

# Examining the Impact of Math Anxiety, Scaffolding, and Math Attitude on Working Memory: A Comparative Analysis between Islamic Boarding Schools and Public Schools

 Eka Fitria Ningsih<sup>1\*</sup>,  Catharina Asri Budiningsih<sup>1</sup>,  Sugiman<sup>1</sup>,  
 Tubagus Pamungkas<sup>2</sup>

<sup>1</sup> Universitas Negeri Yogyakarta, Indonesia

<sup>2</sup> Universitas Riau Kepulauan Batam, Indonesia

 [ekafitria.2019@student.uny.ac.id](mailto:ekafitria.2019@student.uny.ac.id)\*

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## Abstract

The goal of this research is to investigate models relating to psychological aspects of mathematics learning, such as math anxiety, scaffolding, math attitude, and working memory. This study included 548 junior high school students from public schools and Islamic boarding schools. The analytical method utilizes analysis of variance, bivariate product moment supported by SPSS, and Smart PLS 3 for path analysis. Model fit criteria (SMSR < .05; RMS Theta < .102; NFI > .9). The model fits based on the SRMR value .000 < .10 dan NFI 1 > .90. The findings show that students from public schools and Islamic boarding schools are different in terms of math anxiety, scaffolding and math attitude. Path analysis shows that math attitude mediates the interaction between math anxiety and scaffolding on working memory. Furthermore, scaffolding has a direct impact on working memory. The implications of the study's findings have been discussed in this article.

## INTRODUCTION

Math achievement remains a major problem, including those in Islamic schools in various countries (Soleymani & Rekabdar, 2010; Garkaz et al., 2011; Taleb & Hassanzadeh, 2015; Waheed & Mohamed, 2011; Driessen & Merry, 2006; Kane & Mertz, 2012). Math anxiety is one of the variables associated to the psychological aspects of learning that contribute to the achievement of learning mathematics (Huang et al., 2019; Demedts et al., 2022; Pantoja et al., 2020; Anghileri, 2006; Kusmaryono et al., 2020; Bryant et al., 2021) and math attitude (Belbase, 2010; Dowker et al., 2019). Math anxiety gives a negative impact on academic achievement. Anxiety is a type of worry and discomfort that occurs with learning mathematics. Math anxiety is associated with math attitude (Geary et al., 2019; Rice, 2019). High math anxiety encourages students to avoid mathematics.

Furthermore, there is significant relationship between scaffolding and math attitude (Bryant et al., 2016; Frederick et al., 2014). Scaffolding is a type of outside help that encourages kids to learn. Friends and teachers can offer aid in several ways. Secondary school pupils can benefit from scaffolding provided by their peers. Erikson's (1989) developmental theory states

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that junior high school students have a proclivity to share with their classmates, build learning communities, and have a high level of trust in their peers.

Indonesia is a country with a majority Muslim population. Islamic boarding schools in Indonesia started as a traditional education system in the field of religious studies. However, at this time the *pesantren* has developed into a modern educational institution that offers education at all levels including elementary school, junior high school, senior high school and college (Assa'idi, 2021). Students who live in Islamic boarding school-based schools not only study religion but also attend formal education. In contrast to public school students, they usually focus on formal education. Religious subject is also included in the curriculum content in public schools, but the time allocation is limited. As for mathematics, public and Islamic boarding schools have the same time allocation. However, public and Islamic boarding schools' mathematics achievement needs to be improved.

The environment has an impact on student learning achievement. Those who live in Islamic boarding schools have more learning activities than those who do not live in Islamic boarding schools. They must study religious knowledge (the Koran, al-hadith, books) and general knowledge (mathematics, science, languages). However, those who live in *pesantren* (Islamic boarding school) have friends who live together, so they can be used to studying together. It is certainly not experienced by students who do not live in the *pesantren*. After learning at school is over, they return to their homes. This different learning environment condition encourages the need to research psychological factors that impact students' learning achievement from each school.

## Literature Review

### ***The Relationship Between Math Attitude and Working Memory***

Working memory is defined as a brain system that offers temporary storage and can alter information required for complex cognitive activities such as language comprehension, learning, and reasoning (Baddeley, 1992). Researchs has been conducted on attitude and working memory among public high school pupils (Jung & Reid, 2009; Nazir, 2019). Another case, Dowker & Sheridan (2022) said that 40 on college students were researched, and it was discovered that attitude has a significant correlation to math ability. Chen et al. (2018) discovered that positive attitudes were linked to increased hippocampus activation. This explains how attitudes influence memory processes in mathematics A positive attitude towards mathematics will form good character, such as being diligent, persistent, and strict in dealing with things that interfere with learning activities.

This attitude certainly affects the cognitive work system. New knowledge will be easier to store in memory. A positive belief that mathematics is easy and useful can help students retain information about mathematical concepts. Students will carry out mathematical tasks

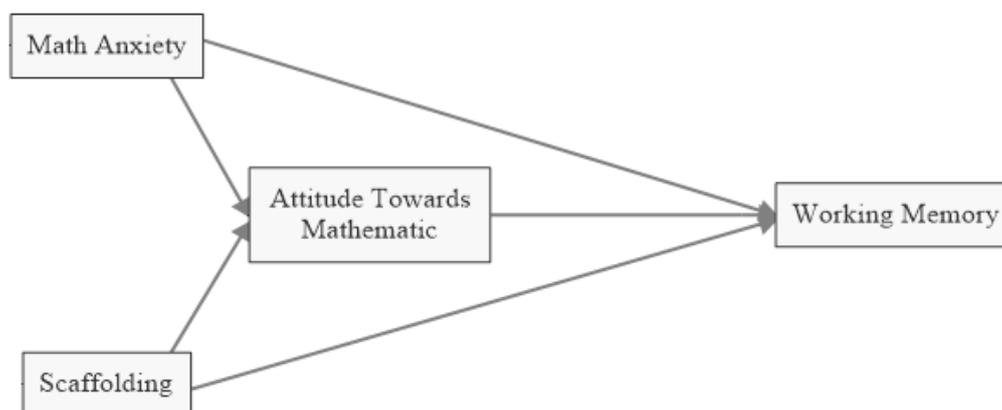


Figure 1. The study's theoretical framework

effectively by utilizing their knowledge. Nazir (2019) discovered that high school students (N = 1303) with great working memory had a good attitude toward mathematics. Despite the fact that attitude appears to have a direct or indirect association with working memory, earlier research was limited to pupils from public schools. As a result, it is unknown whether attitude influences working memory in Islamic boarding schools.

### ***The Relationship Between Math Anxiety, Math Attitude and Working Memory***

Working memory and math anxiety have been extensively researched. The study's findings show that high math anxiety negatively affects working memory performance (Klados et al., 2015; Pellizzoni et al., 2022; Ramirez et al., 2013). Another study, Caviola et al. (2022) found no significant relationship between math anxiety and working memory. The nature of the task influences the link between working memory and learning anxiety (Korem et al., 2022). Math anxiety, on the other hand, creates a negative attitude toward mathematics (Haciomeroglu, 2017). Math anxiety is a feeling of unease that leads to a bad attitude toward mathematics (Akin & Kurbanoglu, 2011). Poor attitudes about mathematics have an effect on their working memory (Jung & Reid, 2009). Students who experience math anxiety will tend to avoid mathematics. Even though they are following the lesson, they will need help concentrating while studying. It can make it challenging to receive and store information. High math anxiety can affect the memory performance system.

It has been claimed that math anxiety is linked to working memory (Ramirez et al., 2013). Math anxiety is a discomfort with the mathematics that encourages behavior to avoid mathematics. Of course, someone with high math anxiety will have a negative attitude toward mathematics. Mathematics is considered a difficult and frightening subject. However, attitude has an influence on one's working memory as well (Jung & Reid, 2009). At the same time, math anxiety and attitude are inversely related. Although math anxiety has a direct effect on working memory, there are several attitudinal factors that mitigate it. Working memory is linked to academic performance (Jung & Reid, 2009). According to research, there is a link between math attitude, math anxiety, and student performance (Casty et al., 2021). Assuming that working memory is related to student performance, there is a link between math anxiety, math attitude, and working memory. However, there may be other models for the exact link between the three variables.

### ***The Relationship Between Scaffolding, Mathematics Attitude and Working Memory***

Scaffolding is the role that adults play in assisting youngsters in completing problem-solving activities. McDonnell (2016) contends that instructors can give scaffolding in the form of assistance and encouragement. According to the theory, internal and extrinsic factors shape students' learning attitudes. We contend that scaffolding as an external incentive influences students' attitudes toward mathematics learning. For example, someone who is having problems learning receives assistance and encouragement from both friends and teachers. Because of the aid provided, students are not alone in their learning. Furthermore, this circumstance will inspire students to have a positive approach to mathematics study. Frederick et al. (2014) discovered a link between scaffolding and student attitudes. Research has shown that scaffolding affects students' academic achievement. Scaffolding has an effect on mathematical achievement. Bryant et al. (2016) shown that scaffolding interventions in learning resulted in a significant gain in mathematical performance. To date, little study has directly explored scaffolding, attitudes, and working memory. Tubagus (2022) research, to the best of our knowledge, demonstrates a link between attitude scaffolding and working memory.

### **The Learning Environment's Role**

The achievement disparity in mathematics attracts attention, particularly among pupils from Islamic schools. Islamic schools with extracurricular activities. Islamic boarding schools provide pupils with a learning atmosphere that includes both formal and non-formal curricula. Non-formal activities that increase religious understanding are prioritized for people who attend Islamic boarding schools. Pupils at Islamic boarding schools are divided into two groups: *kalong* (non-living) students and *mukim* (staying students) students. Mukim students' daily activities mainly consist of congregational prayer, learning the Qur'an, reciting the yellow book, official schooling, and a variety of extra-curricular activities (Srimulyani, 2007). Islamic boarding schools mix two curricula to provide students with more disciplines (Ngarifillaili et al., 2021).

Santri studying at Islamic boarding school must study Monotheism, Morals, Al-Qur'an and Al-Qur'an Science, Al Hadith and Hadith Science, Tafsir, Fiqh, Nahwu, Sharaf, Imla', and Aswaja (Huda et al., 2020). There are differences in conditions between students who attend Islamic schools and those who attend public schools. The mathematical curriculum in Islamic schools is identical to that in public schools, except they have less time given (Hendrayana et al., 2019; Yusuf, 2022). Rahman and Saleh, on the other hand, conducted research (N = 317) on students' performance in algebra content. The data suggest that students from Islamic boarding schools had the highest average score, followed by students from Islamic religious schools and national school pupils (Saleh & Rahman, 2016). This at least demonstrates that children from Islamic boarding schools perform good academically.

### **Rationale of the Study**

Various psychological factors have been studied as variables in some research. Learning attitudes about working memory and math anxiety (Ashcraft & Kirk, 2001; Pelegrina et al., 2020; Ramirez et al., 2013). The relationship between scaffolding and math attitude (Frederick et al., 2014). Math attitudes concerning working memory (Jung & Reid, 2009). This study investigates the interdependence of many parts of psychology in learning. The expert stressed that the learning system is influenced by a variety of factors, not just psychological ones. Learning environment (Nyroos et al., 2022; Wang et al., 2020; Skwarchuk et al., 2022) become one of the sociological elements of students that contribute to the achievement of learning mathematics.

Indonesia, as a culturally diverse country, offers a variety of school types, one of which is an Islamic boarding school (Suryadarma et al., 2006). Islamic schools contain curriculum content, which some students live in Islamic boarding schools while others do not. There has been research on the association of psychological aspects to achievement in studying mathematics in Islamic schools (Garkaz et al., 2011; Taleb & Hassanzadeh, 2015) but the majority of these studies have been conducted at the university level. Nobody has studied the effect of psychosocial factors on working memory in mathematics for junior school students in a Islamic boarding school learning environment. The research's results, both theoretical and practical, lead to the determination of mathematics learning planning in schools that consider on the learning environment of students, particularly those living in Islamic boarding schools.

### **Purpose of the Study**

The aim of this research is to determine whether: 1) there are differences in math anxiety, attitude, scaffolding, and working memory between student who attend Islamic boarding schools and public school; and 2) whether math attitude acts as a mediator between math anxiety, scaffolding and working memory.

Table 1. Demographic Data of Respondents

Demographic	N	Percentage
<i>Gender</i>		
Male	159	29%
Female	389	71%
<i>School type</i>		
Public School	147	26,82%
Islamic Boarding School	401	73,18%
<i>Grade</i>		
Seventh	146	26,65%
Eighth	312	56,93%
Nineth	90	16,42%
<i>Domicile</i>		
East Lampung	188	34,31%
Central Lampung	185	33,76%
Metro City	61	11,13%
North Lampung	36	6,56%
South Lampung	35	6,39%
Way Kanan	43	7,85%

## METHODS

### Research Design

This is a quantitative research design that includes path analysis. By including math attitude as a moderation variable, this study focuses on the relationship between the independent variables math anxiety and scaffolding and the dependent variable working memory.

### Participants

This research involved 548 junior high school students. For one week, students attend five hours of math classes (175 minutes). The average class size is between 25 and 30 people. The students were drawn from public schools (N = 147) as well as Islamic residential schools (N = 401). Students are coming from five different districts in Lampung province (table 1). Numeracy mastery is less than 50% of all students in Lampung province, according to the outcomes of national assessment, according to Table 1.

Students who come from Islamic boarding schools have two curricula that must be followed: Islamic boarding school curriculum and the formal school curriculum. Formal school activities are held in the morning until noon (07.00 am to 12.00 am). Mathematics is taught five hours of lessons for one week (175 minutes). While the other time is used for Islamic boarding school activities. Islamic boarding school activities include activities to read the Al Qur'an (morning and afternoon), read the *Alfiyah* book, study the book of *Riyadus sholihin* and read *wirdullatif*. At night the activity continues to recite the *diniyah* until 09.00 pm. At least in one day the time spent for formal schools is approximately 5 hours while for Islamic boarding schools it is approximately 10 hours.

### Instruments

The instrument in this study consisted of four questionnaires: math anxiety, scaffolding, math attitude, and working memory. These instruments were adapted from researchers whom Tubagus (2022) conducted. Furthermore, these instruments were rearranged according to the context of junior high school students.

### Math Anxiety

Yáñez-Marquina & Villardón-Gallego (2017) and Zakariya (2018) developed a math anxiety instrument. The instrument was adapted and translated into Indonesian by Tubagus

(2022). Learning anxiety was measured using a questionnaire of 12 items with a 5-point Likert scale. As an example of a question item, consider the following: *When I do math in front of the class, my body trembles*. Item validity was measured by correlating each score to the total score (bivariate Pearson). In this study, each correlated item ranged from .24 to .63 and was declared valid ( $r > .22$ ). In addition, this instrument was declared reliable (Cronbach alpha = .89) with a high category (Cronbach alpha  $> .80$ ). Thus, the instrument can be used to measure math anxiety.

### **Scaffolding**

Scaffolding in learning is interpreted as assistance given to students when they have difficulty solving problems. Help can come from friends, teachers, and technology (Bannert & Mengelkamp, 2013; Rojas-Drummond et al., 2013). Scaffolding instrument adapted from Tubagus (2022). Scaffolding was assessed using a 16-item questionnaire. A 5-point Likert scale is also used in this item. An example of an item in the questionnaire is: *When I cannot do the practice questions, a friend explains the first steps in working on a math problem*. Each item has a product-moment correlation between .26 to .66 and is declared valid ( $r > .22$ ). Each score is added to measure scaffolding. The instrument has moderate reliability and can be used to measure scaffolding (Cronbach alpha = .73).

### **Attitude Toward Mathematics**

Attitude toward mathematics is in the form of a student's emotional response in the form of a positive response or a negative response to everything related to learning mathematics (Akinsola & Olowojaiye, 2021; Eshun, 2006; Zan & Di Martino, 2008). The math attitude instrument was adapted from Tubagus (2022). The math attitude instrument consists of 15 questions on a 5-point Likert scale. The instrument comprises positive statements (9 items) and negative statements (6 items). Student responses to each item are summed and then used to measure math attitudes. Each item score is correlated with the total score to measure the item's validity. Each item ( $r$  between .39 to .62) in the instrument was declared valid ( $r > .22$ ), and the instrument had moderate reliability (Cronbach alpha = .77).

### **Working Memory**

Working memory in mathematics is a part of short-term memory capable of storing information (Ashcraft & Krause, 2007; Baddeley, 2019; Kane et al., 1999). The working memory instrument was adapted from Tubagus (2022). The working memory of the instrument contains 12 statements, 8 of which are positive and 4 of which are negative. Positive items are scored while negative items are scored in reverse. The score on each item is added up to measure working memory. Each item was declared valid (product correlation between .24 to .63), and the instrument was declared reliable (Cronbach alpha = .69). One of the items in the questionnaire about working memory is *"I can re-explain to my friends what the teacher has said"*.

### **Procedures**

The researcher first submitted a permit application to the school. After the school gave permission, the researcher consulted with the teacher about distributing the questionnaire. The sampling technique in this study used random cluster sampling. Random sample selection based on classes in each school. The students involved have expressed their willingness to fill out the questionnaire voluntarily by signing the agreement form.

Table 2. Mean Scores and Standard Deviations for Each Variables

Variable	School	N	M	SD	SE	Min	Max
Attitude toward mathematics	Public	147	45.38	6.09	.51	28	72
	Boarding	401	47.83	8.14	.41	15	75
	Total	548	47.17	7.72	.32	15	75
Working memory	Public	147	42.26	4.74	.39	28	56
	Boarding	401	43.18	5.36	.26	27	65
	Total	548	42.94	5.22	.22	27	65
Scaffolding	Public	147	49.93	6.56	.54	32	64
	Boarding	401	53.04	6.22	.31	32	75
	Total	548	52.21	6.45	.27	32	75
Math anxiety	Public	147	42.97	8.33	.68	13	55
	Boarding	401	36.28	11.01	.55	12	60
	Total	548	38.07	10.77	.46	12	60

The researchers worked with high school math teachers and Islamic boarding school administrators. The study was carried out during the even semester of the 2022/2023 academic year. The teacher shares the Google form link to students from public schools. In addition, numerous teachers used computer lab resources connected to the internet network to assist with questionnaire completion. While students in Islamic boarding schools are not permitted to use smartphones, researchers are supported by the boarding school administration by using numerous Islamic boarding school officials' cellphones to assist students in filling out the Google form link.

### Data Analysis

Descriptive analysis is used to describe each variable (table 2). This study examines differences in math anxiety, math attitude, scaffolding, and working memory among students who reside in Islamic boarding schools versus public school students using covariance analysis in IBM SPSS 24. The learning environment is included as a covariance since it influences the findings. Furthermore, IBM SPSS 24 was used to perform bivariate product moment analysis to assess the link between variables from each learning environment (Islamic boarding schools and public schools are analyzed separately). Finally, SmartPLS 3 path analysis was used to explore the impact of math anxiety, math attitude, and scaffolding on working memory. Students from public schools and Islamic boarding school are evaluated simultaneously in this section, can be seen in Table 2.

The average math anxiety of high school students is 38.07 (maximum score of 60), while for scaffolding, it is 52.21 (maximum score of 75). While the average for mathematical attitude is 47.17 and working memory is 42.94. The highest anxiety was experienced by students from Islamic boarding schools (score 60). Likewise, for math attitude (max score = 75), working memory (65), and scaffolding (75), the highest scores were owned by students from Islamic boarding schools.

## RESULTS AND DISCUSSION

### Results

#### *Learning Environment Differences for each Variable*

Table 3 present adjusted means and standard errors of math anxiety. Anova analysis was used to assess scaffolding and working memory dependent on learning environment.

Students from Islamic boarding schools ( $M = 36.3$ ;  $SE = .55$ ) have lower math anxiety than students public schools ( $M = 42.9$ ;  $SE = .68$ ). Furthermore, students who attend Islamic

Table 3. Adjusted means and standard errors of variables by Learning environment

Variabel	Islamic Boarding School (401)	Public school (147)	F	p
Math Anxiety	36.3 (.55)	42.9 (.68)	44.76	.000
Math Attitude	47.8 (.41)	45.1 (.57)	12.65	.000
Scaffolding	53.0 (.54)	49.9 (.54)	26.18	.000
Working Memory	43.2 (.27)	42.3 (.39)	3.38	.066

$P < .05$

Table 4. Pearson correlations between math anxiety, scaffolding, attitude toward mathematics, and working memory for public schools (above diagonal) and Islamic boarding schools (below diagonal)

Variable	Math Anxiety	Math Attitude	Scaffolding	Working Memory
Math Anxiety	-	-.376**	.518**	-.075
Math Attitude	-.412**	-	-.104	.485**
Scaffolding	.042	.204**	-	.168**
Working Memory	-.333**	.519**	.262**	-

\*\* $p < .001$

boarding schools have more positive math attitude ( $M = 47.8$ ;  $SE = .41$ ) than students who attend public schools ( $M = 45.1$ ;  $SE = .57$ ). Islamic boarding school students had greater scaffolding ( $M = 53.04$ ;  $SE = .54$ ) than public school students ( $M = 49.9$ ;  $SE = .54$ ). However, no significant difference in working memory between Islamic boarding school students and public school students.

#### **Correlations among Math Anxiety, Attitude, Scaffolding, and Working Memory**

Math anxiety shows negative correlation with math attitude (public school  $r = -.376$ ;  $p = .000$ ; Islamic boarding school  $r = -.412$ ;  $p = .000$ ). Math anxiety shows positive correlation with scaffolding in public schools ( $r = .518$ ;  $p = .000$ ), but no significant correlation in Islamic boarding schools. Math anxiety had a strong negative connection with working memory in

Table 5. Fitted direct and indirect effects for public school path models

	O	M	SD	T	P
<i>Direct Effect</i>					
Math Attitude -> Working Memory	.323	.318	.089	3.611	.000
Math Anxiety -> Math Attitude	-.554	-.554	.065	8.543	.000
Math Anxiety-> Working Memory	-.337	-.337	.071	4.736	.000
Scaffolding -> Math Attitude	.164	.163	.069	2.381	.018
Scaffolding -> Working Memory	.191	.194	.090	2.133	.033
<i>Indirect Effect</i>					
Math Anxiety -> Math Attitude -> Working Memory	-.179	-.177	.056	3.170	.002
Scaffolding -> Math Attitude -> Working Memory	.053	.051	.026	2.051	.041

Note: O = Original Sample

Table 6. Fitted direct and indirect effects for Islamic Boarding School Path models

	O	M	SD	T	P
<i>Direct Effect</i>					
Math Attitude -> Working Memory	.451	.455	.045	10.096	.000
Math Anxiety -> Math Attitude	-.347	-.348	.058	6.020	.000
Math Anxiety -> Working Memory	-.071	-.068	.046	1.551	.121
Scaffolding -> Math Attitude	.169	.173	.056	3.025	.003
Scaffolding -> Working Memory	.200	.198	.042	4.735	.000
<i>Indirect Effect</i>					
Math Anxiety -> Math Attitude -> Working Memory	-.190	-.191	.029	6.658	.000
Scaffolding -> Math Attitude -> Working Memory	.072	.074	.020	3.544	.000

Note: O = Original Sample

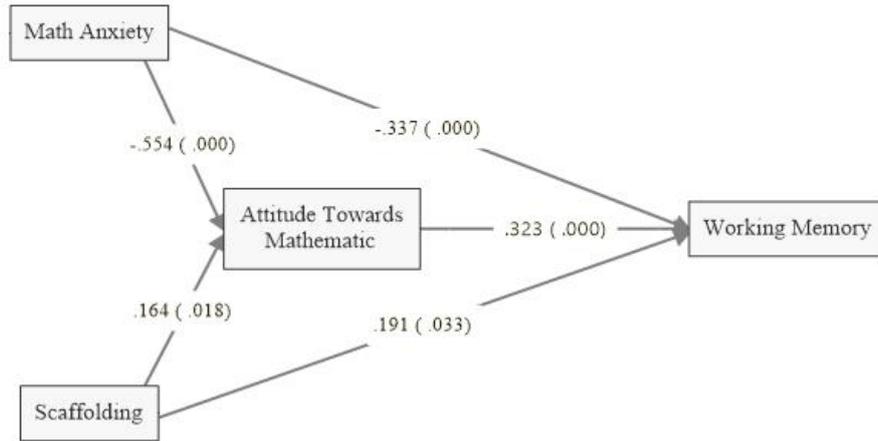


Figure 2. Testing of math attitude as a moderator between relationship among mathematics anxiety, scaffolding, and working memory in public schools

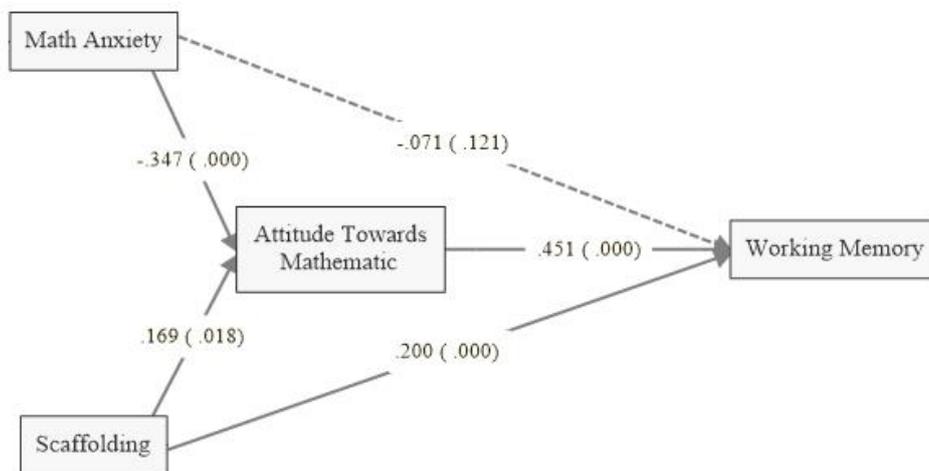


Figure 3. Testing of math attitude as a mediator between the relationship among math anxiety, scaffolding, and working memory in a Islamic boarding school.

Islamic boarding school pupils ( $r = -.33; p = .000$ ), in contrast to public schools. There was no significant correlation between attitude and scaffolding for public school students, but there was significant correlation between attitude and scaffolding for Islamic boarding school students ( $r = .204; p = .000$ ) There was no significant correlation between math attitude and scaffolding for public school students, but there was significant correlation between math attitude and scaffolding for Islamic boarding school students ( $r = .204; p = .000$ ), see Table 4.

**Path Analysis: Attitude as a Mediator**

The findings show that there is a significant direct relationship between attitude towards mathematics and working memory in both public and Islamic boarding schools, as well as a relationship between math anxiety and math attitude; scaffolding and math attitude; and scaffolding and working memory. Whereas in public schools, math anxiety has significant direct effect on working memory, it has no significant effect in Islamic boarding schools. Furthermore, the calculations demonstrate that math attitude is a mediator between math anxiety and working memory in both public and Islamic boarding schools, can see Table 5 and Table 6.

Math anxiety and math attitude have a significant impact on public schools, according to the F Square ( $F = .457$ ). The relationship between working memory and attitude toward mathematics is moderate ( $F = .115$ ). Math anxiety has a moderate impact on working memory ( $.128$ ). Working memory and scaffolding has low effect ( $.057$ ). R Square on mathematical attitude falls into the moderate category ( $R\text{ square} = .320$ ). This demonstrates that scaffolding and math anxiety have a 32% effect on math attitude. Meanwhile, the R square for working memory is in the moderate category ( $R\text{ square} = .377$ ), indicating that scaffolding, math anxiety, and math attitude have a moderate effect on working memory (37.7%).

In Islamic boarding schools, F square math anxiety and attitude toward mathematics have a moderate impact ( $F = .134$ ). The effect of math attitude on working memory is moderate ( $F = .247$ ). Math anxiety to working memory has no significant effect ( $F = .006$ ). Math attitude has a weak category for R square ( $R\text{ square} = .125$ ). This demonstrates that Islamic boarding schools in scaffolding and math anxiety have a smaller influence (12.5%) than public schools (32%). R square in working memory is in the moderate category ( $R\text{ square} = .279$ ). Although scaffolding, math anxiety, and math attitude have a moderate effect in public schools and Islamic boarding schools, the three variables (scaffolding, math anxiety, and math attitude) have a bigger influence (37.7%) in public schools than in Islamic boarding schools (32%). The results of the path analysis for the two groups demonstrate that it has an effect on math anxiety for working memory for public schools but not for Islamic boarding schools. Math anxiety has no significant effect on working memory.

#### **Path Analysis Results: Alternative Models**

The SMSR model fit criteria must be smaller than .05 (Cangur and Ercan, 2015). RMS Theta or Root Mean Square Theta value .102; SRMR value or Standardized Root Mean Square .10 or .08; and NFI value  $> .90$  are the model fit requirements. Based on the model criteria, the value of RMS Theta or Root Mean Square Theta  $.321 > .102$  does not match the fit model criteria. However, based on the SRMR or Standardized Root Mean Square Value, the value is  $.000 < .10$  and NFI  $1 > .90$ , the model is fit based on these two criteria. As a result, we can conclude that the model fits the data.

#### **Discussion**

##### ***Learning Environment Comparison in Math Anxiety, Scaffolding, Math Attitude, and Working Memory***

Previous research has shown that the Islamic boarding school atmosphere has more activities than public schools since it offers two curriculum (Ngarifillaili et al., 2021). Specifically, the school curriculum and religion. There are additional didactic difficulties in studying mathematics for students who come from Islamic boarding schools (Hendrayana et al., 2019; Yusuf, 2022) According to the study findings, pupils who attend Islamic boarding schools had lower levels of math anxiety than those who attend public schools. Similarly to math attitudes and scaffolding, students from Islamic boarding schools have a favorable attitude toward mathematics and value the use of scaffolding in learning mathematics. Students' psychological conditions are influenced by differences in their surrounding conditions. The Islamic boarding school atmosphere instills a positive attitude in students. Parents' primary purpose in sending their children to Islamic boarding schools is to increase their children's religious knowledge, so it is understandable that they feel stressed in the field of general studies.

The research findings demonstrate that pupils from the Islamic boarding school and those from public school have the same working memory capacities. This at least demonstrates that, despite low math anxiety levels, optimistic attitudes, and scaffolding support for students from Islamic boarding schools had no substantial impact on their working memory system. This is supposed to develop due to the burden of religious and general topic matter that must be studied

concurrently. Islamic boarding schools mix two curricula to provide students with more disciplines (Ngarifillaili et al., 2021). Student must study Morals, Al-Qur'an, Al Hadith (Huda et al., 2020). This finding shows that the positive attitude and scaffolding given for Islamic boarding school students are not relevant to the field of mathematics. A positive attitude in learning mathematics comes from the obedience of students towards their teacher (*kyai*) and the intensity of encouragement that is not specific about mathematics. This is why this variable has no impact on working memory systems. According to research (Saleh & Rahman, 2016) Islamic boarding school pupils are better at algebra. This finding surely inspires educators to further reformulate learning in order to maximize the potential of pupils, particularly those in Islamic boarding schools.

### ***Correlation among Math Anxiety, Scaffolding, Math Attitude and Working Memory***

A major finding in this study is a high impact between math anxiety, scaffolding, math attitude and working memory in students from both public and Islamic boarding schools. Students with low math anxiety will have a favorable attitude toward mathematics, which will influence the working memory system. This relates to Haciomeroglu's presentation that excessive learning anxiety generates a negative attitude (Akin & Kurbanoglu, 2011) toward mathematics (Haciomeroglu, 2017). Negative attitudes about mathematics have an effect on their working memory system (Jung & Reid, 2009). Previous research has found that high levels of arithmetic anxiety have a poor impact on working memory performance (Klados et al., 2015; Pellizzoni et al., 2022; Ramirez et al., 2013). This study's findings reflect previous research findings that there is a significant correlation between math anxiety and working memory in public schools. However, the findings of this study suggest that math anxiety has no direct effect on working memory in Islamic boarding schools. However, math anxiety is mediated by math attitude, which impacts on working memory. The outcomes of this study are consistent with Caviola's findings (Caviola et al., 2022) which claimed that there was no significant correlation between math anxiety and working memory.

The next finding shows that there is a significant correlation between scaffolding, math attitudes, and working memory in students from public schools and Islamic boarding schools. Although researchers in this situation are confined to research results that show a relationship between scaffolding and working memory, there are research results that suggest scaffolding has an impact on mathematical achievement (B. R. Bryant et al., 2016). At least, the findings of this study suggest that working memory is related to student performance. Scaffolding is important for learning mathematics, especially for supporting working memory systems.

### **Implications**

Research results have shown that mathematical attitudes and scaffolding directly impact students' cognition. For educational psychologists who design mathematics learning, it is necessary to consider what forms of counseling can be given to students. Especially for students from Islamic boarding schools, providing appropriate assistance has a high potential to improve students' cognitive systems. Math teachers and school counselors can provide math counseling services. The following are forms of counseling that can be given (adapted from Knowles (2004) and Furner (2017)).

### ***Mathematics Mental Health Diagnostics***

Diagnosis of Mental health math, specifically math anxiety. A math teacher needs to have data about how the level of math anxiety experienced by their students. The results of this diagnosis will be a reference for teachers to provide interventions relevant to students' conditions. Reducing math anxiety can be done through guidance sessions with teachers and counselors. Students with high math anxiety are allowed to share their experiences or feelings

about mathematics in the past. In this counseling session, students can express their feelings about mathematics using the College Learning Metaphor Survey (Example: *if mathematics were a color what color would it be? If mathematics were an animal, what would it be?*). The math teacher and students then have a casual discussion discussing how the ideal math class is. After that, a self-talk session to develop positive thinking about learning mathematics. Math teachers can use someone's story of success in math as a relaxation technique. Students can be tasked with making a simple interesting song about something they like in mathematics. Teachers can set up a "math feeling journal" to monitor and manage math anxiety.

### **Mathematical Cognitive Diagnostics**

Diagnosing students' mathematical abilities regarding geometry and algebra can be used to map students' mathematical difficulties. School counselors can provide cognitive test services and discuss the result with the mathematics teacher. In addition, the mathematics teacher can use the results of mathematics achievement during learning to determine who needs help and what assistance is needed.

### **Constructivist Teaching of Mathematics**

Constructive mathematics learning will encourage students to give the correct answer. Instead, learning focuses on the process of doing mathematics. Students are involved in mathematical activities that can encourage them to work harder. Students from Islamic boarding schools live together with peers so that teachers can maximize peer assistance. Teachers can give assignments that involve group discussions outside of class hours. During learning, the teacher can provide scaffolding using the probing questioning technique. Students are involved in mathematical communication activities with dialogues that pay attention to socio-mathematics norms. Mathematical problems must be designed considering contextual problems, for example, through cultural contexts, to make students feel valued.

### **Limitations and suggestions**

This research involved students from the junior high school level who came from public schools and Islamic boarding schools. When choosing the sample, the researcher distinguished between pupils who attended Islamic boarding schools and those who did not attend Islamic boarding schools. Of course, these limitations encourage future research to focus on characteristics of students' mathematical competence. More research is needed that focuses at similar issues while also considering students' abilities into considerations. The following drawback is that the working memory instruments still only support elements of simple concepts and operations. The instrument's assertions do not accommodate applicative characteristics that necessitate a more complicated work system. In reality, understanding mathematics entails this as well.

## **CONCLUSION**

The findings of this study contribute to a number of elements that influence students' learning of mathematics and working memory, including math anxiety, scaffolding and math attitude components in junior high school students. This study also compares math anxiety, scaffolding, math attitude and working memory to pupils from public and Islamic boarding schools. Students who attend Islamic boarding schools have lower math anxiety, higher math attitude, and better scaffolding than students who attend public schools. Previous research has focused on the influence of math anxiety on math attitude. This study extends the research by investigating the impact of math anxiety on working memory using math attitude as a moderate variable. The data show that in Islamic Boarding-based schools, math anxiety has an indirect

impact on working memory that is mediated by math attitude. Furthermore, scaffolding has a significant impact on working memory.

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## AUTHOR CONTRIBUTION STATEMENT

EFN, CAB, and SS contributed to concept preparation and study design. EFN performed data collection. The data analysis section was carried out jointly by EFN and TP. The draft of the article was written by EFN, which was then reviewed again by SS and CAB. All authors contributed and provided feedback on this article.

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