indirect effect of teaching role on learning motivation through mathematics anxiety variable with a significant level (prob.) 0.029 < 0.05 and path coefficient +0.528; and (7) The seventh hypothesis (Ha7) shows that there is an indirect effect of mathematics content on learning motivation through mathematics anxiety variable with a significant level (prob.) of 0.014 < 0.05 and a path coefficient of +0.208.

Answers to Open Questions

In addition to closed questions in the questionnaire that have been answered by the respondents (students), the researcher also provides open questions in the questionnaire. The purpose of open-ended questions is to obtain qualitative data that supports quantitative data. Several key questions were given to respondents with the results of respondents' answers presented in Table 8.

Table 8. Respondents' Answers to Open-Ended Questions

No.	Questions and Answers	Percentage (%)
1.	***What is the teacher's role in supporting the success of your mathematics learning?***	
1a.	Enough to help me understand math problems	39%
1b.	Give more training and tiring tasks	31%
1c.	Lack of attention to the learning problems I'm having	23%
1d.	Reject student failure, and there are other answers	7%
2.	***What do you think about math content in school books?***	
2a.	Quite complicated but contextual and gives a learning challenge	57%
2b.	Math content fills schoolbooks	18%
2c.	Makes me dizzy and sometimes frustrated	14%
2d.	Illustrations are less attractive, and other answers	11%
3.	***What do you do when you have math anxiety so that you can continue to be successful at learning math?***	
3a.	Don't give up and study hard to get good grades	26%
3b.	Looking for more learning resources	25%
3c.	Make small notes for important material	25%
3d.	Motivate yourself to be successful in tests (final school exams)	24%
4.	**What is your biggest motivation for studying math?**	
4a.	Achieve the best grades in math class	33%
4b.	Get a decent job and career in the future	29%
4c.	To support further education in the fields of economics, science, or medicine	21%
4d.	Parents' demands and there are other answers	17%

Discussion

Influence of Teacher Role and Mathematics Content

Analysis of the questionnaire results (see Table 3) shows that the average scores of the teacher's role indicator achievement was at a high level. This means the teachers had an important role in the success of their student. However, the results of statistical analysis (see Table 7 and Figure 5) show that the role of the teacher partially had a direct and negative contribution to the level of mathematics anxiety and the student motivation. This means the teacher's role was not effective in motivating student but had the potential to increase students' mathematics anxiety.

Referring to the answers of the open questions about the role of teachers in learning, the results seemed to be very surprising to researchers. Most of the students stated that the teacher gave more exercises and tiring assignments, the mathematics learning was boring, the teacher paid less attention to the students' learning difficulties, the teacher demanded that the students improved, and the teacher rejected the student's failure. Responses (students) are related to the teacher's unpleasant teaching style and the way the students' performance was assessed (Rozgonjuk et al., 2020). The low competence of teachers in managing mathematics learning certainly hindered student learning progress to achieve it (Brewster & Miller, 2020; Finlayson, 2014). This situation of learning mathematics by teachers is a trigger for mathematics anxiety and hampers the knowledge construction process for students (Kusmaryono et al., 2021).

The mathematics content variable partially had direct and indirect effects on the level of mathematics anxiety and the student motivation (see Tables 6 and 7). This means that the content of mathematics was sufficient to be noticed by students in learning the subject. Result of answering open-ended questions shows, students liked math books accompanied with clear and contextual task instructions.

The results of the SEM analysis (see Figure 5) show that the teacher's role and mathematics content variables together had a significant effect on the level of mathematics anxiety. The findings of this study were strengthened by research which stated that the role of the teacher and the content of mathematics contributed significantly to the emergence of mathematics anxiety experienced by students (Shehayeb & Anouti, 2018; Zhang et al., 2019).

Effects of Mathematics Anxiety

The research data (see Table 3) shows that the average math anxiety score is in the high category. These results further strengthen the hypothesis that students with high academic achievement still have mathematics anxiety, in other words, it doesn't mean they don't have mathematics anxiety, in fact, there are some students who have high-level mathematics anxiety (Lai et al., 2015; Mutlu, 2019).

The findings (see Tables 6 and 7), indicate that the mathematics anxiety variable had a direct effect on the level of student motivation with a positive path coefficient. These data implied that the mathematics anxiety variable has a positive contribution to the motivation variable (Marticion, 2021) as is the substructure equation (2) (see Figure 5). In the case of this study, it was found that high levels of anxiety contributed to learning achievement, but at the same time learning motivation increased due to pressure from anxiety factors. In the case of students with low levels of anxiety, they experience a decrease in learning achievement because students feel they do not get a bigger challenge. In situations and conditions like this, it can be said that each individual has the characteristics of an optimal level of mathematics anxiety which is called positive anxiety (Al Majali, 2020). Positive anxiety is an anxiety situation (condition) in which self-development is needed to overcome the situation based on personal experience and resources.

Mathematics Anxiety Doesn't Always Have a Bad Effect

In the modern approach, mathematics anxiety is not considered a negative initial condition but is a signal of the student's inadequacy or unpreparedness to face the situation (Al Majali, 2020). In line with the substructure equation (2) (see Figure 5), mathematics anxiety is a predictor of strategies to increase learning motivation (Marticion, 2021). This condition is supported by the answers to open-ended questions where respondents (students) did positive things and did not avoid mathematics (see Table 8). For students, the teacher's demands for achievement were a challenge for them to learn independently.

Why do students with high levels of mathematics anxiety still excel?" the answer is because most of the respondents (students)were capable of managing the anxiety and turned it up into a positive stimulus (challenge and motivation for achievement) (Herges et al., 2017). When they were in a mathematics anxiety situation, they (students) did not give up and were capable of maintaining their spirit of learning. Therefore, they did not fail. They independently searched for more study resources, took small notes, and motivated themselves to successfully complete exams (final school exams). Based on the respondents' answers to the questionnaire (open questions) it can be interpreted that students had succeeded in deconstructing mathematics anxiety into learning motivation (Kusmaryono et al., 2020).

This study had the same variables that became the focus of previous research, namely mathematics anxiety, motivation, and learning achievement. Previous researchers had shown quantitatively that the negative influence of mathematics anxiety on motivation and learning achievement was undeniable. The higher the level of mathematics anxiety, the lesser the students' motivation and learning achievement will be (Brewster & Miller, 2020; Dowker et al., 2016; Irhamna et al., 2020; Lai et al., 2015; Musa & Maat, 2021; Olango, 2016; Prahmana et al., 2019; Rozgonjuk et al., 2020; Suren & Kandemir, 2020; Zhang et al., 2019). However, previous research has not explored the other side of student anxiety, especially in high achieving students.

The results of our study had a very significant difference in opinion from previous studies. We found that mathematics anxiety had been responded by the students with high achievement with positive reactions. Therefore, it did not interfere with cognitive function performance. For them, mathematical anxiety became a useful stimulus and challenge to solve problems (Ramirez, Shaw & Maloney, 2018). At the end, it can be concluded that mathematics anxiety did not always have a negative impact on student's motivation and learning achievement. This finding was evidence that the claim "mathematics anxiety had a negative impact on learning achievement" is a non-universal opinion.

Conclusion

This study concluded: (1) there was a significant direct effect between mathematics anxiety on students' learning motivation, and there was an indirect effect between the teacher's role and the mathematics content on learning motivation; (2) students were capable of managing mathematics anxiety when they were in optimal anxiety situations or positive anxiety. Therefore, they could change mathematics anxiety into a stimulus for achievement, while at the same time deconstructing anxiety into motivation according to experience and personal resources. Results of this study also confirmed that the statements "mathematics anxiety will always have a negative effect on students' motivation and learning achievement" is not universal, because mathematics anxiety based on the study does not always have a negative impact on students' motivation and learning achievement if it is managed effectively.

Recommendations

Suggestions for future research are (1) researchers can investigate other factors as variables that affect mathematics anxiety, such as self-confidence, so that teachers (researchers) will be able to control the influence of these factors in learning mathematics; (2) motivational factor is the main key to success in learning mathematics, therefore teachers must always motivate students so that they do not easily give up facing the difficulties and challenges of learning mathematics; (3) teachers must update the mathematics content according to the curriculum constantly by creating learning modules or math comic; (4) teachers must create a conducive, challenging, and meaningful learning atmosphere to increase students' learning motivation, for example, application of contextual teaching and learning-based learning approaches, realistic mathematics education, and outdoor mathematical learning; and (5) they (students) need more professional teachers who can teach well. Therefore, they will be guided to overcome difficulties they face. Teachers need to increase their involvement in mathematics classes by always being motivators and learning facilitators.

Limitation

The original MARS consisted of 98 items (Alexander & Martray, 1989), but in this study, the number of items in the MA questionnaire was only 40 items according to the indicator variable (a shortened MARS) so more items need to be developed. A larger number of MA items will increase internal consistency and convergent validity. The fact that there is no psychometrically perfect measure of MA for respondents aged 8 to 13 years (elementary school students) would make that almost impossible (Morgando et al., 2017), if you are uncomfortable then avoid respondents at that age. However, previous researchers have started using the MA questionnaire on respondents aged 8-13 years (Ramirez et al., 2013; Suren & Kandemir, 2020; Wu et al., 2012). Further research is needed by including other variables that are not well recorded in school data but may have an influence on the variables of mathematics anxiety and learning motivation.

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