Journal of Engineering Science and Technology
Special Issue on ISCoE2022, Jan (2022) 239 - 252

STUDENTS' MATHEMATICS ANXIETY DURING DISTANCE LEARNING: A SURVEY ON PRIMARY SCHOOL STUDENTS DURING COVID-19

TATANG HERMAN[1,*], SLAMET ARIFIN[2],
NADYA SYIFA UTAMI[1], IFA FATHIYAH[1]

[1] Universitas Pendidikan Indonesia, Jl Setiabudhi No. 229, Bandung, Indonesia
[2] Universitas Negeri Malang, Jl. Semarang No. 5, Malang, Indonesia
author: tatangherman@upi.edu

Abstract

This study aims to describe the difference in students' mathematics anxiety levels during distance learning and the factors affecting their anxiety. We hypothesized that there are differences between students' mathematics anxiety according to their demographic such as gender, geographical area, and experience in online learning before the pandemic. We also hypothesized that factors such as difficulty to understand mathematics content, parent guidance, and teacher guidance, affect the students' mathematics anxiety. To examine these hypotheses, a quantitative method was used in this study. As for the research instrument, a survey about anxiety in learning mathematics was administered to 324 Indonesian primary school students from 9 to 12 years old on average. The result shows that there is no sufficient evidence to support the first three hypotheses since no significant differences in students' anxiety levels were found whether it is based on their gender, geographical area, or experience in distance learning before the pandemic. Furthermore, the results also show that parental and teacher guidance have no considerable effect on students' anxiety during distance learning. The sole factor that contributed to students' learning anxiety was how challenging it was for them to comprehend the mathematics material that their teacher was delivering online. In conclusion, levels of anxiety in learning mathematics are not determined by students' demographic as listed above. Additionally, difficulties in understanding mathematics content through online meetings have been proven to have a significant influence on students' mathematics anxiety.

Keywords: Covid-19, Distance learning, Learning anxiety, Learning mathematics.

1. Introduction

The spread of Coronavirus Disease 2019 (COVID-19) has affected many aspects of life, including the education system [1]. In response to the spread of COVID-19, educational institutions have made online learning their primary channel. Beginning in March 2020, the Ministry of Education and Culture will strictly enforce its policy on distance learning. Similar to other countries, Indonesian students have been taught by their teachers via distant learning as COVID-19 has spread [2]. This challenges educators and teachers on finding good strategies on how to make teaching and learning processes for students [3-20].

As a consequence of online learning implementation, students use electronic devices to conduct online learning from home, including mathematics learning practice. However, online learning has been the first experience of most students in Indonesia, particularly primary school students. Many students have struggled to adapt to this change [21]. Several studies state some problems appeared due to the unexpected change in school-learning activities. Teachers experienced unpreparedness for designing the learning activity through online mode since there were limited time and space [2]. According to the literature [22], because of the growing distance between the students and their peers as well as the students and their teachers, students started to get bored after the first two weeks of online study. Additionally, during the teaching-learning activity, students began displaying more anxiety and fewer happy emotions [23].

In terms of online learning, Smith and Ferguson [24] stated that compared to other fields, web-based mathematics courses are far more difficult. Children experience anxiety because of the difficulty of math problems as well as unexpected tasks, tests, and queries [25]. The anxious feeling when learning mathematics is called mathematics anxiety. Tobias and Weissbord (in Rozgonjuk [26] described mathematics anxiety as symptoms of distress and despair when someone is asked to figure out a mathematical task or problem. Mathematics anxiety involves tension experienced when working with numbers and solving mathematical problems [27].

Many studies have focused on students' mathematics anxiety during teaching-learning mathematics. A previous study [28] showed that students' attitude to their mathematics anxiety was divided into four types: Students who exhibited low anxiety over time, gained anxiety over time, steadily decreased anxiety over time, and drastically increased over time. Some of the studies also revealed that the level of students' mathematics anxiety affects their mathematics achievement. Students with low levels of anxiety and high levels of motivation to learn gain high levels of achievement in mathematics [29, 30]. Moreover, some teaching solutions also have been designed and implemented to overcome students' mathematics anxiety. For example, implementing a creative problem-solving strategy for gifted students [31], digital game-based learning [32], and field-based tasks [33] were proven to have good influences in decreasing students' mathematics anxiety.

As mentioned above, students' mathematics anxiety has become the primary topic in many previous studies. Nonetheless, there are not many studies focusing on students' mathematics anxiety as a result of online learning during the pandemic COVID-19. Therefore, this study focuses on the effect of learning from home on the students' anxiety when learning mathematics. In this study, we tried to examine students' levels of anxiety due to online learning. We would like to confirm the differences according to certain demographic categories (experience in online

learning before the pandemic, gender, and location where the student lived). We also tried to identify which factors (difficulties in understanding math content, teacher's guidance, and parents' guidance) could influence their mathematics anxiety level during online learning.

We highlight six hypotheses regarding our studies: (1) there is a significant difference in student's mathematics anxiety levels during online learning between students who have experienced online learning before the pandemic and those who have not, (2) there is a significant difference of student's mathematics anxiety level during online learning between male and female students, (3) there is significantly different of student's mathematics anxiety level during online learning between students who lived in an urban and rural area, (4) there is a significant correlation of students' difficulty in understanding mathematics content towards their level of mathematics anxiety, (5) there is a significant correlation of teachers' guidance towards students' level of mathematics anxiety, and (6) there is a significant correlation of parents' guidance towards students' level of mathematics anxiety.

2. Mathematics Anxiety

As the beginning of what mathematics anxiety is, we look back to the definition of anxiety itself and the first time that mathematics anxiety was introduced. Within the last quarter-century, anxiety has spawned significant scientific concerns. The construct is roughly described as an emotional state characterized by fear and dread [34]. It is distinguished by feelings of uncertainty and despair in the face of threat. Two of them appear to be especially common in academia: test anxiety and mathematics anxiety [35].

To explore mathematics anxiety, test anxiety must first be explored. Previously, test anxiety was designed to explore students' anxiety and how anxiety affects students' academic progress. Following the test being administered to the students, it was discovered that students with low anxiety outperformed students with high anxiety [36]. Later, the test was developed with a different intention. For instance, Wine [37] took an exclusively cognitive approach. According to her attentional hypothesis, test-anxious individuals prioritize task-relevant efforts above preoccupations with worry, self-criticism, and physical concerns. Their performance suffers as a result of having less attention available for test-related activities. Through the development of test anxiety and its theory, several studies began to expand the study to mathematics anxiety.

Most researchers viewed that test anxiety and mathematics anxiety were highly related. According to some, mathematics anxiety is just subject-specific test anxiety [38]. Others place it in a broader context, including a general fear of mathematics, particularly of examinations. Furthermore, there is no exact definition of mathematics anxiety. In brief, mathematics anxiety is defined as a feeling of anxiety that makes it hard to manipulate numbers and solve mathematical problems, both in real-life and academic settings [27]. Many factors can affect math anxiety. They are classified into three categories named emotional, assessment, and environmental factors [39]. In this sense, some areas in mathematics appear to be cognitively difficult for many people to acquire, but not all mathematical difficulties are caused by cognitive difficulties [40]. Some people have mathematics anxiety, which may affect their mathematics learning and

performance, both by avoiding any mathematical activities and by overloading and interrupting working memory during mathematical tasks [40].

3. Fractions

One of the materials that students were currently studying when this survey was carried out is fractions. This learning was carried out online through WhatsApp groups and Zoom Meetings, as well as using technological assistance media in the form of the GeoGebra application. The following is the explanation of the concept of fractions and operations on fractions, namely addition, subtraction, multiplication, and division.

A fraction is a number formed by $\frac{a}{b}$ with a called the numerator and b called the denominator. Fractions that have the same denominator are called like fractions, while fractions that have different denominators are called different fractions. For instance, $\frac{1}{2}$ and $\frac{2}{4}$ are called different fractions, while $\frac{1}{3}$ and $\frac{2}{3}$ are called fractions. In addition, there is a so-called equivalent fraction. Equivalent fractions are fractions that have different types of writing but have the same quotient. For example, $\frac{1}{2}$, $\frac{2}{4}$, and $\frac{3}{6}$ are equivalent fractions.

Moreover, there are two cases in the addition and subtraction of fractions, namely: (i) the addition and subtraction of fractions with the same denominator, and (ii) the addition and subtraction of fractions with different denominators. In the first case, we just need to add or subtract the numerator. For example, it is done when using the following calculation: $\frac{5}{7} - \frac{2}{7} = \frac{(5-2)}{7} = \frac{3}{7}$.

In the second case, if we are asked to add or subtract fractions with different denominators, then the first thing that we need to do is to equate those denominators. We considered the following example: $\frac{2}{3} + \frac{1}{4} = \frac{8}{12} + \frac{3}{12} = \frac{(8+3)}{12} = \frac{11}{12}$.

Furthermore, this learning can also use technologies such as GeoGebra. Figure 1 shows how the addition in fractions can be illustrated by using GeoGebra.

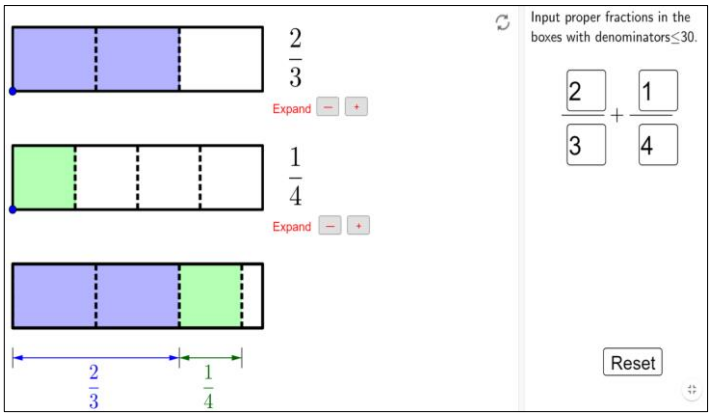

Fig. 1. Fraction addition and subtraction using GeoGebra (see https://www.geogebra.org/m/j4w554q8#material/GceeVgnb, Retrieved on December 2023).

On the multiplication and division of fractions, we do not need to pay attention to the denominator. Thus, what does $\frac{1}{2} \times 3$ mean? In fractional multiplication, $\frac{1}{2} \times 3$ is interpreted as $\frac{1}{2}$ of 3. To solve this, we apply the usual multiplication of the numerator and the denominator. So, $\frac{1}{2} \times 3 = \frac{1}{2} \times \frac{3}{1} = \frac{1 \times 3}{2 \times 1} = \frac{3}{2} = \frac{2}{2} + \frac{1}{2} = 1 + \frac{1}{2} = 1\frac{1}{2}$.

Then, how to solve $\frac{1}{2} \div \frac{1}{3}$? In general, the division of fractions in the form of $\frac{a}{b} \div \frac{c}{d}$ can be solved by writing them into the form $\frac{\frac{a}{b}}{\frac{c}{d}}$ and then multiplying them by 1 which is changed to $\frac{\frac{d}{c}}{\frac{d}{c}}$ so that it becomes $\frac{\frac{a}{b}}{\frac{c}{d}} \times \frac{\frac{d}{c}}{\frac{d}{c}}$. So, $\frac{1}{2} \div \frac{1}{3} = \frac{\frac{1}{2}}{\frac{1}{3}} \times \frac{\frac{3}{1}}{\frac{3}{1}} = \frac{\frac{3}{2}}{\frac{3}{3}} = \frac{\frac{3}{2}}{1} = \frac{3}{2} = 1\frac{1}{2}$.

Figure 2 shows how the multiplication in fractions can be illustrated by using GeoGebra.

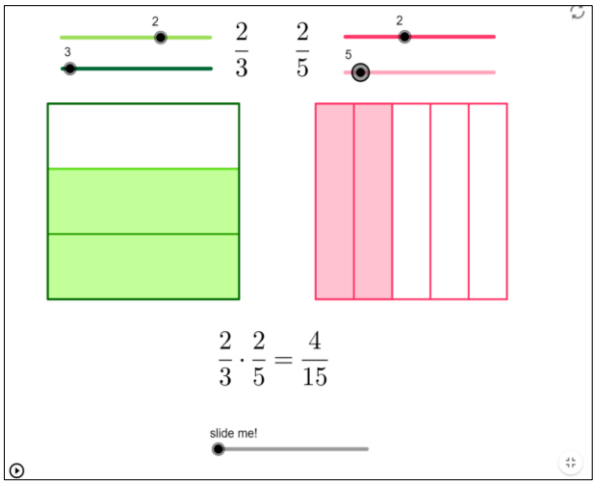

Fig. 2. Fraction multiplication and division using GeoGebra (Source: https://www.geogebra.org/m/j4w554q8#material/s6fgsqv9).

4. Method

A quantitative method was used in this research. This study aims to describe the difference in students' mathematics anxiety levels during distance learning and the factors affecting their anxiety. We hypothesized that there are differences between students' mathematics anxiety according to their demographic such as gender, geographical area, and experience in distance learning before the pandemic. We also hypothesized that factors such as difficulty to understand mathematics content, parents' guidance, and teachers' guidance, affect the students' mathematics anxiety.

4.1. Participant

The target population of this study was primary school students in Java, Indonesia. A total of three hundred and twenty-four primary school students participated in this online survey through a random sampling technique. Students ranged in age

from 9 years to 12 years old. The distribution of the respondents in this online survey, according to their gender and geographical area is shown in Fig. 3.

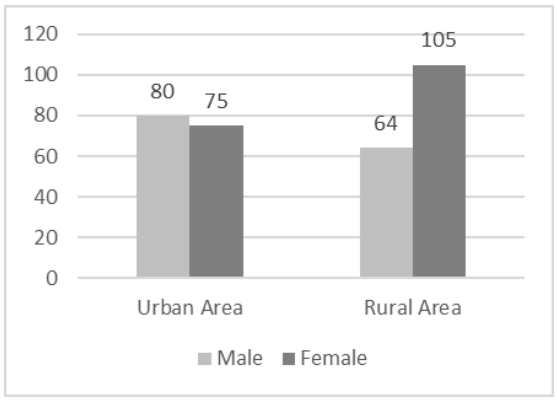

Fig. 3. The distribution of the respondents.

As shown in Fig. 3. there were 144 male and 180 female students who filled out the online survey about anxiety in learning mathematics from home. Based on their geographical area, there were 155 students from the urban area and 169 students from the rural area. According to the grade level, students in grades four, five, and six participated in this online survey with the number of students being 67, 177, and 80 respectively.

4.2. Data collection

The data was collected through an online survey. The survey consists of fifteen questions to assess students' anxiety when learning mathematics from online classes. The survey was developed using *Google Forms* and its link was distributed to the students through the teachers in the target area of the survey via *WhatsApp* message. The data were collected within a period from 15 to 21 July 2020.

4.3. Data analysis

The data were analysed using a statistical program IBM SPSS 22.0. Detailed information on how to use SPSS is reported in previous literature [41]. First, a descriptive statistical test was used to depict the demographic and other specified features of the respondents. Following this, a Mann-Whitney analysis was carried out to examine the difference in mathematics anxiety levels based on three demographic parameters (gender, prior experience with online learning before the pandemic, and area of the student). Finally, a correlational analysis was used to examine the connection between students' anxiety during distance learning and three different factors (difficulties in understanding mathematical contents, parental guidance, and teacher guidance).

5. Results and Discussion

The minority of 324 students in this study had prior experience learning through online media. Table 1 displays the descriptive analysis results for students' experiences with online learning.

Table 1. Students' experience in distance learning before the pandemic.

Experience	Number of Students	Ratio (%)
Never	255	78.7
Ever	69	21.3

According to Table 1, about 21.3% of the students in this survey had learned from online media. Following this finding, we discovered that 55.1% (38) of the 69 students who have experience learning through online media are from rural areas, whereas 44.9% (31) are from urban areas.

5.1. Students' anxiety during distance learning

5.1.1. Students' anxiety based on online learning experience before the pandemic COVID-19

In terms of experience in online learning before the pandemic, most students have never experienced online learning until the pandemic happened (255 out of 324 students) and the rest stated they have experienced it. The students' distribution level of anxiety based on online-learning experience before the pandemic is shown in Table 2.

Table 2. The number of students based on their mathematics anxiety levels and distance learning experience.

Level of Anxiety	Never		Ever	
	Number of Students	Percentage (%)	Number of Students	Percentage (%)
No Anxiety	45	17.6	15	21.7
Anxiety	154	60.4	38	55.1
High Anxiety	56	22.0	16	23.2

According to Table 2, most students, both those who have or do not have online learning experience before the pandemic, have anxiety but at a medium level. However, in the level of high anxiety, the percentage of students who experienced online learning before the pandemic is slightly high than those who does not (23.2% and 22% respectively). We can also see that 17.6% of students with no experience in online learning before the pandemic feel no anxiety, which percentage is smaller than those with experience.

5.1.2. Students' mathematics anxiety based on geographical area and gender

In terms of geographical area or the location where the student lives, we divide them into two regions, that is students who lived in the rural area and the urban area. Table 3 depicts the distribution of students' anxiety levels based on geographical areas.

Table 3 shows that 61.5% of students in rural areas and 56.8% of students in urban areas experience anxiety during distance learning. Furthermore, our findings indicate that 21.9% of students in rural areas and 22.4% of students in urban areas exhibit high anxiety during distance learning. It suggests that students in urban

areas are slightly more anxious than those in rural areas. Although the majority of students who participated in this study exhibited anxiety and high anxiety during distance learning implementation, our findings revealed that 16.6% of students in the rural area and 20.6% of students in the urban area demonstrated no anxiety during distance learning implementation. Therefore, our findings reveal that students in both rural and urban areas experience equal levels of anxiety during distance learning. There are 144 male students and 180 female students among the 324 participants in this online poll. Table 4 shows the analysis results of the student's level of anxiety during distance learning based on gender.

Table 4 reveals that 22.2% of the 144 male students in this study had no anxiety, 54.9% had anxiety, and 22.9% had high anxiety. Then, among 180 female students, 16% indicated no anxiety, 61.5% indicated anxiety, and 22.5% indicated high anxiety. This suggests that the majority of students (both male and female) were anxious during distance learning.

Table 3. The number of students based on their mathematics anxiety levels and geographical area.

Level of Anxiety	Rural Area		Urban Area	
	Number of Students	Percentage (%)	Number of Students	Percentage (%)
No Anxiety	28	16.6	32	20.6
Anxiety	104	61.5	88	56.8
High Anxiety	37	21.9	35	22.4

Table 4. The number of students based on their mathematics anxiety levels and gender.

Level of Anxiety	Male		Female	
	Number of Students	Percentage (%)	Number of Students	Percentage (%)
No Anxiety	32	22.2%	27	16
Anxiety	79	54.9%	104	61.5
High Anxiety	33	22.9%	38	22.5

Following the descriptive results in Tables 2, 3, and 4, the Mann-Whitney test was used to assess differences in students' anxiety based on prior online-learning experience, geographic area, and gender. The Mann-Whitney test (with $\alpha = 0.05$) results are shown in Table 5.

Table 5. Differences between students' mathematics anxiety based on distance learning experience, geographical area, and gender.

Grouping variable		*N*	*P-value*
Experience	Never	225	0.752
	Ever	69	
Geographical area	Rural area	155	0.645
	Urban area	169	
Gender	Female	180	0.464
	Male	144	

The Mann-Whitney test results displayed in Table 5, based on students' prior experience learning through online classes before the pandemic, indicate that (*P-value* = 0.752 > 0.05). The findings suggest that there is insufficient evidence to reject the null hypothesis, indicating that there is no significant difference in anxiety levels between students who have and students who have not experienced studying through online media before the pandemic. Furthermore, the anxiety level of students in rural and urban areas indicates that (*P-value* = 0.645 > 0.05). Again, there is no marked difference in students' anxiety levels between those who live in rural and urban areas. The anxiety levels of male and female students show a similar tendency. There is no significant difference in anxiety levels between male and female students during distance learning (*P-value* = 0.464 > 0.05*).*

5.2. Correlation analysis

Correlational analysis was used to examine the correlation between students' anxiety during distance learning and factors such as students' difficulties understanding mathematical content, parental guidance, and teacher guidance. Table 6 displays the results of the correlational analysis ($\alpha = 0.05$).

Table 6. Correlation analysis between students' anxiety during distance learning and potential factors affecting them.

Potential factor	*R* (Pearson's correlation coefficient)	*P-value*
Difficulty to understand mathematics content	0.417	0.000
Parents' guidance	0.092	0.078
Teachers' guidance	0.015	0.768

A correlational analysis was used to assess the correlation between students' learning anxiety and prospective factors such as students' difficulty understanding mathematical content delivered by the teacher via online mode; parents' guidance during distance learning; and teachers' guidance during distance learning. Table 6 showed that the students' difficulty understanding the teacher's mathematical content during distance learning was considerably correlated to the student's level of anxiety during distance learning (*P-value* = 0.000 - 0.05) with a medium correlation (*r* = 0.417). Our findings, on the other hand, show that parental guidance (*P-value* = 0.078 > 0.05) and instructor guidance (*P-value* = 0.768 > 0.05) had no significant correlation with students' anxiety levels during distance learning. It can be seen that both have a very weak correlation with *r* = 0.092 and *r* = 0.015 respectively.

5.3. Discussion

The purpose of this study was to investigate the impact of COVID-19 on primary school students' anxiety during distance learning. We described students' anxiety during distance learning based on their prior online learning experience, geography, and gender, and we analysed whether each demographic category had a significant difference in students' mathematical anxiety levels. Furthermore, our study looked at the correlation between prospective factors that affect students' anxiety, such as

students' difficulties understanding mathematical content delivered by the teacher using online mode, as well as parents' and teachers' guidance during distance learning.

Our study found that the majority of students are anxious during the online deployment of distance learning. These findings back up previous research by confirming high anxiety among online students [42]. Furthermore, our survey indicated no significant difference in students' anxiety during distance learning between students in rural and urban areas. Only 16.6% of rural students and 20.6% of urban students indicated no anxiety during distance learning, while the majority of students indicated anxiety and the remaining students indicated high anxiety. Similarly, there was no significant difference between students' gender and their level of anxiety during distance learning. During the application of distance learning, both groups experienced anxiety. Our findings differ from the earlier studies, which found that female students are more anxious about online courses than male students [35, 43, 44]. As a result of this finding, we discovered that students' anxiety during distance learning was influenced by the difficulty of understanding mathematical content delivered by the teacher via online mode.

Parents and teachers play an important role in assisting kids' success in distance learning [45]. However, following our findings, we discovered that factors such as parental and teacher guidance had no significant correlation with students' anxiety during distance learning. It may be concluded that parent and teacher guidance throughout the deployment of distance learning via online mode did not affect students' anxiety during distance learning. During distance learning, the majority of students received guidance from their parents and teachers. According to this study, fully online learning necessitated more parent-teacher communication, parental involvement in their child's education, and parental investment in their child's learning outcomes [46]. Furthermore, Gu and Lee [47] claim that when students receive instructional assistance, their knowledge gained from online mathematics learning can be improved. The sole factor that contributed to students' anxiety was their inability to comprehend mathematics knowledge presented by the teacher via online mode.

6. Conclusion

The majority of primary school children who took part in this study reported feeling anxious during the online deployment of distance learning. The difficulty of understanding mathematical content delivered by teachers via online media contributes to the student's anxiety. According to our findings, the roles of teachers and parents in supporting students through distance learning were critical. Because the majority of the children in our study received guidance from teachers and parents during distance learning, there is no significant correlation between parental and teacher guidance and students' anxiety during distance learning.

There are several limitations to this study that suggest future research priorities. First, this study's participants were students from both rural and urban areas. Students in rural areas who participated in this study had an internet connection and were able to learn online. Future studies could focus on students who live in remote areas and have limited access to the internet. Then, this study's participants were students in grades four, five, and six. Therefore, the findings of this study cannot be applied to all students in primary school. The result may differ for students in lower grades, such as first, second, and third grades.

References

1. Stambough, J.B.; Curtin, B.M.; Gililland, J.M.; Guild, G.N.; Kain, M.S.; Karas, V.; and Moskal, J.T. (2020). The past, present, and future of orthopedic education: Lessons learned from the COVID-19 pandemic. *The Journal of arthroplasty*, 35(7), S60-S64.
2. Mailizar, M.; Almanthari, A.; Maulina, S.; and Bruce, S. (2020). Secondary school mathematics teachers' views on e-learning implementation barriers during the COVID-19 pandemic: The case of Indonesia. *Eurasia Journal of Mathematics, Science and Technology Education*, 16(7).
3. Sani, Y.; Rochyadi, E.; Wardany, O.F.; Hufad, A.; Sunardi, S.; and Nandiyanto, A.B.D. (2021). Understanding the importance of implementation health protocols in the Covid-19 epidemic for student with hearing impairment trough experimental demontrations. *Journal of Engineering, Science and Technology*, 16, 1-8.
4. Maryanti, R.; Hufad, A.; Sunardi, Nandiyanto, A.B.D.; Al-Obaidi, A.S.M. (2020). Understanding Covid-19 particle contagion through aerosol droplets for students with special needs. *Journal of Engineering, Science and Technology*, 15(3), 1909-1920.
5. Saputra, H.; Albar, C.N.; Soegoto, D.S. (2022). Bibliometric analysis of computational chemistry research and its correlation with covid-19 pandemic. *Moroccan Journal of Chemistry*, 10(1), 37-49.
6. Nandiyanto, A.B.D.; Al Husaeni, D.N.; Al Husaeni, D.F. (2021) A bibliometric analysis of chemical engineering research using vosviewer and its correlation with Covid-19 pandemic condition, *Journal of Engineering Science and Technology*,16(6), 4414-4422.
7. Artawati, A.; Handaya, F.H.D.; Marito, S.L. (2022). Comparison analysis of the effectiveness of online and offline clasess in following tax brevet training on accounting students of Universitas Komputer Indonesia during the Covid-19 pandemi. *ASEAN Journal of Community Service and Education*, 1(1), 51-62.
8. Giani, W.A.; Safiya, D.A.S.; Damanik, B.R.A. (2022). Use of ice-breaking methods in increasing student concentration amid online learning during COVID-19 pandemic. *ASEAN Journal of Community Service and Education*, 1(1), 43-50.
9. Leony, I.; Muktiarni, M.; and Mupita, J. (2022). Utilization of educational video as a media for learning simple accounting for elementary school students' during the COVID-19 period. *ASEAN Journal of Economic and Economic Education*, 1(1), 27-34.
10. Benito, B.S.A.; and Camral, K.A.M. (2023). Understanding the advantages and disadvantages of online class during the COVID-19 pandemic lockdowns in Southern Philippines. *ASEAN Journal of Educational Research and Technology*, 2(2), 145-152.
11. Azhar, F.M.; and Maryanti, R. (2023). Response of junior high school students on online learning in suppressing the spread of COVID-19. *ASEAN Journal of Educational Research and Technology*, 2(1), 21-28.
12. Ayupratiwi, T.; Nandiyanto, A.B.D.; Kurniawan, T.; and Bilad, M.R. (2022). Online learning using audio-visual for elementary school students during the

Covid-19 pandemic. *ASEAN Journal of Educational Research and Technology*, 1(2), 125-132

13. Shirtode, M.B.; and Madam, M.J. (2022). A study on working from home during the covid-19 pandemic; satisfaction, challenges, and productivity of employees. *ASEAN Journal of Educational Research and Technology*, 1(1), 53-58.
14. Pangestu, T.I.; and Sakti, A.W. (2023). Learning color theory in elementary school using basic infographic media during the covid-19 pandemic. *ASEAN Journal of Science Education*, *2*(1), 1-6
15. Octaviani, H.; Sakti, A.W.; and Bilad, M.R. (2022). Improving activities and learning outcomes of elementary school students through experimental methods using lime as an alternative electrical energy source during the covid-19 pandemic. *ASEAN Journal of Science Education*, 1(2), 63-74
16. Nafsi, N.R.R.; and Maryanti, R. (2022). Analysis of teacher skills in e-learning content development during distance learning during the Covid-19 pandemic. *ASEAN Journal of Science Education*, 1(1), 23-32
17. Sangsawang, T. (2020). An instructional design for online learning in vocational education according to a self-regulated learning framework for problem solving during the covid-19 crisis. *Indonesian Journal of Science and Technology*, 5(2), 283-198.
18. Mulyanti, B.; Purnama, W.; and Pawinanto, R.E. (2020). Distance learning in vocational high schools during the covid-19 pandemic in West Java province, Indonesia. *Indonesian Journal of Science and Technology*, 5(2), 271-282.
19. Hashim, S.; Masek, A.; Abdullah, N.S.; Paimin, A.N.; and Muda, W.H.N.W. (2020). Students' intention to share information via social media: A case study of covid-19 pandemic. *Indonesian Journal of Science and Technology*, 5(2), 236-245.
20. Wahyu, A.G.M.; and Sakti, A.W. (2023). The effect of the implementation of animated learning videos on increasing students' motivation and learning outcomes in citizenship education during the covid 19 pandemic in junior high schools. *ASEAN Journal of Science and Engineering Education*, 3(2), 139-148.
21. Moorhouse, B.L. (2020). Adaptations to a face-to-face initial teacher education course 'forced' online due to the COVID-19 pandemic. *Journal of Education for Teaching*, 46(4), 609-611.
22. Irawan, A.W.; Dwisona, D.; and Lestari, M. (2020). Psychological impacts of students on online learning during the pandemic COVID-19. *KONSELI: Jurnal Bimbingan dan Konseling (E-Journal)*, 7(1), 53-60.
23. Li, S.; Wang, Y.; Xue, J.; Zhao, N.; and Zhu, T. (2020). The impact of COVID-19 epidemic declaration on psychological consequences: A study on active Weibo users. *International Journal of Environmental Research and Public Health*, 17(6), 1-9.
24. Smith, G.G.; and Ferguson, D. (2005). Student attrition in mathematics e-learning. *Australasian Journal of Educational Technology*, 21(3), 323-334.
25. Szczygieł, M.; and Pieronkiewicz, B. (2022). Exploring the nature of math anxiety in young children: Intensity, prevalence, reasons. *Mathematical Thinking and Learning*, 24(3), 248-266.

26. Rozgonjuk, D.; Kraav, T.; Mikkor, K.; Orav-Puurand, K.; and Täht, K. (2020). Mathematics anxiety among STEM and social sciences students: The roles of mathematics self-efficacy, and deep and surface approach to learning. *International Journal of STEM Education*, 7(1), 1-11.
27. Richardson, F.C.; and Suinn, R.M. (1972). The mathematics anxiety rating scale: Psychometric data. *Journal of Counselling Psychology*, 19(6), 551-554.
28. Wang, Z.; Oh, W.; Malanchini, M.; and Borriello, G.A. (2020). The developmental trajectories of mathematics anxiety: Cognitive, personality, and environmental correlates. *Contemporary Educational Psychology*, 61(2020), 1-14.
29. Azizan, F.L.; Rahim, N.F.; Siaw, E.S.; Ghani, K.A.; and Sathasivam, S. (2022). Innovative classroom strategy: impact on students' mathematics motivation, anxiety and achievement in pre-university studies. *International Journal of Information and Education Technology*, 12(2), 165-170.
30. İlhan, A.; Poçan, S.; and Gemcioğlu, M. (2021). The effect of mathematics class commitment and anxiety on mathematics success: A path analysis study. *Education and Urban Society*, 54(2), 186-204.
31. Alabdulaziz, M. (2020). Creativity enhanced program for twice exceptionally gifted: effects of mathematics anxiety level. *Journal for the Education of Gifted Young Scientists*, 8(3), 1185-1199.
32. Bouzid, T.; Kaddari, F.; Darhmaoui, H.; dan Bouzid, E.G. (2021). Enhancing math-class experience throughout digital game-based learning, the case of moroccan elementary public schools. *International Journal of Modern Education and Computer Science*, 13(5), 1-13.
33. Juniati, D.; and Budayasa, I.K. (2021). Field-based tasks with technology to reduce mathematics anxiety and improve performance. *World Transactions on Engineering and Technology Education*, 19(1), 58-64.
34. Lewis, A. (1970). The ambiguous word "anxiety." *International Journal of Psychiatry*, 9, 62-79.
35. Hembree, R. (1990). The nature, effects, and relief of mathematics anxiety. *Journal for Research in Mathematics Education*, 21(1), 33-46.
36. Sarason, S.; and Mandler, G. (1952). Some correlates of test anxiety. *Journal of Abnormal and Social Psychology*, 47, 810-817.
37. Wine, J. (1971). Test anxiety and direction of attention. *Psychological Bulletin*, 76, 92-104.
38. Brush, L. (1981). Some thoughts for teachers on mathematics anxiety. *Arithmetic Teacher*, 29(4), 37-39.
39. Wahid, S.N.S.; Yusof, Y.; and Razak, M.R. (2014). Math anxiety among students in higher education level. *Procedia-Social and Behavioral Sciences*, 123, 232-237.
40. Dowker, A.; Sarkar, A.; and Looi, C.Y. (2016). Mathematics anxiety: What have we learned in 60 years?. *Frontiers in Psychology*, 7, 1-16.
41. Afifah, S.; Mudzakir, A.; and Nandiyanto, A.B.D. (2022). How to calculate paired sample t-test using SPSS software: From step-by-step processing for users to the practical examples in the analysis of the effect of application anti-

fire bamboo teaching materials on student learning outcomes. *Indonesian Journal of Teaching in Science*, 2(1), 81-92.

42. Devaney, T.A. (2010). Anxiety and attitude of graduate students in on-campus vs. online statistics courses. *Journal of Statistics Education*, 18(1), 1-15.
43. Conrad, D.L. (2002). The influence of learning style preferences on student success in online versus face-to-face environments. *American Journal of Distance Education Distance Education*, 16(4), 227-244.
44. Abdous, M. (2019). Influence of satisfaction and preparedness on online students' feelings of anxiety. *Internet and Higher Education*, 41, 34-44.
45. Serianni, B.A.; and Coy, K. (2014). Doing the math: Supporting students with disabilities in online courses. *Teaching Exceptional Children*, 46(5), 102-109.
46. Smith, S.J.; Burdette, P.J.; and Cheatham, G.A. (2016). Parental role and support for online learning of students with disabilities: A paradigm shift. *Journal of Special Education Leadership*, 29(2), 101-112.
47. Gu, P.; and Lee, Y. (2019). Promoting students' motivation and use of SRL strategies in the web-based mathematics learning environment. *Journal of Educational Technology Systems*, 47(3), 391-410.