

The Limited Face-To-Face Learning Implementation: Gender and Math Anxiety Towards Mathematical Conceptual Understanding

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Abstrak

Tujuan dari penelitian ini adalah untuk mengetahui: 1) apakah terdapat hubungan antara gender dan kecemasan matematika terhadap kemampuan pemahaman konsep; 2) apakah terdapat hubungan antara gender dan kemampuan pemahaman konsep; 3) apakah terdapat hubungan antara kecemasan matematika dan kemampuan pemahaman konsep. Penelitian ini adalah penelitian kuantitatif dengan jenis asosiatif. Siswa kelas VIII salah satu SMP Negeri di Cikarang Barat merupakan populasi pada penelitian ini. Sampel minimal diperoleh menggunakan rumus Slovin. Sebanyak 175 siswa dipilih dengan teknik cluster random sampling. Hasil tes kemampuan pemahaman konsep matematis dan data skor angket kecemasan matematika merupakan data utama pada penelitian ini. Uji asumsi klasik (normalitas, multikolinearitas dan heteroskedastisitas) digunakan sebelum pengujian hipotesis. Uji regresi berganda digunakan untuk menguji hipotesis. Penelitian ini memberikan hasil: (1) sebesar 2,5% kemampuan pemahaman konsep ditentukan oleh faktor gender dan kecemasan matematika; (2) Terdapat hubungan antara gender dan kecemasan terhadap pemahaman konsep; (3) Terdapat hubungan antara gender dan kemampuan pemahaman konsep; dan (4) Tidak terdapat hubungan antara kecemasan matematika terhadap kemampuan pemahaman konsep.

Kata Kunci: gender; kecemasan; konsep; matematika; pemahaman.

Abstract

The goals of this study were to find out: (1) there was a correlation between gender and math anxiety toward conceptual understanding ability; (2) there was a correlation between gender and conceptual understanding ability; and (3) there was a correlation math anxiety and conceptual understanding ability. This was a quantitative study with an associative type. The population consisted of grade VIII students from one of secondary school in Cikarang Barat District. The Slovin Formula was used to determine the minimum sample size required. A total of 175 student were selected using cluster random sampling technique. The mathematics anxiety score and conceptual understanding ability score were the main data in this study. The classical assumption tests were required before hypothesis test. Furthermore, the research hypothesis was tested multiple regression test. The following findings were obtained from this study: (1) gender and math anxiety determined 2,5% of conceptual understanding ability; (2) there was a correlation between gender and math anxiety toward conceptual understanding ability; (3) there was a correlation between gender and conceptual understanding ability; and (4) there wasn't a correlation between math anxiety and conceptual understanding ability.

Keywords: gender; anxiety; conceptual; mathematics; understanding.

I. INTRODUCTION

WHO (WHO, 2020) declared Covid-19 as a world pandemic in March 2020. Many countries have implemented lockdowns to reduce social contact and limit the spread of the virus (Fang et al., 2020; Qiu et al., 2020). Like others, the Indonesian government has made it mandatory to do any activity involving many people at home, including schooling, which must now be done via online distance learning (Ulfah et al., 2021). However, this lost school time could have a prejudicial impact on children's educational outcomes and learning loss escalated (Azevedo et al., 2021; Parmar et al., 2022). Furthermore, parents were opposed to online learning for a variety of reasons, including the disadvantages of online learning, their children's poor self-regulation, and their lack of time and professional knowledge in supporting their children's online learning (Al-Kayed, 2020; Dong et al., 2020; Masfuah et al., 2021). These issues arose in Indonesia as well. Hence, following those considerations, the Ministry of Education, Culture, Research, and Technology issued a circular letter allowing for limited face-to-face learning in schools (Kemdikbud, 2021).

The implementation of limited face-to-face learning is carried out by taking into account health protocols. Furthermore, anyone entering the school must have been immunized. According to a decree issued by four ministries, the

implementation of it is carried out with several provisions, including: (1) the maximum number of students who attend the class is 18 people with a minimum distance of 1.5 meters; (2) it is formed a shifting class; (3) it cuts off the duration learning; and (4) students who come to school are in good health. A study conducted with a teacher who implemented this learning found that it was preferable to online learning because of the active two-way interaction with students, teachers were also able to understand and recognize students better than online (Suryani et al., 2022). While Onde et al., (2021) discovered that students' learning outcomes in mathematics were below a threshold, which was affected by the shorter duration of learning, and teachers' failure to fully media and models of learning caused students' lack of interaction.

Gender influences how students respond to learning (Rohmawati & Afriansyah, 2022). Males and females have distinct characteristics. Jensen (2011) stated that the different physical and biological structures of the brain influence how males and females think, resulting in differences in behavior, cognitive development, and processing. They have different preferences for problem-solving strategies. (Zhu, 2007; Kusumaningsih et al., 2019). A previous study found that male students were not hesitant to voice their ideas when answering a question,

whereas female students wrote none when they did not know the answer (Anggraini et al., 2019). Gender is one variable that has an impact on the conceptualization process in mathematics education (Keitel, 1998).

Students' errors in answering mathematical questions continue to occur in the student's tasks in constructing mathematical concepts (Virgana, 2019; Syaifuddin & Rahmasari, 2023). In fact, it is a critical precondition for solving mathematical and real-world problems (Hadi & Kasum, 2015; Yani, Haryono, & Lovia, 2022) and it requires students to commit to a meaningful method of learning rather than just memorizing (Sukaesih et al., 2020). In addition, it was formed independently by the students; it could not be accomplished solely through knowledge delivery (Wardani, 2020). As a result, understanding mathematical concepts is a necessary skill for students to possess.

Affective aspects influence the ability to understand concepts. This is consistent with Masri et al., (2018) who stated that, in addition to academic cognitive, students must also have affective manner when learning mathematics. One of the affective attitudes that can affect the decline in the ability to understand concepts is anxiety. It is characterized by an unpleasant affective state followed by a physical sensation that warns a person of an impending danger Freud (Feist & Feist, 2013). Akmalia & Ulfah (2021) stated that the bigger the

pupils' mathematics anxiety, the lower the value of learning outcomes.

Many studies on mathematics conceptual understanding in terms of gender and math anxiety have been conducted. The research conducted by Yuberta et al. (2019) revealed that there was an effect of math anxiety on the conceptual understanding ability in male and female students. Furthermore, Humaira Syaifar et al. (2022) found in their research that there were differences in the conceptual understanding ability between male and female students. Putri et al., (2021), in their research related to math anxiety and conceptual understanding ability, found that there was a significant effect between two variables. Therefore, researchers are interested in investigating the effect of gender and math anxiety towards students' conceptual understanding ability. Researchers want to know whether by changing online learning to limited face-to-face learning, there will be differences in results from previous research. Based on the research objectives, the hypotheses in this study were as follows.

Hypothesis 1 (F-test):

H₀: There wasn't a correlation between gender and mathematics anxiety towards in the ability to understand concepts

H₁: There was a correlation between gender and mathematics anxiety

towards in the ability to understand concepts

Hypothesis 2 (Partial t-test):

H₀: There wasn't a correlation between gender and students' conceptual understanding ability

H₁: There was a correlation between gender and students' conceptual understanding ability

Hypothesis 3 (Partial t-test):

H₀: There wasn't a correlation between mathematics anxiety and students' conceptual understanding ability

H₁: There was a correlation between mathematics anxiety and students' conceptual understanding ability

II. METHOD

This research was a quantitative study conducted with an associative type. This study was carried out in Cikarang Barat District, Bekasi Regency. The population in this study consisted of grade VIII students from one of SMP Negeri in Cikarang Barat District in the 2021/2022 academic year, during limited face-to-face learning. A cluster random sampling technique was used to select the sample for this study after the Slovin Formula was used to determine the minimum sample size required. The sample was 175 students consist of 78 male dan 97 female students. The primary data collection instruments were a mathematics anxiety questionnaire and an ability test for understanding

mathematical concepts, both of which had previously been validated by experts.

After obtaining a sample of male and female students, they were given a mathematics anxiety questionnaire using Google Forms. Cavanagh & Sparrow (2010) developed aspects for the mathematics anxiety questionnaire, which were divided into three indicators: (1) attitudinal, (2) cognitive; and (3) somatic. The mathematics anxiety questionnaire has been made consists of 32 questions.

The students were given a conceptual understanding ability test on the Two Variable Linear Equation System material. The conceptual understanding ability test was developed using conceptual understanding ability indicators adapted from Pratiwi (2016). The indicators of mathematical concept understanding included: (1) repeating a concept; (2) grouping topics based on special characteristics similar to the concept; (3) presenting examples and non-examples of a concept; (4) presenting the concept with a version of the mathematical description; (5) describing a concept's necessary or sufficient conditions; (6) applying, using, and sorting out the correct procedure based on method; and (7) applying the concept or algorithm to problem solving.

Before testing the research hypothesis, the following analysis classic assumption tests were carried: (1) normality test using the Kolmogorov Smirnov test; (2)

Multicollinearity test, and heteroscedasticity test (Mukti et al., 2022; Wisudaningsi et al., 2019). Multiple linear regression, determination coefficient, F-test, and t-test were used to test hypothesis (Fitriyah et al., 2021). The significance level in this study was set at 5% for all tests. The research hypothesis was rejected when the value of $f_{stat} > f_{tab}$, the value of $t_{stat} > t_{tab}$, and the significance level is less than 0,05.

III. RESULT AND DISCUSSION

A. Description of Research Data

The research's sample was chosen using a cluster random sampling technique. 175 students were sampled using this technique. Independent variable

in this research was gender (X1) and mathematics anxiety (X2). The dependent variable was ability to understand concepts. The data descriptive of mathematics anxiety details as follows.

Table 1.

Data Description

	Mean	std	max	Min
X ₂	107,79	15,38	156	70
Y	15,85	5,86	28	4

The research sample consist of 78 male dan 97 female students. A mathematics anxiety questionnaire was gives to the sample divided into three categories: low, moderate, and high category. Data on math anxiety were classified using the mean and standard deviation with the categorization details as follows.

Table 2.

Distribution Students Mathematics Anxiety Categories

Category	Score Interval	Frequency	Percentage
Low	$x_i > 123$	21	12%
Moderate	$92 < x_i < 123$	125	71%
High	$x_i < 92$	29	17%

(Magfirah et al., 2015)

Based on Table 2, the highest percentage for the category of math anxiety is in the moderate category. The result was in line with Nurjanah & Alyani, (2021) research, which found that 73,78% of students experienced moderate math anxiety.

A conceptual understanding test was gives to the sample divided into three categories: low, moderate, and high category. Data on conceptual understanding were classified using the mean and standard deviation with the categorization details as follows.

Table 3.

Distribution of Student's Conceptual Understanding Categories

Category	Score Interval	Frequency	Percentage
High	$x_i > 21$	34	19%
Moderate	$9 < x_i < 21$	113	65%
Low	$x_i < 9$	28	16%

(Magfirah et al., 2015)

Based on the Table 3, it was found that most students had moderate category of conceptual understanding ability, follow by the high and low categories.

B. Classic Assumption Tests

Before testing the research hypothesis, the following analysis classic assumption tests were carried: (1) normality test using the Kolmogorov Smirnov test; (2) Multicollinearity test, and (3) heteroscedasticity test. The significance level was set at 5% for all tests.

1) Normality Test

The Kolmogorov Smirnov method was used for the normality test (Yuliana et al., 2021). The following table is a summary of the normality test results.

Table 4.
Summary of Data Normality Test

Statistic	Result
N	175
Mean	0,00000000000000052783
Std dev	5,755819
D	0,091
Ks Table	0,10281

According to Table 4, the D value was less than Kstable. This means that the residuals data of regression was normally distributed.

2) Multicollinearity test

The multicollinearity test was used to determine whether the regression model discovered a significant relationship between the independent variable in terms of gender and math anxiety (Yuliana et al., 2021). Tolerance values and variance-inflating error (VIF) were used to

test multicollinearity. The results of the multicollinearity test are shown in the table below.

Table 5.
Summary of Tolerance dan VIF Test

Correlation	Tolerance	VIF
X ₁ and X ₂	0,9993	1,0006

Based on the Table 5, it was found that the tolerance value was greater than 0,1 and the VIF value was less than 10,00. So that multicollinearity didn't occur. The test concludes that there wasn't multicollinearity between gender and math anxiety.

3) Heteroscedasticity Test

The regression model must be free from heteroscedasticity (Yuliana et al., 2021). The following table is a summary of the heteroscedasticity test results.

Table 6.
Summary of Heteroscedasticity Test

Variable	P-value
X ₁	0,7926
X ₂	0,3858

Based on the Table 6, the significance probability of the variables gender and math anxiety was greater than 0,05. It can be concluded that there weren't symptoms of heteroscedasticity.

C. Hypothesis Tests and Discussion

1) Multiple Regression Test

The multiple linear regression was carried out so the researchers could find out the effect of gender and math anxiety on the conceptual understanding ability

simultaneously (Yuliana et al., 2021). The following table is a summary of the coefficient's multiple linear regression.

Table 7.
Summary of Multiple Linear Regression

Coefficients	
Intercept (b_0)	13,7036
b_1	2,1998
b_2	0,0086

Based on Table 7, the equation of $Y=13,7036+2,1998 X_1-0,0086 X_2$ was obtained. It was shows that the values of variable X_2 increase, then the output values of Y would be increase.

2) Determination Coefficient

Coefficient determination is used to determine the percentage of effect gender and math anxiety on conceptual understanding ability. The following table is a summary of the determination coefficient.

Table 8.
Results of determination Coefficient

Regression Statistics	
Multiple R	0,189029466
R Square	0,035732139
Adjusted R Square	0,024519722

Based on the Table 8, it could be interpreted that 2,5% of the conceptual understanding ability is determined by gender and math anxiety, while the remaining 97,5% is determined by other variable. The correlation value between gender and math anxiety was 0,189 (very low category).

According to the findings of Yuberta et al. (2019) also stated that there was an

effect of math anxiety on the ability to understand concept in male and female students. The other research showed that The effect of students learning anxiety on the ability to understand concept was 2,89% (Septiansyah, 2014). The other research showed that math anxiety affects learning achievement was 15,9% (Mukti et al., 2022).

3) F-test

To test the related hypotheses written, multiple correlation analysis was used by F-test. to find (Yuliana et al., 2021). The following table is a summary of the F-test.

Table 9.
Summary of F-tets

	F	Significance F
Regression	3,1868	0,0437

Based on the Table 9, the value of $f > f_{tab}$ (3,0485) and the significance level is less than 0,05. It can be concluded that H_0 was rejected. The result of this test provide that gender and math anxiety had a correlation with the conceptual understanding ability.

The calculation result on Table 9 are in line with Syahri Nasution & Nurdalilah (2018), who stated that there was an interaction effect between math anxiety and gender on students' ability to understand mathematical concept. Yuberta et al. (2019) also stated that there was an effect of math anxiety on the ability to understand concept in male and female students. The research result was reinforced by the statement by Wijaya et

al. (2018), who stated that there was a simultaneous influence between anxiety and gender on adaptive reasoning abilities. Previous research findings support this study, which found a link between gender, math anxiety, and math ability.

4) Partial t-test

a) Gender toward Conceptual Understanding Ability

The t-test calculation of gender toward conceptual understanding ability results are presented in the Table 10 below.

Table 10.
Summary of t-test

	t Stat	P-Value
X ₁ vs Y	2,4977	0,0134

According to the Table 10, the gender factor obtained $t_{stat} = 2,4977$ and $P_value = 0,0134$ with a critical area $(CA) = \{t | t > 1,9736\}$. H_0 was rejected because of the value of t_{stat} in the critical area. This result showed that gender and conceptual understanding ability have correlation.

According to the results of the previously written hypothesis test, there was a correlation between gender and the ability to understand concept. This is in line with the research result of Humaira Syaifar et al. (2022), which stated that female students have better conceptual understanding ability than male students which indicates there was a correlation between gender and mathematical conceptual understanding ability. Female students can meet the indicators of ability

to understand concept better than male students. Furthermore, according to Leyva (2017), gender differences influence students' mathematical abilities as well as their mathematical experience. Another study stated that girls are expected to be more persistent, more vocal, and more confident than boys, so girls' math skills improved (Laurie H. Rubel, 2016). In contrast to the findings of Kusumaningsih et al. (2019), who found that male students were better at understanding concepts than female students. Meggiolaro (2018) also stated that female students' learning achievement was lower than male students'.

The differences in the ability to understand concepts between man and woman indicate that gender differences have a correlation with the ability to understand concepts. Gender differences not only affect differences on abilities in mathematics but also affect how to acquire mathematical knowledge (Amir, 2013).

b) Mathematics Anxiety towards Conceptual Understanding Ability

The t-test calculation of gender toward conceptual understanding ability results are presented in the Table 11 below.

Table 11.
Summary of t-tets

	t Stat	P-Value
X ₂ vs Y	0,3018	0,7631

According to the Table 11, the gender factor obtained $t_{stat} = 0,3018$ and

$P_value=0,7631$ with a critical area $(CA)=\{t|t>1,9736\}$. H_0 accepted because of the value of t_{stat} wasn't in the critical area. This result showed mathematics anxiety and conceptual understanding ability doesn't had correlation.

The research result on Table 11 was supported by Istiqa Yanti & Fadiana (2022), which stated there isn't significant correlation between math anxiety and understanding of mathematical concept. In line with Siti Fikriyah et al. (2021), which stated there isn't correlation between math anxiety and students' mathematical understanding. Slightly different from Munasiah (2015) which stated that there is significant correlation between math anxiety and the ability to understand concepts. In contrast, Auliya, (2016); Handayani, (2019); Putri et al., (2021) which stated that there is a significant influence between math anxiety and the ability to understand concepts.

The difference in the results study is possible due to the changed methods of learning in school (from online to limited face-to-face learning) and the limited space or time for students to learn in class. Furthermore, the findings of this study can be used as one of the factors in determining how far students' conceptual understanding ability have progressed. As stated by Bisson et al., (2016), it is critical to improve students' conceptual understanding skills. The understanding concepts is a precondition for supported higher cognitive levels. The ability to

understand concepts is so important, teacher needs to examine the students' conceptual understanding ability from various perspectives.

IV. CONCLUSION

The goals of this study were to find out: The goals of this study were to find out: (1) there was a correlation between gender and math anxiety toward conceptual understanding ability; (2) there was a correlation between gender and conceptual understanding ability; and (3) there was a correlation math anxiety and conceptual understanding ability. The following findings were obtained from this study: (1) 2,5% of the conceptual understanding ability was determined by gender and math anxiety; (2) there was a correlation between gender and math anxiety toward conceptual understanding ability; (3) there was a correlation between gender and conceptual understanding ability; and (4) there wasn't a correlation between math anxiety and conceptual understanding ability.

The understanding concepts is a precondition for supported higher cognitive levels. The ability to understand concepts is so important, teacher needs to examine the students' conceptual understanding ability from various perspectives. The result of this study is reminder for future researchers to investigate correlation of mathematics anxiety and conceptual understanding ability. Furthermore, the population in this

study was still restricted to one school. Researchers hope that future studies will include larger populations.

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