Students' Anxiety Level in Learning Calculus 1 during the COVID-19 Endemic

Fadila Amira Razali [1*], Anisah Dasman [2], Nor Fadhilah Dzulkifli[2], Marina Mohamed[4] & Norhuda Mohammed[5]

[1-6]College of Computing, Informatics and Mathematics, Universiti Teknologi MARA Cawangan Pahang, 26400 Bandar Tun Abdul Razak Jengka, Pahang, Malaysia
fadila962@uitm.edu.my
*Corresponding author

Received: 15 July 2023
Accepted: 08 September 2023
Date Published Online: 21 October 2023

Abstract: The COVID-19 pandemic has precipitated substantial modifications to the educational system, requiring students to continually switch from traditional learning into online distance learning. Previous studies have revealed that students experienced severe levels of anxiety in the COVID-19 period. Considering the close relationship that has always linked anxiety to mathematics, this paper is concerned with the anxiety level of Diploma Science students at Universiti Teknologi MARA (UiTM) Pahang (Jengka Campus) in relation to the Calculus 1 course. This study aimed to identify the anxiety level of student in learning Calculus 1 during online distance learning. Additionally, the study sought to ascertain whether there was a significant difference in the mean levels of anxiety levels and academic performance between genders. The study sample consisted of 218 Diploma in Science (AS120) students. The collected data were analyzed using mean score and independence t-test analysis. The result highlighted that three factors, emotion, environment and technology, had a low level of anxiety. Based on the mean score obtained, the students were rarely affected emotionally, environmentally, and technologically towards this course during online learning. Meanwhile, students experience more anxiety with their assessment factor in learning Calculus 1. The comparison between males and females with respect to anxiety factors and their performance in Calculus 1 has also been checked. The overall mean values for three anxiety factors of emotion, environment and assessment anxiety were slightly higher in male students as compared to female students. Moreover, female students were found to have higher performance in Calculus 1 than male students. This indicates that female students perform better in Calculus 1 during online learning compared to male students. Thus, it can be seen that anxiety level significantly affects the students' performance. Therefore, it is recommended that University should take action and concern towards the students and manage their academic anxiety to boost their confidence in online learning, especially in the Calculus 1 subject.

Keywords: Anxiety, Calculus 1, Performance, Online Learning

Introduction

Currently, online learning has been a major use in higher education in Malaysia since the outbreak of the Covid-19 pandemic. This is because there are many benefits that arise from this type of learning, such as convenience, particularly in terms of time, flexibility, and accessibility (Callaway, 2012). Furthermore, online learning also helps many students who especially are unable to attend face-to-face classes due to other constraints. However, there are also some disadvantages that arise from this online learning. Cole et al. (2014) stated that some students lack discipline and have low retention rates during online classes. Besides, university students are dissatisfied with online learning because

of technology problems that lead to high frustration levels, lack of interaction, feelings of isolation, and unclear course expectations (Callaway, 2012; Yen & Lee, 2011). Apart from that, students' internet connections may be unreliable, making it impossible for them to continue their lessons. Problems with internet connectivity disproportionately affect rural students and have a negative impact on their learning experience (Hampton et al., 2020). In 2009, a study by Ajmal and Ahmad explored the difference between face-to-face and online learning and associated environmental factors affecting students that can cause anxiety and then will influence their performance. There are numerous types of academic anxiety including computer anxiety, research anxiety, statistical anxiety, writing anxiety, foreign language anxiety, general test anxiety, and math anxiety (Onwuegbuzie, Jiao, & Bostick, 2004).

Mathematics performance among students from primary school through higher education institutions remains a problem. Despite the fact that mathematics has been taught since kindergarten, many students in higher education institutions struggle with basic mathematics questions. Most of them believe that mathematics is a tough paper, requires extensive understanding, difficult to learn, very complex, and difficult to pass, among other things. These negative thoughts all contributed to mathematical anxiety.

Literature Review

There were concerns that learning mathematics outside of the classroom could undermine inquiry-based approaches to learning mathematics in a variety of ways. First, as Sullivan et al. (2020) point out, explicit explanations followed by repeated practise are conducive to the use of video technology, specifically instructional videos that can be prepared ahead of time and shared via a weblink. In contrast, inquiry-based approaches to mathematics learning require student-centred, mathematically rigorous discussions centred on students' experiences working on tasks. Kalogeropoulos et al. (2021) also stated that online mathematics learning will undoubtedly reduce students' opportunities to learn mathematics with their peers because interactions between students are limited (Calder et al., 2021) as well as the lack of interaction between students and teachers (Fauzy & Nurfauziah, 2021). According to the research conducted by Smith & Ferguson (2005), it was observed that the attrition rate for online mathematics courses is comparatively higher when compared to other online subjects. This higher attrition rate can be attributed to the challenges posed by the utilisation of complex mathematical symbols within the online learning environment. Tawil et al. (2012) similarly discovered that engineering students exhibit a preference for conventional in-person lectures when it comes to mathematics, due to the same reason. Since the traditional learning itself was tough and hard for students, the online distance learning could be the problem. Recent studies have revealed that students experienced severe levels of anxiety in the COVID-19 period. According to Zhang et al. (2020), a significant proportion of junior high and high school students encountered adverse psychological consequences, including increased levels of anxiety, depression, and stress, within the COVID-19 pandemic. In contrast to other academic disciplines, mathematics is often associated with a prevalent emotional state known as anxiety. This emotional response tends to escalate with age and has been found to impede the development of mathematical skills, resulting in avoidance behaviours and limited proficiency in mathematical abilities (Elizondo, 2021).

Math anxiety is defined as an irrational feeling of panic, embarrassment, flurry, avoidance, failure, and fear, which are physically visible, and prevent solutions, learning, and success in mathematics (Bekdemir, 2020). Several factors closely related to math anxiety are teacher influence, parental influence, the impact of the teaching method, the perception of math difficulty, the pressure of time limits on tests, the fear of public embarrassment, and the belief that math performance is a measure of intelligence (Wani, 2020). Other studies also point out several reasons for the anxiety in online learning, which are lack of communication with the tutors, poor feedback from the tutors, lack of understanding of assignments, lack of time given to prepare assignments, due dates of assignments, assessments, poor quality of books and tutor remarks, performing a job side by side with education, including several issues regarding assignment schedules (Merrell, 2008; Ajmal & Ahmad, 2019). In a study conducted by Ariawan (2022), it was discovered that a significant proportion of respondents, specifically 88.36%, exhibited a lack of comprehension regarding the mathematics material that was disseminated online. Math anxiety has been shown to have effects on physiological, cognitive, and

emotional levels (Pirrone et al., 2022). A previous study also found less emotional tension, better use of study resources such as books, online encyclopedias, and school notes, greater study flexibility, and more active processing during online school (Martin, 2017). From this perspective, computer screens appear to 'shield' students from mathematics-induced anxiety and, as a result, improve some aspects of the learning process.

Apart from emotional, math anxiety has also affected the environment of the students. According to Lukowski et al. (2019), math anxiety should be viewed as a multidimensional construct because it includes anxiety about performing mathematical calculations, anxiety about math in the classroom, and anxiety about math tests. In other words, math anxiety should not be measured based on just one cause. Environment, assessment, math skills and social skills should be emphasized together. A previous study also found that personal, family, institutional, social and political factors are considered to be potential threats to students' serious academic anxiety (Rehman, 2016). This statement could relate to the fact that the environmental situation also affects students' anxiety during online learning.

Numerous studies have been undertaken to examine academic achievement in mathematics and the various factors that influence it particularly during online distance learning. Apart from that, it is important to make sure that all students have good mental health. This is because a person with unstable mental health, including students, could affect their daily life. Therefore, the objective of this study is to identify students' anxiety level towards Calculus 1 subject and to determine the mean difference of students' anxiety level as well as their performance between gender. The findings of this study are anticipated to offer valuable and advantageous insights for students, educators, and parents seeking to enhance mathematics performance in higher education institutions

Methodology

The current situation of Covid-19 makes online distance learning (ODL) the main medium in the teaching and learning process, including in higher education institutions. From this viewpoint, a study of students' anxiety was conducted to determine the level of their anxiousness between all factors and also among genders.

A total of 218 students were involved in this study to explore their anxiety factors levels in learning Calculus 1 during online distance learning. The second-year Faculty of Applied Sciences students were randomly selected for this study. A simple random sampling procedure was used to select a sample. This method was chosen because the students were comes under the same programs.

A self-developed questionnaire was built and distributed to the students using Google Forms online to achieve the objectives of the study. The reliability of the constructed questionnaire has been measured, and Cronbach's alpha obtained was equivalent to 0.948. The questionnaire comprises two parts with a total of fifty-nine items. The first part consists of twelve items related to the respondents' demographic profile. At the same time, the second part consists of four anxiety factors: emotional, assessment, environmental and technological factors. All the items were measured on a five-point Likert scale that ranges from Never to Always.

The Statistical Procedure for Social Sciences (SPSS) was used to encode and analyze the data. The statistical method used in this study was descriptive and an independent t-test. Firstly, descriptive analysis was used to describe the demographic characteristics of all respondents. The percentage (%) for the gender, hometown and perception of the respondents were presented since it was a categorical variable. Meanwhile, the mean and standard deviation (SD) were presented for the numerical variable. A mean score was employed to conclude the respondents' feedback towards each anxiety factor which are emotional, assessment, environmental and technological factors as given in the survey form.

An independent t-test was used to compare two sample means to determine whether the population means were significantly different. There are several assumptions that need to be fulfilled before conducting the independent t-test. The normality assumption for each factor has been checked using the normal probability and residual scatter plots to detect and eliminate any outliers. It has been found that the normality assumption for the variables was not violated. After checking the normality, an equal variance must be assumed to proceed with the Independent t-test. Levene test has been used in order to check the assumption of equal variance for all factors across the gender. An equal variance is considered to be met when the p-value in the Levene Test is more than 0.05. Based on the tests, the

assumption of equal variance was not violated for all factors. Finally, the mean difference of all factors between different genders has been checked by using the independent t-test. The factors are considered different between genders if the p-value is less than alpha = 0.05.

Results and Discussion

A total of 218 students were involved in this study to explore their anxiety factors level in learning Calculus 1 during online distance learning. The second-year Faculty of Applied Sciences students were randomly selected for this study. Out of 218 students that have been investigated, 15.6% were male, while 84.4% were female students. Most respondents were 20 years old, with 76.1%, followed by 23% of students aged between 18 to 19 years old, and the rest were above 21 years old. The majority of the students for this study were 69.7% from urban areas, and the rest, 30.3% from rural areas.

Table 1 Demographic characteristics

Characteristic	**Frequency (%)**
Gender	
Male	34 (15.6)
Female	184 (84.4)
Age	
18 years old	1 (0.5)
19 years old	49 (22.5)
20 years old	166 (76.1)
21 years and above	2 (0.9)
Hometown	
Rural	66 (30.3)
Urban	152 (69.7)

Of all participating students, 54.6% think that Calculus 1 is not suitable to be taught using the online platform, and the other 45.4% think it is suitable for those cases. Table 2 also shows that 81.7% of the students felt that learning Calculus 1 using an online platform is difficult, whereas 18.3% did not think so. Other studies also found that only 21.4% agreed that they preferred the online environment, and 62.5% of students preferred the traditional classroom assessment instead of being assessed online (Krishnan, 2016). The result on multiple bar charts visualizes the difficulty ranking by courses among diploma science students. The participants took four courses. Based on the chart, Calculus 1 was nominated as the most difficult course after Science subject. 43.1% % of students ranked that Calculus 1 was difficult to learn using the online platform, followed by 16.1% that voted for very difficult to learn, and 39.9% said it was moderate. This result shows how much students were concerned about learning Calculus 1 course.

Table 2 Student's perception towards learning Calculus 1 using the online platform

Students perception	**Frequency (%)**	
	Yes	No
Suitability Learning Calculus 1 using Online Platforms	99 (45.4)	119 (54.6)
Difficulty Learning Learning Calculus 1 using Online Platforms	178 (81.7)	40 (18.3)

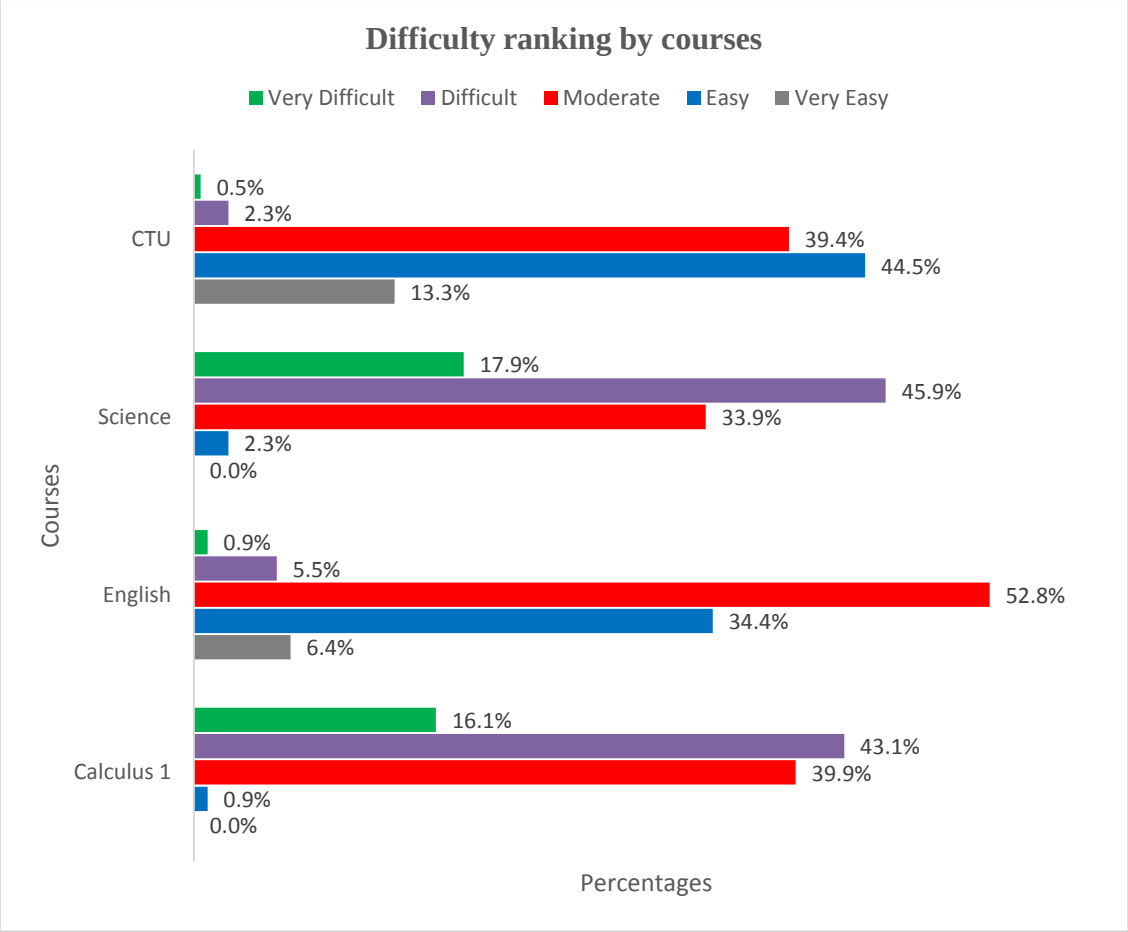

Fig. 1 Multiple bar chart of difficulty ranking by courses

Table 3 shows the mean score and standard deviations for emotional anxiety factors towards Calculus 1 during ODL. On average, students seem not emotionally affected towards the Calculus 1 course during online learning. The average range between 2 and 3 shows that the students were rarely emotionally affected towards this course during online learning. Other study also identified that more than two-thirds of the students expressed a preference for responses indicating that learning mathematics at home was enjoyable, interesting, or not tedious (Kalogeropoulos et al., 2021). Furthermore, the study found that these students reported feeling content while engaging in mathematical activities within their home environment. However, there were several items that show that the students often felt emotionally affected by this course. For example, students often felt nervous and upset when doing and thinking about this course. In fact, during online classes, they often felt headaches and neck stiffness when doing or thinking about Calculus 1.

Table 3. Students' perception towards learning Calculus 1 using online platforms

Emotions	**Mean (SD)**	**Standard Deviation**
I feel like I do not have much control over my grades in Calculus 1 through online distance learning.	3.27	0.957
I feel my heart race when doing or thinking about Calculus 1 during online distance learning.	3.25	1.012
I get emotionally upset when doing or thinking about Calculus 1 during online distance learning.	3.28	1.001

I get sweaty or clammy hands when doing or thinking about Calculus 1 during online distance learning.	2.68	1.184
I feel butterflies in my stomach when doing or thinking about Calculus 1 during online distance learning.	2.69	1.123
My stomach gets physically upset when doing or thinking about Calculus 1 during online distance learning.	2.51	1.163
My muscles feel tense, and I feel stiff when doing or thinking about Calculus 1 during an online distance learning.	2.61	1.197
I have trouble sleeping at night before or after an online class or online tests in Calculus 1.	2.65	1.259
I feel like I have to urinate more frequently when in an online class or working on the tutorial of Calculus 1.	2.11	1.099
I get headaches or neck stiffness when doing or thinking about Calculus 1 during online distance learning.	3.01	1.249
I get anxious when I think about logging into my online Calculus 1 course.	2.63	1.24
I get nervous when I am required to participate in online discussions.	3.09	1.164
I am scared that someone will misinterpret my text-based messages during the online class.	3.21	1.21

Next, Table 4 revealed the mean score for assessment anxiety factors. Based on the value mean score, students experience more anxiety with their assessment factor in learning Calculus 1. This can seen by looking at on the second and third items as example in Table 4, where student felt like they need to prepare much more for Calculus 1online assessment that other subject. They also complained that Calculus 1 online assessment are much more stressful compare to other subject. The mean value score was more than 3, indicating that they were sometimes affected by the assessment in learning Calculus 1. Ajmal & Ahmad's (2019) study found that the students were moderately affected due to lack of time given to prepare assignments, due dates of assignments, understanding of assignments, and assessment of assignments and tutor remarks. A recent study also claimed that understanding the material in online learning takes longer than face-to-face learning (Huda et al., 2021).

Table 4. Mean scores and standard deviations for assessment factors scale items

Assessment	**Mean (SD)**	**Standard Deviation**
I tend to do very poorly on Calculus 1 online assessment.	2.89	1.075
I feel like I need to prepare much more for Calculus 1 online assessment than for other subjects.	3.68	.967
Calculus 1 online assessments are much more stressful to me than other assessments.	3.16	1.152
When studying for a Calculus 1 online assessment, I find myself showing anxious behaviour.	2.84	1.231

I feel that I understand certain Calculus 1 concepts in online classes but do poorly on the assessment.	3.40	1.050
I have trouble concentrating during Calculus 1 online assessment.	3.18	1.089
I do not feel confident when taking the Calculus 1 online assessment, no matter how much I study.	3.42	1.152
I feel that I am not confident with my idea/ method of solution during the Calculus 1 online assessment.	3.23	1.089
I generally feel that online assessments in any subject are a reflection of my worth as a person	3.46	1.041
During Calculus 1 online assessments, I find myself not really concerned/serious about the assessment.	2.75	1.144

In regards to the environmental factor, the mean score was between 2 to 3, which revealed that the students were rarely affected by this factor. However, there were several items that the students were sometimes affected by environmental factors. The students sometimes were affected by the online learning environment as can be seen in item two in Table 5. This indicates they were uncomfortable with the medium used for teaching and learning. The study by Kalogeropoulos et al. (2021) described that it was "extremely difficult" and a "significant challenge" to find ways to engage students in the home learning space. The individuals expressed apprehension regarding the potential disengagement of students who encounter difficulties in comprehending mathematical concepts within an educational setting. This concern is particularly heightened in instances where these students lack the necessary assistance from an adult figure within their domestic environment. According to Grecu (2022), teachers identified a lack of math knowledge resulting from inadequate student engagement as the primary factors contributing to math anxiety. They are also sometimes affected due to the comparison and thinking about their peer's perception and performance in Calculus 1. This somehow tends to increase their anxiety in Calculus 1.

Then, on technology anxiety factors, Table 6 shows that the students had a low level of anxiety. All the mean score value was less than 3, which indicated that they were rarely affected by technologcal factor. Nevertheless, with a mean score of more than 3, students sometimes felt confused when learning with the Internet medium. All of these factors will affect students' performance. If the level of anxiety were high, it would have affected students' performance (Ajmal & Ahmad, 2019).

Table 5. Mean scores and standard deviations for environment factors scale items

Environment	**Mean (SD)**	**Standard Deviation**
I feel that I will never be able to learn Calculus 1, no matter how hard I try through this online class.	2.56	1.096
I am not confident learning Calculus 1 in an online environment.	3.07	1.105
I feel that others have a more "mathematical" or "logical" mind than I do.	3.43	1.173
My parents and/or friends tell me about their own struggles and frustrations with math.	3.00	1.191
I rely on other people to help me with day-to-day Calculus 1 situations.	3.17	1.035

I feel that in math, answers are either right or wrong, and there is little room for anything in between.	3.20	1.024
I have had Calculus 1 lecturers that were not really helpful during online classes.	1.91	1.074
I find myself worrying about other people's math abilities and comparing them to my own.	3.18	1.260
I feel that although I am quite talented at some things, none of them (family/lecturers/friends) help me with Calculus 1 during online distance learning.	2.35	1.196
I have been punished or embarrassed in Calculus 1 online class for not understanding something.	1.69	1.073
I feel like I have never really understood Calculus 1, and I am faking my way through it through the online class.	2.53	1.250

Table 6. Mean scores and standard deviations for technology factors scale items

Technology	**Mean (SD)**	**Standard Deviation**
I am insecure about my computer skills.	2.87	1.136
I am anxious when I work on computers.	2.58	1.087
I am quite relaxed when I work with computers. (recode)	3.18	0.988
I am apprehensive about working on computers.	2.76	0.783
I avoid working on computers.	2.26	1.067
I am less intimidated by computers than most other people I know. (recode)	3.33	0.915
I feel confident about navigating the Internet during online classes. (recode)	3.10	0.915
I get anxious when I am required to use Internet resources during online classes.	2.49	1.060
I get nervous about getting lost in cyberspace during my online class.	2.88	1.127
I get excited about using the Internet during online classes. (recode)	3.20	0.917
I enjoy browsing the Internet during online classes. (recode)	3.07	0.892
I get confused when learning on the Internet.	3.08	.978

The mean difference between gender for both mean score of anxiety factor and their performance in Calculus 1 had been checked as in Table 7. The mean score of technology anxiety factors among the students does not have a significant difference between different gender (t = -0.429, P-value = 0.611). However, there is a significant difference in the emotion factor between gender (t = -2.483, P-value = 0. 014. The mean score of the emotion factor among male students was 3.173, which was higher compared to the mean score of female students at 2.786. This indicates that male students were affected more emotionally compared to female students. The assessment factor was also significantly different between gender, with a P-value less than 0.05 and a confidence interval not including 0. The mean score for male students was 3.497, which was higher than for female students

(3.038). Lastly, there is also a significant difference in environmental factors between male and female students (t = -2.905, P-value = 0.004). The mean score for environmental factors was reported that male students had a higher mean score (M = 3.064) than female students (M = 2.675). Meanwhile, a significant difference among male and female scores related to their Calculus 1 also has been checked. It was found that there was a significant difference in their performance between gender (t = 3.383, P-value = 0.001). The mean score for female students (M = 76.94) was higher than for male students (M = 71.06). This indicates that female students perform better in Calculus 1 during online learning than male students. This result is in line with the study conducted by Ajmal and Ahmad (2019); Ahmad, Hussain, and Khan (2018), where compared to male students, female students show better performance and less anxiety. However, some literature found that there are higher levels of math anxiety in females than in males (Wigfield & Meece 1988; Mutodi & Ngirande 2014). Despite that, Brenda et al. (2013) believed that gender differences in mathematical anxiety might differ in different cultures.

Table 7. The Independent t-test of anxiety factors and student performance between different genders

	Gender, Mean(SD)		**Levene Test (Sig.Value)**	**t-test(sig value)**	**95% Confidence Interval of the Difference**	
	Male	**Female**			**Lower**	**Upper**
Emotion	3.173(0.981)	2.786(0.804)	1.976(1.161)	-2.483(0.014)	-0.693	-0.0796
Assessment	3.497 (0.712)	3.038(0.755)	0.321(0.571)	-3.288(0.001)	-0.735	-0.184
Environment	3.064(0.669)	2.675(0.727)	0.025(0.875)	-2.905(0.004)	-0.654	-0.125
Technology	2.934(0.586)	2.895(0.465)	1.42(0.235)	-0.429(0.069)	-0.453	0.139
Exam Score (Calculus 1)	71.06(8.889)	76.94(9.377)	0.237(0.627)	3.383(0.001)	2.453	9.299

Conclusion

This study is conducted to investigate the level of anxiety among all factors in learning Calculus 1 via online distance learning during the Covid-19 pandemic among 218 respondents. Several factors have been considered, such as gender, hometown, perception, emotions, assessment, environment and technology. To conclude, Calculus 1 is not suitable to be taught online since this subject is determined as difficult compared to the other four subjects. This conclusion was supported by Krishnan (2016), and Hamat et al. (2021) stated that students prefer learning mathematics in a classroom instead of online environment. Besides, the assessment factor has moderately influenced anxiety due to the requirement of the subject. This factor needs further discussion between the lecturer and the student for enhancement. This result is in line with the study conducted by Ajmal and Ahmad (2019), where students experience anxiety due to the assessment given. Meanwhile, it is found that learning Calculus via ODL has not affected the students' anxiety emotionally, environmentally and technologically. All students mostly have a low level of anxiety in regard to these three factors. Moreover, it found that male students seem to have higher anxiety than female students for the factor of emotional, environmental and assessment. In terms of Calculus 1 performance, it found that females have a better performance compared to male's student during online learning. Therefore, it can be inferred that students who exhibit lower levels of mathematics anxiety are likely to achieve higher performance in the field of mathematics.

Based on the aforementioned findings, it is anticipated that in the context of online learning, both educators and students should actively address the assessment factor. This factor has been determined to have a moderate impact on students' performance, regardless of gender, in comparison to other factors. Efforts should be made to identify appropriate methodologies aimed at assisting

students in managing the evaluation process related to the subject matter. At least, this may help reduce students' anxiety and consequently increase their examination scores in the Calculus 1 subject. In the future, there may be a greater emphasis on addressing mathematics anxiety at an early stage, such as in primary or secondary school. This preventive measure could help reduce the prevalence of severe mathematical anxiety, particularly in the context of online distance learning. Therefore, it is anticipated that this discovery will offer valuable insights to individuals engaged in enhancing mathematics achievement in higher education institutions.

References

Ajmal, M., & Ahmad, S. (2019). Exploration of Anxiety Factors among Students of Distance Learning: A Case Study of Allama Iqbal Open University. *Bulletin of Education and Research*, *41*(2), 67–78.

Ariawan, I. P. W. (2022). The academic impact of online mathematics learning during COVID-19 for junior high school students. Jurnal Elemen, 8(1), 131–143.

Bekdemir, M. (2010). The pre-service teachers' mathematics anxiety related to depth of negative experiences in mathematics classroom while they were students. Educational Studies in Mathematics, 75(3), 311–328. https://doi.org/10.1007/s10649-010-9260-7

Brenda R.J., Jolien L., Marthe S., Sanne H.G. Van der Ven, Sharon K., Han L.J. Van der Maas. (2013). The influence of experiencing success in math on math anxiety, perceived math competence and math performance. Journal of Elsevier 24, (pp. 190-197).

Calder, N., Jafri, M., & Guo, L. (2021). Mathematics education students' experiences during lockdown: Managing collaboration in elearning. Education Sciences, 11(4).

Callaway, S. K. (2012). Implications of online learning: Measuring student satisfaction and learning for online and traditional students. Insights to a Changing World Journal, 2, 67- 94.

Elizondo, A.M. (2021). I Don't Know What to Do: A Mixed Method Study of Math Anxiety as Perceived by Students and Their Parents. Available online: https://hdl.handle.net/1969.6/89786 (accessed on 1 September 2023).

2021. Available online: https://hdl.handle.net/1969.6/89786 (accessed on 6 March 2022).Fauzy, A., & Nurfauziah, P. (2021). Kesulitan Pembelajaran Daring Matematika Pada Masa Pandemi COVID-19 di SMP Muslimin Cililin. Jurnal Cendekia : Jurnal Pendidikan Matematika, 5(1), 551–561.

Grecu, A.-E. (2022). Online teaching and students' perceived level of math anxiety during covid-19 pandemic. Journal of Educational Sciences, 46(1), 45–56.

Hamat, M., Omar, M., Ahmad, N., & Zahari, M. F. (2021). *Perceptions Of Students In Learning Mathematics Through Open Aand Distance Learning (ODL)*. 138–144.

Hampton, K., Fernandez, L., Robertson, C., & Bauer, J. M. (2020). Repercussions of Poor Broadband Connectivity for Students in Rural and Small Town Michigan. SSRN Electronic Journal, 1–34. https://doi.org/10.2139/ssrn.3749644

Huda, N., Wahyuni, T. S., & Fauziyah, F. D. (2021). Students' Perceptions of Online Mathematics Learning and Its Relationship Towards Their Achievement. *Proceedings of the International Conference on Engineering, Technology and Social Science (ICONETOS 2020)*, *529*(Iconetos 2020), 522–529. https://doi.org/10.2991/assehr.k.210421.077

Kalogeropoulos, P., Roche, A., Russo, J., Vats, S., & Russo, T. (2021). Learning Mathematics From Home During COVID-19: Insights From Two Inquiry-Focussed Primary Schools. Eurasia Journal of Mathematics, Science and Technology Education, 17(5), 1–16.

Krishnan, S. (2016). Students' Perceptions of Learning Mode in Mathematics. *The Malaysian Online Journal of Educational Sciences*, *4*(2), 32–41.

Lukowski, S. L., DiTrapani, J. B., Jeon, M., Wang, Z., Schenker, V. J., Doran, M. M., Hart, S. A., Mazzocco, M. M. M., Willcutt, E. G., Thompson, L. A., & Petrill, S. A. (2019). Multidimensionality in the Measurement of Math-Specific Anxiety and its Relationship with Mathematical Performance. Learning and individual differences, 70, 228–235. https://doi.org/10.1016/j.lindif.2016.07.007

Martin, S., & Alvarez Valdivia, I. M. (2017). Students' feedback beliefs and anxiety in online foreign language oral tasks. International Journal of Educational Technology in Higher Education, 14(1). https://doi.org/10.1186/s41239-017-0056-z

Merrell, K. W. (2008). Helping students overcome depression and anxiety: A practical guide (2nd ed.). Guilford.Onwuegbuzie, A. J., Jiao, Q. G., & Bostick, S. L. (2004). Library anxiety: Theory, research, and applications. Scarecrow Press, Lanham, MD, and Oxford.

Pirrone, C., Di Corrado, D., Privitera, A., Castellano, S., & Varrasi, S. (2022). Students' Mathematics Anxiety at Distance and In-Person Learning Conditions during COVID-19 Pandemic: Are There Any Differences? An Exploratory Study. Education Sciences, 12(6). https://doi.org/10.3390/educsci12060379

Rehman, A. U. (2016). Academic Anxiety among Higher Education Students of India , Causes and Preventive Measures : An Exploratory Study. June.

Smith, G. G., & Ferguson, D. (2005). Student attrition in mathematics e-learning. Australasian Journal of Educational Technology, 21(3), 323–334.

Sullivan, P., Bobis, J., Downton, A., Feng, M., Hughes, S., Livy, S., McCormick, M., & Russo, J. (2020). Threats and opportunities in remote learning of mathematics: implication for the return to the classroom. Mathematics Education Research Journal, 32(3), 551–559.

Tawil, N. M., Ismail, N. A., Asshaari, I., Osman, H., Nopiah, Z. M., & Zaharim, A. (2012). Learning process in mathematics and statistics courses towards engineering students: E-learning or traditional method? Asian Social Science, 8(16), 128–133.

Wani, I. U. (2020). Math anxiety: Causes, symptoms and strategies to reduce.InProceedingsofthe9thNationalConferenceonMathematicsEducation,Bhopal, India (pp.20-22).

Wigfield, A., & Meece, J. L. (1988). Math Anxiety in Elementary and Secondary School Students. *Journal of Educational Psychology*, *80*(2), 210–216.

Yen, J., & Lee, C. (2011). Exploring problem solving patterns and their impact on learning achievement in a blended learning environment. Comput. Educ., 56, 138-145.

Zhang, C., D, M., Ye, M., Ph, D., Fu, Y., D, M., Yang, M., D, M., Luo, F., & D, M. (2020). The psychological impact of the COVID-19 pandemic on teenagers in China. *Journal of Adolescent Health*, *67*(6), 747–755.