Jurnal Elemen, 9(1), 256-270, January 2023
https:/doi.org/10.29408/jel.v9i1.6971

e- ISSN: 2442 - 4226

Gender differences in mathematics anxiety and learning motivation of students during the COVID-19

Syafika Ulfah [*], Rizka Akmalia, Hella Jusra

Department of Mathematics Education, Universitas Muhammadiyah Prof. DR. HAMKA, DKI Jakarta, Indonesia

[*] Correspondence: syafika.ulfah@uhamka.ac.id

Abstract

The COVID-19 pandemic is causing a change in the field of education, where learning is currently becoming online. It affects the psychology of the students. This study aimed to analyze the mathematics anxiety and learning motivation of secondary students based on gender during the pandemic. This study was quantitative research. The participants in this study were 451 eighth-grade students of State Secondary School in South Jakarta. The instrument used was a questionnaire. It consisted of 45 statements belonging to 22 items on mathematics anxiety and 23 items on student learning motivation. The data analysis applied was descriptive, Mann-Whitney test, and correlation analysis. The results found that students' mathematics anxiety during the COVID-19 pandemic was moderate. Meanwhile, students' learning motivation was in the high category. In addition, there were significant differences in mathematics anxiety levels between male and female students. However, there was no significant difference in the motivation of learning mathematics students. The correlation between mathematics anxiety and learning motivation indicated a negative relationship.

Keywords: COVID-19; gender; learning motivation; mathematics anxiety

How to cite: Ulfah, S., Akmalia, R., & Jusra, H. (2023). Gender differences in mathematics anxiety and learning motivation of students during the COVID-19. *Jurnal Elemen, 9*(1), 256-270. https://doi.org/10.29408/jel.v9i1.6971

Received: 6 November 2022 | Revised: 20 November 2022
Accepted: 23 November 2022 | Published: 2 January 2023

Introduction

The emergence of Coronavirus Disease (COVID-19) causes an alteration in the education system (Syauqi et al., 2020). The virus spreads quickly and has become a global epidemic (Fitria & Ifdil, 2020). It can provide pressure on the individual and society (Choi et al., 2020). As Zhang et al. (2020) stated, this pandemic reduces sleep quality, increasing anxiety and stress. It reconstructs the education system from learning face-to-face at school to learning from home through online learning. It brings new challenges for all educational institutions. The entire series of instructions have moved into the house, and all exercises have been converted into homework. As a result, students must become accustomed to online learning.

However, a study of 238 college students found that 52.5 percent of the participants disliked studying online since they could not talk to the teacher directly and freely and also had much homework (Hermanto et al., 2021). Students are concerned about the new education system because the materials or tasks assigned would be challenging to comprehend, particularly in mathematics. Students are becoming increasingly anxious due to this learning system (Christiansen, 2021). It can impact their mental health (Mendoza et al., 2021). students' anxiety in mathematics can begin in elementary and junior high schools (Zakaria & Nordin, 2008). When a fear of mathematics emerges in elementary school, it will carry over to the next level of education. Students learning outcomes could be harmed by mathematics anxiety (Devine et al., 2012; Erdoğan et al., 2020; Kesici & Erdogan, 2010). According to study of Keshavarzi and Ahmadi (2013), students' learning outcomes tend to decrease when anxious. While another study said that students with little or no mathematical anxiety perform better than students with mathematical anxiety (Tapia & Marsh, 2004). Furthermore, the students' mathematical performance is influenced by his/her motivation to learn mathematics (Albool, 2012; Tapia & Marsh, 2004; Zakaria & Nordin, 2008).

Motivation can be classified into two types: intrinsic and extrinsic factors. Intrinsic factors exist within the student, whereas extrinsic factors come from parents, teachers, and the surrounding environment (Sengodan & Iksan, 2012). The motivation provided by the teachers has a significant impact on student's learning desires. Self-motivation is also critical; if students are not interested in and enjoy learning, they will tend to disregard it. Furthermore, Hidi and Harackiewicz asserted that as children grow older, their interests in learning, particularly mathematics, fade away (Otoo et al., 2018).

In addition, Suren and Kandemir (2020) revealed that gender differences could also influence learning outcomes. Leder and Forgasz (2002) showed that boys did not comprehend mathematics subject. While Keshavarzi and Ahmadi (2013) found contrasting phenomena, half of the male students in their research said they loved mathematics and performed better in math than the other subjects. It is supported by Tapia and Marsh (2004), which found that gender influences students' motivation and level of mathematical anxiety. It implies that people's cognitive and learning psychology can depend on their sexes. As a result, boys and girls learn mathematics in very different ways depending on their personalities. Since the 1970s, researchers have been studying the relationship between mathematics learning and gender and

found that men are better suited to mathematics than women, according to history (Leder & Forgasz, 2002).

Research on mathematics anxiety and learning motivation based on gender is not new. It is yet unanswered, however, on that study during the COVID-19 pandemic as it took place for the first time. Based on the background above, this study aims to analyze the anxiety of mathematics and motivation to learn mathematics based on gender during the COVID-19 pandemic.

Methods

The research was quantitative. The data collection for this study employed a survey method by using a questionnaire with a 5-point Likert scale. The questionnaire was adopted from Suren and Kandemir (2020). It was classified into two parts: assessing for mathematics anxiety and learning motivation toward mathematics. There were 22 items in the section on mathematics anxiety. It was broken down into five indicators which were attitude (4 statements), confidence (5 statements), mathematics content knowledge (4 statements), learning activities (4 statements), and examination (5 statements). Respondents could select one out of five answers, including never anxious (1), a little anxious (2), occasionally anxious (3), frequently anxious (4), and very anxious (5).

For the students' learning motivational section, there were 23 statements. All of these were divided into five indicators. They were intrinsic goal orientation (3 statements), extrinsic goal orientation (4 statements), task value (5 statements), beliefs (5 statements), and self-efficacy (6 statements). Respondents could select one of five answer options, including strongly disagree (1), disagree (2), neutral (3), agree (4), and strongly agree (5). Table 1 shows the questionnaire interpretation of mathematics anxiety and motivation to learn mathematics (Suren & Kandemir, 2020).

Table 1. Questionnaire interpretation

Mean	Interpretation
1.00 - 1.79	Very Low
1.80 - 2.59	Low
2.60 - 3.39	Moderate
3.40 - 4.19	High
4.20 - 5.00	Very high

Regardless, the researchers modified these instruments to fit the current COVID-19 pandemic learning condition. Before being distributed, the questionnaire was translated into Bahasa Indonesia and validated by one mathematics expert and a linguist. Improvisation was carried out in several items as per the validators' suggestions. After adjustment, the instrument was compiled in Google Forms and distributed online to schools. At the same time, the reliability analysis used Cronbach's Alpha. It was obtained at .907 for the mathematics anxiety questionnaire and .913 for the learning motivation questionnaire, belonging to the high and very high categories, respectively.

Participants in this study were eighth-grade students from secondary state schools in Southern Jakarta during the 2020/2021 academic year. The researchers were not able to obtain the exact number of eighth-grade students. According to Statistics Indonesia, the number of secondary students studying at state schools in Southern Jakarta is 50,206 during the 2020/2021 academic year (BPS, 2020). Therefore, the researchers approximated the number of eighth-grade students by dividing it into three secondary school degrees in Indonesia. To acquire a minimum sample size of them, Nevitte Cowan's Estok formula was applied (Karami, 2018).

$$n = \frac{Z_{\frac{\alpha}{2}}{}^2[P(1-P)]N}{Z_{\frac{\alpha}{2}}{}^2[P(1-P)] + (N-1)E^2}$$

With population number of eight-grade students (N) was approximated to be 16,736; the standard value of the normal distribution $(Z_{\frac{\alpha}{2}})$ was 1.96 at the .05 significance level; and the proportion of population (P) was .3333 with bound of error (E) .05. Hence, a minimum sample size (n) of 335 was required to gain a portraying the population.

Simple random sampling was applied as a sampling technique. From 11th February 2021 to 27th March 2021, 508 students completed the online questionnaire. The sorting data was then carried out to exclude the invalid data. It was discovered that students filled out the questionnaire more than once, and some needed to complete the identity as directed. The sorting result displayed 451 students involved in this study. Table 2 shows the percentages of male and female students.

Table 2. Sample count and percentage

Gender	N	%
Male (m)	187	41.46
Female (f)	264	58.54
Total	451	100

This study's data analysis included a descriptive, the Mann-Whitney test, and correlation analysis. The descriptive was used to assess students' mathematics anxiety and motivation levels. It displayed each item's mean score, skewness, and kurtosis values. The Mann-Whitney test showed the differences between the two data groups, which were normally not distributed either or both. Following a prerequisite test and obtaining data that were not normally distributed, a non-parametric test, the Mann-Whitney test, was performed in this study.

The Mann-Whitney test was applied to examine the differences between mathematics anxiety and students' motivation based on gender. Correlation analysis was used to determine the association between mathematics anxiety and students' motivation. It also revealed whether there was a strong relationship between mathematics anxiety and students' learning motivation. The correlation value has a value between -1 and 1. Correlation between variables is considered strong when the value of correlation (r) approaches 1 or -1, while the correlation will be weaker when the value of r is close to 0 (Susanto, 2018). If the calculation result is obtained $r_{count} > r_{table}$, then mathematics anxiety and learning motivation are considered to have a linkage, whereas if the results $r_{count} < r_{table}$ then the mathematics anxiety and motivation of students are considered to have no linkage (Yudihartanti, 2018). If the correlation value is negative, the

two variables have an inversely proportional relationship (Susanto, 2018). It means that the higher the student's mathematics anxiety score, the smaller the motivational score would be. All data analysis in this study was calculated using Microsoft Excel 2016 software.

Results

This study focuses on the gender-based variables of mathematics anxiety and motivation to learn mathematics. The following sections explain the findings and discussions.

Descriptive analysis

Statistical analysis of the data set determined the level of mathematics anxiety. Table 3 displays each item's descriptive analysis results of the mathematics anxiety questionnaire.

Table 3. Descriptive analysis of mathematics anxiety

Item	Statement	Gender	$\bar{x}$	Skewness	Kurtosis
1	When a mathematics teacher sends you a link to an online math class.	m	2.04	.83	.06
		f	2.03	.70	-.30
2	On the first day of school, I see new math book.	m	1.88	1.28	.94
		f	1.93	1.16	.53
3	When I grab a mathematics notebook.	m	1.61	1.68	2.89
		f	1.70	1.63	2.01
4	When having discussions about mathematics.	m	2.28	.73	-.22
		f	2.54	.45	-.45
5	When I tell my classmates about my mathematical abilities.	m	2.51	.42	-.82
		f	2.57	.40	-.95
6	When listening to a mathematics teacher's voice through a laptop or mobile speaker while participating in online learning.	m	1.87	1.30	.86
		f	2.04	1.01	.02
7	When the teacher inquiries about math lessons or problems.	m	2.82	.21	-.80
		f	3.33	-.07	-1.09
8	During online learning, I am asked to explain mathematics problems directly.	m	3.45	-.44	-.95
		f	3.70	-.50	-.89
9	When someone inquires me about mathematics.	m	2.61	.24	-.81
		f	2.82	.25	-.88
10	When I look at the mathematics problem of geometric shapes.	m	2.58	.37	-.82
		f	2.82	.32	-.74
11	When I look at the graphs in the mathematics book.	m	2.35	.53	-.53
		f	2.53	.57	-.32
12	When I see a page containing mathematical rules.	m	2.25	.58	-.47
		f	2.34	.76	-.29
13	When I look at the page with mathematical formulas.	m	2.32	.56	-.40
		f	2.60	.41	-.96
14	When I am unable to solve a mathematical problem.	m	3.71	-.65	-.61
		f	4.18	-1.05	.04
15	When I am stuck on math problems and do not know where to begin.	m	3.31	-.17	-.95
		f	3.59	-.28	-.93
16	When I am unable to recall the mathematics material that I have learned.	m	3.74	-.59	-.51
		f	3.94	-.74	-.54

Item	Statement	Gender	$\bar{x}$	Skewness	Kurtosis
17	When I am unable to comprehend the materials taught during online learning.	m	3.59	-.43	-.79
		f	3.86	-.68	-.71
18	Once the date of the mathematics exam has been set.	m	2.72	.37	-.92
		f	3.07	.00	-1.16
19	When I see a mathematics question in an exam.	m	2.75	.28	-.91
		f	3.01	.11	-.90
20	When I practice answering math problems before exams.	m	2.03	.90	.15
		f	2.28	.67	-.37
21	When the results of the mathematics exam are announced.	m	3.40	-.31	-1.19
		f	3.86	-.69	-.73
22	When my parents find out my mathematics test scores are low.	m	3.93	-.95	-.40
		f	3.99	-1.04	-.17
MA. Overall	Overall Mathematics Anxiety	m	2.72	.29	-1.12
		f	2.93	.12	-1.26

Item no 22 had the highest mean score for male students' ($\bar{x} = 3.93$) referring to Table 3. It was stated that "when my parents found out my mathematics test scores" which fell into the high mathematics anxiety category as seen in Table 2. This category is similar among the highest mean score female students ($\bar{x} = 4.18$) but the item was "when I am unable to solve a mathematical problem". Overall, the mathematics anxiety during the pandemic show that female students ($\bar{x} = 2.93$) were more anxious than male students ($\bar{x} = 2.72$). The level of math anxiety for both genders, however, was moderate.

Table 4 shows the descriptive analysis results of learning motivation of eighth-grade students in South Jakarta.

Table 4. Descriptive analysis of learning motivation

Item	Statement	Gender	$\bar{x}$	Skewness	Kurtosis
1	I love learning topics I like in mathematics lessons, even though they are difficult.	m	3.29	.04	-.41
		f	3.52	-.08	-.18
2	Learning mathematics makes me very happy	m	3.01	.05	.09
		f	2.98	-.15	.33
3	I do mathematics homework to get knowledge not just for good grades	m	3.92	-.71	.00
		f	4.06	-.68	-.26
4	I love getting good grades in mathematics lessons	m	4.50	-1.94	4.27
		f	4.77	-3.02	12.58
5	I want to get a good test score	m	4.67	-2.86	9.48
		f	4.86	-2.90	8.22
6	I want to get higher mathematics scores than my friends	m	4.40	-1.58	2.09
		f	4.56	-1.72	2.56
7	I want to show my friends and family that I can succeed in mathematics lessons	m	4.23	-1.29	1.40
		f	4.54	-1.92	3.73
8	I can apply mathematics to other lessons	m	3.50	-.18	-.42
		f	3.64	.03	-.65
9	For me, mathematics is important to learn	m	3.81	-.56	-.14
		f	4.05	-.70	.55
10	Mathematics lessons caught my attention	m	3.17	-.22	.03
		f	3.15	.02	.15
11	Mathematics lessons are very useful for me	m	3.71	-.38	.01

Item	Statement	Gender	$\bar{x}$	Skewness	Kurtosis
		f	3.80	-.31	-.28
12	I love mathematics lessons	m	3.06	-.04	-.18
		f	3.05	-.05	.03
13	Understanding mathematics lessons is very	m	3.71	-.38	-.21
	important to me	f	3.89	-.43	-.13
14	If I learn well, I can sure understand	m	4.38	-1.59	3.10
	mathematics	f	4.49	-1.27	1.39
15	I realize if I fail the mathematics lesson, then	m	4.12	-.81	.22
	it is my fault	f	4.12	-.89	.90
16	If I study seriously, I am sure I can	m	4.43	-1.70	3.40
	understand mathematics	f	4.56	-1.50	3.02
17	If I do not understand mathematics subjects,	m	4.03	-.71	-.16
	this is because I do not learn seriously	f	4.08	-.98	.95
18	If I study mathematics, then I get good grades	m	4.24	-1.30	2.10
		f	4.20	-.55	-.82
19	I can understand mathematics subjects even	m	2.99	.12	-.40
	the most difficult topics	f	2.77	.23	.06
20	I can understand the lessons taught in	m	3.44	-.05	-.25
	mathematics lessons	f	3.21	-.12	.24
21	I can understand the most difficult	m	2.87	.06	-.39
	mathematics lessons described by teachers in the classroom	f	2.69	.10	-.10
22	I will get high scores for assignments and	m	3.78	-.15	-.44
	mathematics exams	f	3.81	-.35	-.45
23	I will succeed in mathematics lessons	m	3.85	-.57	-.11
		f	4.09	-.36	-1.09
Mo.	Overall Learning Motivation	m	3.79	-.57	-.37
Overall		f	3.89	-.61	-.33

According to the Table 4, both genders had highest mean score (male $\bar{x} = 4.67$; female ($\bar{x} = 4.86$) in the same item which was "I want to get a good test score". Based on Table 1, this corresponded to a very high level of learning motivation. As we can see for all indicators, students were eager to learn mathematics. Overall, female students ($\bar{x} = 3.89$) were more encouraged than male students ($\bar{x} = 3.79$) to learn mathematics during the pandemic.

Normality test

Kim (2013) stated that skewness and kurtosis are an alternative way determining the normality test when the number of data is large ($N > 300$). Hence, according to Table 3 and Table 4, it can be seen that the data was not normally distributed. The data is said to be normal if skewness and kurtosis scores are in the range of ±2 (Suren & Kandemir, 2020). Therefore, a non-parametric test, the Mann-Whitney test, was employed instead of a t-test as a parametric test.

Mann-Whitney test

The Mann-Whitney rank test aims to examine the similarity of two independent populations (Yanti, 2007). In this study, the Mann-Whitney test was conducted to determine whether there were differences in students' mathematics anxiety and learning motivation level based on gender by perceiving the indicators of each variable. The results of the Mann-Whitney test calculation using a two parties test and a significance level of .05 obtained a value of $z_{table} = z_{0.5(1-0.05)} = z_{0.0475} = 1.96$ are listed in Table 5.

Table 5. Mann-Whitney test

Indicators	Gender	N	$\bar{x}$	z
Attitude	m	187	1.95	-1.35
	f	264	2.05	
Confidence	m	187	2.65	-2.49
	f	264	2.89	
Mathematics Content Knowledge	m	187	2.38	-1.84
	f	264	2.57	
Learning Activities	m	187	3.59	-3.28
	f	264	3.89	
Examination	m	187	2.97	-2.93
	f	264	3.24	
Overall Mathematics Anxiety	m	187	2.72	-2.90
	f	264	2.93	
Intrinsic Purpose Orientation	m	187	3.41	-1.92
	f	264	3.52	
Extrinsic Purpose Orientation	m	187	4.45	-3.82
	f	264	4.68	
Task Value	m	187	3.45	-1.54
	f	264	3.54	
Beliefs	m	187	4.13	-1.11
	f	264	4.23	
Self-Efficacy	m	187	3.53	1.04
	f	264	3.46	
Overall Learning Motivation	m	187	3.79	-1.46
	f	264	3.89	

According to Sundayana (2014) H_0's acceptance criteria are $-z_{table} < z_{count} < z_{table}$. Based on Table 5, in the results of mathematics anxiety on attitude indicators (z_{count} = -1.35) and knowledge of mathematics content (z_{count} = -1.84), there were no significant differences from mathematics anxiety between male and female students. Meanwhile, in the indicators of confidence (z_{count} = -2.49), learning activities (z_{count} = -3.28) and exams (z_{count} = -2.93), there were significant differences. The calculation results for the overall mathematics anxiety (z_{count} = -2.90) showed that there was a significant difference in mathematics anxiety between male and female students.

The calculation results in Table 5 for learning motivation on extrinsic goal orientation indicators (z_{count} = -3.82) demonstrated that there were significant differences in the motivation of learning mathematics between male and female students. In the meantime, in the

intrinsic goal orientation indicator (z_{count} = -1.92), task value (z_{count} = -1.54), beliefs (z_{count} = -1.11), and self-efficacy (z_{count} = 1.04), there was no significant difference in the motivation of learning mathematics between male and female students. In the calculation results for the overall motivation of learning mathematics z_{count} = -1.46, it was demonstrated that there was no significant difference in the motivation of learning mathematics between male and female students.

Correlation analysis

The connection between mathematics anxiety and motivation to learn mathematics was identified using Person Product Moment correlation analysis. A Pearson Product Moment coefficient (r_{count}) represents the strength of both variables when likened to an r_{table}. The $r_{table} = .09$ was obtained with a significance level of $.05$ and the number of samples was (N) 451. The results of the correlation analysis computation are seen in Table 6, with each indicator written using an abbreviation in the first two words.

Table 6. Correlation between mathematics anxiety and mathematics learning motivation

Indicator	MA. A	MA. C	MA. MCK	MA. LA	MA. E	MA. Overall
Mo. In	-.28	-.38	-.33	-.11	-.25	-.32
Mo. Ex	.04	.06	.04	.22	.13	.12
Mo. TV	-.24	-.33	-.30	-.08	-.20	-.28
Mo. B	-.10	-.12	-.12	.11	-.01	-.06
Mo. SE	-.28	-.33	-.30	-.11	-.20	-.29
Mo. Overall	-.23	-.30	-.27	-.01	-.15	-.23

When the absolute value of $r_{count} > r_{table}$, then the variables correlate. The direction of the connection between variables was indicated by the sign of positive and negative. Table 7 explains how to interpret correlation coefficient values (Nikmatun & Waspada, 2019).

Table 7. Interpretation of correlation coefficient values

Correlation Coefficient Interval	Correlation Level
.00 - .19	Very Low
.20 - .39	Low
.40 - .59	Medium
.60 - .79	Strong
.80 - 1.00	Very Strong

Table 6 shows that the indicator of attitude had a negative correlation with all indicators of mathematics learning motivation, with the exception of extrinsic goal orientation, which did not correlate ($r_{count} = .04$). This implies that when students exhibit more anxiety through gestures, their eagerness to learn mathematics in terms of intrinsic goal orientation, task value, beliefs, and self-efficacy were lower. The strength of the correlation between these variables, however, was weak but the beliefs indicator ($r_{count} = -.10$) was very low.

A similar correlation is shown for the indicator of confidence and mathematics content knowledge. Both did not correlate with extrinsic goal orientation.($r_{count} = .06$; $r_{count} = .04$).

This expresses that whether a nervous students' confidence level or mathematics content knowledge was high or low had no effect on extrinsic goal orientation. The highest correlation value was found at this link, which connects the confidence indicator to the intrinsic goal orientation ($r_{count} = -.38$). However, this correlation remained in the low range.

In addition, indicator of learning anxiety had positive correlation with the extrinsic goal orientation indicator ($r_{count} = .22$) and the beliefs indicator ($r_{count} = .11$). The strength of the relationship was low and very low, respectively. Meanwhile, the correlation between the learning anxiety and the intrinsic goal orientation had negative relationship with very low category ($r_{count} = -.11$). The indicator of self-efficacy was likewise. Computation shows that there was no correlation between the indicator of learning anxiety and the indicator of task value ($r_{count} = -.08$).

Another correlation is for the indicator of examination. It is seen that the examination indicator had negative correlation with three of four indicators of motivation learning. They were the intrinsic goal orientation ($r_{count} = -.25$), the task value ($r_{count} = -.20$), and the self-efficacy ($r_{count} = -.20$). According to Suardana & Simarmata (2013), The strength of correlation in these indicators belongs to the low level category. Simultaneously, the examination had positive correlation with very low level in the relationship with the extrinsic goal orientation ($r_{count} = .13$). For the correlation between the examination and the beliefs, there was no relationship between them ($r_{count} = -.01$).

Overall, mathematics anxiety had a low relationship with mathematics learning motivation in the pandemic period. Its Pearson correlation value was $-.24$ and it had a negative correlation. This was in line with the research of Widodo et al. (2017) and Suardana and Simarmata (2013).

Discussion

In this study, gender differences were used as a variable to investigate students' anxiety about mathematics and learning motivation during the pandemic. The study confirms that female students outperform male students in the overall mathematics anxiety result and all sub-dimensions. It is aligned with previous studies (Amani et al., 2011; Devine et al., 2012; Goetz et al., 2013). During this pandemic period, both genders experienced moderate levels of mathematics anxiety following a recent study by Lailiyah et al. (2021). Khesht-Masjedi et al. (2019) declare that anxiety is always associated with adolescence, which could explain why there is no statistically significant difference in anxiety levels across ages. However, it is unclear in this study why females frequently report feeling more anxious about mathematics than males. The possible reason could be explained by Biaggio and Nielsen (1976), who reveals that women are more likely than men to express their anxiety openly. Besides, Batchelor et al. (2017) say that male and female students respond differently; male students may reply based on how they truly feel, whereas female students may respond based on how they believe they should feel.

Another finding of this study is that students were eager to learn mathematics during the pandemic, as seen in the overall value of motivation score. It is a good starting point for students to learn because one study found that the success or failure of online learning is determined by

the student's motivation to learn (El-Seoud et al., 2014). In terms of level, the motivation of female students outnumbers male students. However, their highest mean score was located in the same item, which was that they would like to achieve the best score for mathematics subject. This item belongs to the sub-dimension of extrinsic goal orientation. According to goal orientation theories, this sub-dimension refers to the subconscious purpose of learning, leading to performance goals of doing better than others and avoiding appearing dumb (Cook & Artino, 2016).

Since gender was concentrated as the variable, the study discovered a significant difference in overall mathematics anxiety between girls and boys in the implementation of online learning. Confidence, learning activities, and tests were the sub-dimensions with significant differences for both genders. According to various research, boys surpass girls in terms of confidence (Fennema & Hart, 2020; Sherman, 1980). At the same time, girls experienced more exam anxiety than boys (Devine et al., 2012).

On the other hand, it was discovered that there was no significant difference in overall learning desire for both genders regarding mathematics. When the data were analyzed further, it was discovered that there was a significant difference in a sub-dimension of learning motivation and extrinsic goal orientation.

In addition, findings revealed that the examination indicator negatively correlated with overall learning motivation. It stated that anxious students had a low desire to learn mathematics and vice versa. It contradicts one study, which found that students who were undervalued by their teachers and had a low rank in math performance were more anxious in test anxiety sub-dimensions, despite having a high level of motivation (Urhahne et al., 2011). Individual personality differences may necessitate various psychological strategies for dealing with academic anxiety. The correlation between mathematics anxiety and learning motivation towards mathematics revealed a weak negative relationship. Previous studies have found that when students are engaged in and enjoy what they are learning, they learn more effectively (Mata et al., 2012; Nicolaidou & Philippou, 1997). It implies that their desire to learn decreases when students are in unpleasant situations, are worried, or do not feel passionate about learning.

Conclusion

The overall calculation of students' mathematics anxiety during the COVID-19 pandemic is moderate. In addition, learning motivation shows that it is in the high category.

There were significant differences in mathematics anxiety between male and female students. It is contrary to the motivation of learning which has no significant difference. In addition, between mathematics anxiety and student motivation, there was a low association with the motivation learning student mathematics.

These findings may assist teachers in advancing the mathematical-learning process for boys and girls students in comprehending mathematics. Furthermore, it can provide insights into the search for a teaching method for reducing mathematics anxiety.

Acknowledgement

This article is the culmination of my lectures. We would like to thank the lecturers of the Mathematics Education Department at Universitas Muhammadiyah Prof. DR. HAMKA for their knowledge and energy.

Conflicts of Interest

The authors declare that no conflict of interest regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancies have been completely by the authors.

Funding Statement

This work received no specific grant from any public, commercial, or not-for-profit funding agency

Author Contribution

Syafika Ulfah: conceptualization, methodology, validation, resources, writing – review & editing, supervision, project administration, funding acquisition. **Rizka Akmalia:** investigation, software, formal analysis, data curation, writing – original draft, visualization. **Hella Jusra:** supervision, funding acquisition.

References

Albool, R. M. (2012, 2012). *The effect of utilizing storytelling strategy in teaching mathematics on grade four students' achievement and motivation towards learning mathematics* International Conference: The Future of Education, https://core.ac.uk/download/pdf/86431343.pdf

Amani, A., Alamolhodaei, H., & Radmehr, F. (2011). A gender study on predictive factors of mathematical performance of university students. *Educational Research*, *2*(6), 1179–1192. https://www.interesjournals.org/articles/a-gender-study-on-predictive-factors-of-mathematical-performance-of-university-students.pdf

Batchelor, S., Gilmore, C., & Inglis, M. (2017). Parents' and children's mathematics anxiety. In *Understanding Emotions in Mathematical Thinking and Learning*. Elsevier Inc. https://doi.org/10.1016/B978-0-12-802218-4.00012-1

Biaggio, M. K., & Nielsen, E. C. (1976). Anxiety correlates of sex-role identity. *Journal of Clinical Psychology*, *32*(3), 619–623. https://doi.org/10.1002/1097-4679(197607)32:3

BPS. (2020). Jumlah sekolah, guru, dan murid Sekolah Menengah Pertama (SMP) di bawah Kementerian Pendidikan dan Kebudayaan menurut Kabupaten/Kota di Provinsi DKI Jakarta [Number of schools, teachers and junior high school students under the Ministry of Education and Culture by City in DKI Jakarta Province]. https://jakarta.bps.go.id/indicator/28/734/1/jumlah-sekolah-guru-dan-murid-sekolah-menengah-pertama-smp-di-bawah-kementerian-pendidikan-dan-kebudayaan-menurut-kabupaten-kota-di-provinsi-dki-jakarta-2017-2018-.html

Choi, E. P. H., Hui, B. P. H., & Wan, E. Y. F. (2020). Depression and anxiety in Hong Kong during covid-19. *International Journal of Environmental Research and Public Health*, *17*(10), 3740–2750. https://doi.org/10.3390/ijerph17103740

Christiansen, R. (2021). *How the COVID-19 pandemic affected high school student mathematical anxiety during distance learning* [Ph.D. Thesis, Minnesota State University]. https://red.mnstate.edu/thesis

Cook, D. A., & Artino, A. R. (2016). Motivation to learn: An overview of contemporary theories. *Medical Education*, *50*(10), 997–1014. https://doi.org/10.1111/medu.13074

Devine, A., Fawcett, K., Szucs, D., & Dowker, A. (2012). Gender differences in mathematics anxiety and the relation to mathematics performance while controlling for test anxiety. *Behavioral and Brain Functions*, *8*(33), 1–9. https://doi.org/10.1186/1744-9081-8-33

El-Seoud, M. S. A., Taj-Eddin, I. A. T. F., Seddiek, N., El-Khouly, M. M., & Nosseir, A. (2014). E-learning and students' motivation: A research study on the effect of e-learning on higher education. *International Journal of Emerging Technologies in Learning*, *9*(4), 20–26. https://doi.org/10.3991/ijet.v9i4.3465

Erdoğan, A., Kesİcİ, Ş., & Şahİn, İ. (2020). Prediction of high school students' mathematics anxiety by their achievement motivation and social comparison. *Elementary Education Online*, *10*(2), 646–652. https://core.ac.uk/download/pdf/230030769.pdf

Fennema, E., & Hart, L. E. (2020). Gender and the JRME. *Journal for Research in Mathematics Education*, *25*(6), 648–659. https://doi.org/10.5951/jresematheduc.25.6.0648

Goetz, T., Bieg, M., Lüdtke, O., Pekrun, R., & Hall, N. C. (2013). Do girls really experience more anxiety in mathematics? *Psychological Science*, *24*(10), 2079–2087. https://doi.org/10.1177/0956797613486989

Hermanto, R., M, N. G., & Fahmi, A. (2021). Students' opinions about studying from home during the COVID-19 pandemic in Indonesia. *Cypriot Journal of Educational Sciences*, *16*(2), 499–510. https://doi.org/10.18844/cjes.v16i2.5627

Karami, R. A. (2018). Aplikasi SMS gateway quick count pemilu berbasiskan PHP [SMS gateway application quick count election based on PHP]. *Jurnal Al-Azhar Indonesia Seri Sains dan Teknologi*, *4*(2), 70–73. https://doi.org/10.36722/sst.v4i2.261

Keshavarzi, A., & Ahmadi, S. (2013). A Comparison of mathematics anxiety among students by gender. *Procedia - Social and Behavioral Sciences*, *83*, 542–546. https://doi.org/10.1016/j.sbspro.2013.06.103

Kesici, S., & Erdogan, A. (2010). Mathematics anxiety according to middle school students' achievement motivation and social comparison. https://eric.ed.gov/?id=EJ917167

Khesht-Masjedi, M. F., Shokrgozar, S., Abdollahi, E., Habibi, B., Asghari, T., Ofoghi, S. R., & Pazhooman, S. (2019). The relationship between gender, age, anxiety, depression, and academic achievement among teenagers. *J Family Med Prim Care*, *8*, 799–804. https://doi.org/10.4103/jfmpc.jfmpc_103_18

Kim, H. Y. (2013). Statistical notes for clinical researchers: assessing normal distribution (2) using skewness and kurtosis. *Restorative Dentistry & Endodontics*, *38*(1), 52–54. https://doi.org/10.5395/rde.2013.38.1.52

Lailiyah, S., Hayat, S., Urifah, S., & Setyawati, M. (2021). Levels of students' mathematics anxieties and the impacts on online mathematics learning. *Cakrawala Pendidikan*, *40*(1), 107–119. https://doi.org/10.21831/cp.v40i1.36437

Leder, G. C., & Forgasz, H. J. (2002). *Two new instruments to probe attitudes about gender and mathematics*. Office of Educational Research and Improvement.

Mata, M. d. L., Monteiro, V., & Peixoto, F. (2012). Attitudes towards mathematics: effects of individual, motivational, and social support factors. *Child Development Research*, 1–10. https://doi.org/10.1155/2012/876028

Mendoza, D., Cejas, M., Rivas, G., & Varguillas, C. (2021). Anxiety as a prevailing factor of performance of university mathematics students during the COVID-19 pandemic. *Obrazovanie I Nauka*, *23*(2), 94–113. https://doi.org/10.17853/1994-5639-2021-2-94-113

Nicolaidou, M., & Philippou, G. (1997). Attitudes towards mathematics, self-efficacy and achievement in problem-solving. *European Research in Mathematics Education*, *III*, 1–11. https://www.academia.edu/81310852/Attitudes_towards_mathematics_self_efficacy_and_achievement_in_problem_solving

Nikmatun, I. A., & Waspada, I. (2019). Implementasi data mining untuk klasifikasi masa studi mahasiswa menggunakan algoritma K-Nearest Neighbor [Implementation of data mining for classifying students' study period using the K-Nearest Neighbor algorithm. *Jurnal SIMETRIS*, *10*(2), 421–432. https://jurnal.umk.ac.id/index.php/simet/article/view/2882/1855

Otoo, D., Iddrisu, W. A., Kessie, J. A., & Larbi, E. (2018). Structural model of students' interest and self-motivation to learning mathematics. *Education Research International*, 1–10. https://doi.org/10.1155/2018/9417109

Sengodan, V., & Iksan, Z. H. (2012). Students' learning styles and intrinsic motivation in learning mathematics. *Asian Social Science*, *8*(16), 17–23. https://doi.org/10.5539/ass.v8n16p17

Sherman, J. (1980). Mathematics, spatial visualization, and related factors: Changes in girls and boys, Grades 8-11. *Journal of Educational Psychology*, *72*(4), 476–482. https://doi.org/10.1037/0022-0663.72.4.476

Suardana, A. A. P. C. P., & Simarmata, N. (2013). Hubungan antara motivasi belajar dan kecemasan pada siswa kelas VI sekolah dasar di Denpasar menjelang ujian nasional [The relationship between learning motivation and anxiety in sixth grade elementary school students in Denpasar ahead of the national exam. *Jurnal Psikologi Udayana*, *1*(1), 203–212. https://doi.org/10.24843/JPU.2013.v01.i01.p20

Sundayana, R. (2014). Statistika penelitian pendidikan (IV.

Suren, N., & Kandemir, M. A. (2020). The effects of mathematics anxiety and motivation on students' mathematics achievement. *International Journal of Education in Mathematics, Science and Technology*, *8*(3), 190–218. https://doi.org/10.46328/ijemst.v8i3.926

Susanto, E. (2018). Analisis korelasi kepadatan bangunan terhadap frekuensi sambaran petir di wilayah kota makassar [Correlation analysis of building density to the frequency of lightning strikes in the Makassar city area. *1*, 1–4. https://ojs.unm.ac.id/semnasfisika/article/view/8716/5085

Syauqi, K., Munadi, S., & Triyono, M. B. (2020). Students' perceptions toward vocational education on online learning during the COVID-19 pandemic. *International Journal of Evaluation and Research in Education*, *9*(4), 881–886. https://doi.org/10.11591/ijere.v9i4.20766

Tapia, M., & Marsh, G. E. (2004). The relationship of math anxiety and gender. *Academic Exchange Quarterly*, *8*(2), 130–134.

Urhahne, D., Chao, S. H., Florineth, M. L., Luttenberger, S., & Paechter, M. (2011). Academic self-concept, learning motivation, and test anxiety of the underestimated student. *British Journal of Educational Psychology*, *81*(1), 161–177. https://doi.org/10.1348/000709910X504500

Widodo, S. A., Laelasari, L., Sari, R. M., Dewi Nur, I. R., & Putrianti, F. G. (2017). Analisis faktor tingkat kecemasan, motivasi dan prestasi belajar mahasiswa [Factor analysis of anxiety level, motivation and student achievement. *Taman Cendekia: Jurnal Pendidikan Ke-SD-An*, *1*(1), 67–77. https://doi.org/10.30738/tc.v1i1.1581

Yanti, T. S. (2007). Uji Rank Mann-Whitney Dua Tahap [Two Stage Mann-Whitney Rank Test. *Statistika*, *7*(1), 55–60.

Yudihartanti, Y. (2018). Analisa korelasi mata kuliah penelitian dengan tugas akhir menggunakan model product moment [Correlation analysis of research courses with the final assignment using the product moment model. *Progresif: Jurnal Ilmiah Komputer*, *13*(2), 1691–1696.

Zakaria, E., & Nordin, N. M. (2008). The effects of mathematics anxiety on matriculation students as related to motivation and achievement. *Eurasia Journal of Mathematics, Science and Technology Education*, *4*(1), 27–30. https://doi.org/10.12973/ejmste/75303

Zhang, Y., Zhang, H., Ma, X., & Di, Q. (2020). Mental health problems during the COVID-19 pandemics and the mitigation effects of exercise: A longitudinal study of college students in China. *International Journal of Environmental Research and Public Health*, *17*(10), 3722–3737. https://doi.org/10.3390/ijerph17103722