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Depression from and Fear of Covid-19 as predictors of Pre-service Teachers' Mathematics Anxiety

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ABSTRACT

Mathematics anxiety is a permeative element influencing both the pre-service teachers and educators, importantly affecting instructional outcomes, particularly achievement in mathematics. The eruption of the COVID-19 epidemic has created a huge alteration and commotion in education, possibly aggravating mathematics anxiety among pre-service teachers. This present study investigated depression and fear of COVID-19 as predictors of mathematics anxiety among 200 Nigerian pre-service teachers at the University of Lagos, through a predictive correlational research design in the 2020/2021 academic session. Three valid and reliable research instruments were used for data collection and they included: the Fear of COVID-19 scale (FCV19-S, α=0.85), Depression from COVID-19 (DEP, α=0.89), and the Abbreviated Mathematics Anxiety Scale (AMAS, α=0.93). Analyses of data were achieved through the mean, standard deviation, Pearson product-moment correlation, and multiple regression analysis. The outcomes of the study showed the significant roles of depression from COVID-19 and fear of COVID-19 in forecasting pre-service teachers' mathematics anxiety. These psychological constructs are intertwined, explaining significantly the mathematics anxiety enacted by pre-service teachers, specifically within the milieu of the COVID-19 pandemic.

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1. INTRODUCTION

Mathematics anxiety is a common phenomenon among pre-service teachers and teachers, and it has been found to negatively affect learning outcomes, particularly mathematics performance. The pandemic resulting from COVID-19 has produced significant changes and disturbances in schooling, which may exacerbate anxiety towards mathematics among future teachers. The global pandemic of 2019-20 has had a widespread impact on institutions of learning across the globe, resulting in the almost complete shutdown of educational systems. This is due to fear and anxiety associated with depression and other forms of health. Many fears and worries are associated with COVID-19 which in one way or another affected pre-service teachers' learning and mental health. Schimmenti, Billieux, and Starcevic (2020) mentioned among others, the fear of body symptoms and their possible meanings. The COVID-19 pandemic surfaced towards the end of the year 2019 in Wuhan, China. (Chahrour *et al*., 2020). The initial eruption of COVID-19 in Wuhan swiftly disseminated, impacting various regions within China. In a matter of weeks, instances of COVID-19 surfaced in numerous foreign nations, swiftly evolving into a worldwide problem (Spina *et al.*, 2020).

The World Health Organization (WHO) officially labeled the coronavirus outbreak a pandemic in 2020. By March 29, 2020, the virus had reached over 177 countries, affecting over 722,435 individuals and leading to more than 33,997 fatalities (CSSE, 2020). Areas significantly impacted by the outbreaks encompass China, Italy, the United Kingdom, Spain, Iran, South Korea, the United States, and Nigeria, to name a few (Khachfe *et al*., 2020).

Anxiety can be triggered by having either too much information or by the fear of the unknown concerning virus transmission. In reality, an ongoing and evasive threat has the potential to become overwhelming (Mertens *et al*., 2020). Since many infected individuals may not display symptoms, it's incredibly challenging to provide accurate reports and calculations on the fatality rate. As a result, pre-service teachers, like anyone else, can't easily discern if someone nearby is carrying the virus. This uncertainty naturally contributes to heightened fear and anxiety in the situation. Intolerance to uncertainty occurs when people strongly feel the impact of the unknown, which often leads to increased anxiety (Fergus, 2013). The fear of what's uncertain seems to be a deeply rooted fear and a central aspect of anxiety (Carleton, 2016). Concerns linked to COVID-19 encompass not just fear of the unknown but also the anxiety generated from situations that are unpredictable and beyond our control.

Novella (2022) suggested that amid infectious disease outbreaks, certain clinical indicators of fright and unease become obvious. Furthermore, a strong link is present between fear, anxiety, and depression (Novella, 2022). Anxiety is a mental condition characterized by feelings of unease and concerns about what lies ahead (Banerjee, 2020). The global economic downturn caused by the COVID-19 outbreak has become a significant worry for pre-service teachers. Fear about doing well in mathematics courses somehow forms mathematics anxiety in the minds of current pre-service teachers.

In April 2020, almost 1.8 billion learners were impacted as schools were shut down in reaction to the spread of COVID-19. As observed, many nations have enforced countrywide shutdowns, and few nations enacted localized shutdowns. This has affected nearly 98.4% of the world's population of aspiring teachers. The closure of schools in response to the COVID-19 pandemic has brought attention to a range of social, economic, and psychological challenges, such as the financial burden on pre-service teachers and the shift to digital learning (Jamerson & Mitchell, 2020) and lack of housing along with the availability of childcare, healthcare, housing, internet access, and disability services, fearfulness and unease

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are prevalent. Furthermore, due to heightened concerns about contagion and close contact, a large number of individuals, including teachers, have transitioned to remote work. Billions are now under quarantine or isolation in their own homes, with schools and universities canceling in-person classes. Additionally, many countries have closed down restaurants, bars, gyms, and other public gathering places (Casale & Flett, 2020). People from disadvantaged homes were negatively influenced by these changes. Thus, their education was interrupted, they faced difficulties in maintaining proper nutrition, encountered childcare problems, and experienced financial hardships due to the inability to work.

The Coronavirus is rapidly spreading across the globe, and we are just starting to witness its effects. Its presence is causing significant changes. The media is filled with reports about the necessity of limiting social interactions, which has a detrimental effect on the long-term sustainability of educational institutions. This also has a noticeable impact on the mental well-being of pre-service teachers at universities (Sahu, 2020). The COVID-19 pandemic has created a significant, multifaceted global mental health issue that affects all aspects of life and disrupts social connections. It has given rise to various fears, including contamination concerns, fear about the future, financial insecurity, xenophobia, agoraphobia, aichmophobia, and more. These fears have triggered elements related to anxiety and fear, similar to what is seen in specific phobias. Fear is typically something people try to evade, but just like pain or hunger, it can serve as a useful mechanism to confront imminent dangers. Anxiety can be a useful response to address potential threats. However, when it's not accurately adjusted to the real threat, it can have harmful effects, impacting both individuals and society as a whole (Mertens *et al.*, 2020).

Schools in 22 countries across three continents have implemented various forms of closure. This has resulted in the upheaval of hundreds of millions of pre-service teachers worldwide, with 13 countries shutting down schools nationwide. The United Nations has expressed concern about the unprecedented scale and speed at which the coronavirus is causing disruption, not only in education but also in mental well-being. The closure of schools in over a dozen countries due to the COVID-19 outbreak has had a significant impact on the education of at least tens of millions of pre-service teachers globally, as reported by UNESCO. Depression and fear of COVID-19 are two psychological factors that have been linked to anxiety in individuals. As such, this research examined depression and fear of COVID-19 as predictors of Nigerian pre-service teachers' mathematics anxiety.

This study addressed the following research questions:

(i) What is the relationship between pre-service teachers' fear of COVID-19 and their mathematics anxiety?
(ii) To what extent is the relation between pre-service teachers' depression from COVID-19 and their mathematics anxiety?
(iii) What is the connection between COVID-19-related fear and COVID-19-induced depression among pre-service teachers?
(iv) What is the predictive influence of fear of COVID-19 on pre-service teachers' mathematics anxiety?
(v) What is the predictive influence of depression from COVID-19 on pre-service teachers' mathematics anxiety?

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2. METHODS

2.1. Research Design

For this study, the predictive correlational research design was adopted. The study used this type of design to conduct an in-depth research investigation on the population being studied.

2.2. Participants

The study focused on 623 pre-service mathematics teachers who were enrolled in the Department of Science Education at the University of Lagos, Nigeria, for the 2020/2021 academic session. A sample of 200 pre-service mathematics teachers was randomly chosen from this population using a simple random sampling technique. Of the full sample, 42% were women (n = 84), and 58% were men (n = 116). The average age of the participants ranged from 18 to 34 years.

2.3. Instrument for Data Collection

Three instruments were used for this study:

(i) Fear of COVID-19 scale (FCV19S): The FCV19S was adopted from Ahorsu *et al*. (2020) and it contained seven items on a four-point Likert scale for assessing the fear of novel coronavirus. This instrument demonstrated a high level of reliability in the study sample, with (α = 0.85).

(ii) Depression from COVID-19 scale (DCV19S): The DCV19S was adapted from references (Lovibond & Lovibond, 1995; Brown *et al*., 1997) widely acknowledged for its effectiveness in measuring depression, anxiety, and stress, owing to its statistical strength, durability, and consistency over an extended period. This instrument demonstrated a high level of reliability in the study sample, with (α = 0.89).

(iii) Abbreviated Mathematics Anxiety Scale (AMAS): The nine-item on a four-point scale was adopted from Hopko *et al*. (2003). This instrument demonstrated a high level of reliability in the study sample, with (α = 0.93).

The study focused on 623 pre-service mathematics teachers who were enrolled in the Department of Science Education at the University of Lagos, Nigeria, for the 2020/2021 academic session. A sample of 200 pre-service mathematics teachers was randomly chosen from this population using a simple random sampling technique. Of the full sample, 42% were women (n = 84), and 58% were men (n = 116). The average age of the participants ranged from 18 to 34 years.

2.4. Procedure for Data Collection

We used the Google Form questionnaire, it was chosen as the data collection method due to their ease of use, and accessibility for the collection of data for the study. A comprehensive questionnaire was used to collect data relating to depression from and fear of COVID-19 as predictors of pre-service teachers' mathematics anxiety. Participants were invited to complete the Google Form questionnaire through a unique link distributed to group chats of pre-service mathematics teachers of the Department of Science Education, University of Lagos for data collection. Data collection took place over 3 weeks. Ethical approval was obtained from the department before data collection. All the participants filled out the informed consent form.

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2.5. Data Analysis

We processed the collected data through calculations involving the mean, standard deviation, Pearson product-moment correlation, and multiple regression analysis. The analysis and numerical data coding were conducted using SPSS version 23.

3. RESULTS AND DISCUSSION

3.1. Research Question One: To What Extent is the Relationship Between Fear of COVID-19 and Mathematics Anxiety Among Pre-service Teachers?

In **Table 1**, Pearson correlation analysis was computed to assess the association between the fear of COVID-19 and mmathematics anxiety among pre-service teachers. There is a moderate, positive, and significant relationship between Fear of COVID-19 and Mathematics anxiety among pre-service Mathematics teachers (r = 0.479*, N=200, p= < 0.001).

Table 1. Correlation between the fear of COVID-19 and mathematics anxiety among Pre-service teachers.

Variable	N	Mean	SD	R	Sig.
Fear of COVID-19	200	2.33	0.606	0.479*	< 0.001
Mathematics Anxiety	200	2.19	0.637		

3.2. Research Question Two: To What Extent is the Relationship Between Depression from COVID-19 and Mathematics Anxiety among Pre-service Teachers?

In **Table 2**, Pearson correlation analysis was computed to assess the association between depression from COVID-19 and mathematics anxiety among pre-service teachers. There is a moderate, positive, and significant relationship between depression from COVID-19 and mathematics anxiety among pre-service mathematics teachers (r = 0.390*, N=200, p= < 0.001).

Table 2. Correlation between the depression of COVID-19 and mathematics anxiety among Pre-service teachers.

Variable	N	Mean	SD	R	Sig.
Depression from COVID-19	200	2.33	0.606	0.390*	< 0.001
Mathematics Anxiety	200	2.19	0.637		

3.3. Research Question Three: To What Extent is the Relationship Between Fear of COVID-19 and Depression from COVID-19 Among Pre-service Teachers?

Table 3, Pearson correlation analysis was computed to assess the association between the fear of COVID-19 and depression from COVID among pre-service teachers. There is a strong, positive, and significant relationship between fear of COVID-19 and depression from COVID-19 among pre-service mathematics pre-service teachers (r = 0.710*, N=200, p= < 0.001).

Table 3. Correlation between the fear of COVID-19 and depression from COVID-19 among pre-service teachers.

Variable	N	Mean	SD	R	Sig.
Depression from COVID-19	200	2.33	0.606	0.390*	< 0.001
Mathematics Anxiety	200	2.19	0.637		

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3.4. Research Question Four: What is the Predictive Influence of Fear of COVID-19 in the Explanation of Variance in Pre-Service Teachers' Mathematics Anxiety?

Table 4 above shows that the variable fear of COVID-19 yielded a Multiple Regression coefficient (R) of 0.479, a Multiple R Square of 0.229, and an Adjusted R Square of 0.225. From the results shown the interpretation that can be made is that 22.9% of the variance in Mathematics anxiety among pre-service teachers can be explained by the influence of the variable. The table also showed that the analysis of variance for the multiple regression data produced an F- ratio of 58.940 which is significant at the 0.01 level. The standardized coefficient revealed that the regression model: Mathematics anxiety $_{predicted}$ = 1.014 + (0.504 × fear of COVID-19). This indicated that the effectiveness of the predictor variable in predicting Mathematics anxiety could not have occurred by chance.

Table 4. The contribution of the independent variable: fear of COVID-19 to mathematics anxiety.

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1.014	0.158		6.45	0.001
Depression from COVID-19	0.504	0.066		7.67	0.001
Multiple R = 0.479	df1 = 1, df2 = 198		0.4979		
Multiple R Square = 0.229	F = 58.940				
Adjusted R Square= 0.225	p < 0.01				

Dependent variable: Mathematics Anxiety

3.5. Research Question Four: What is the Predictive Influence of Fear of COVID-19 in the Explanation of Variance in Pre-Service Teachers' Mathematics Anxiety?

Table 5 shows that the variable Depression from COVID-19 yielded a Multiple Regression coefficient (R) of 0.390, a Multiple R Square of 0.152, and an Adjusted R Square of 0.148. From the results shown the interpretation that can be made is that 15.2% of the variance in Mathematics anxiety among pre-service teachers can be explained by the influence of the variable. The table also showed that the analysis of variance for the multiple regression data produced an F- ratio of 35.539 which is significant at the 0.01 level. The standardized coefficient revealed that the regression model: Mathematics anxiety$_{predicted}$ = 1.411 + (0.371 × Depression from COVID-19). This indicated that the effectiveness of the predictor variable in predicting mathematics anxiety could not have occurred by chance.

Table 5. The contribution of the independent variable: depression from COVID-19 to mathematics anxiety.

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	0.411	0.137		10.317	0.001
Depression from COVID-19	0.371	0.062		5.961	0.001
Multiple R = 0.390	df1 = 1, df2 = 198		0.390		
Multiple R Square = 0.152	F = 35.539				
Adjusted R Square= 0.148	p < 0.01				
Stand. Error of Estimate = 0.58828					

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Analysis of the data gathered showed tAhat there is a moderate and positive relationship between fear of COVID-19 and mathematics anxiety among pre-service mathematics teachers. This shows that fear of COVID-19 has a significant role in the formation of mathematics anxiety among pre-service mathematics teachers. The relationship observed between fear of COVID-19 and anxiety among pre-service mathematics teachers is consistent with some of the previous studies (Mertens *et al*., 2020). The association between mathematics anxiety and the fear of COVID-19 is multifaceted, and it can differ from pre-service teacher to pre-service teacher. The fear of COVID-19 is connected to elevated tension and emotion levels in many pre-service teachers. The outcomes of elevated levels of anxiety due to the COVID-19 pandemic can aggravate mathematics anxiety. The COVID-19 fear can surely lend support to anxiety in general, and for pre-service teachers already enmeshed in mathematics anxiety, this fear may worsen their overall anxiety levels. Anxiety and fear can promote avoidance behaviors, thereby making the pre-service teachers evade mathematics-related undertakings and further worsen their mathematics anxiety. Treating the fear of COVID-19, with perpetually dynamic info, and warnings can devour cognition bandwidth. This mental overburden may make focusing on mathematics tasks unbearable for pre-service teachers, and this can aggravate mathematics anxiety. Because of COVID-19, many pre-service teachers were forced to transition to online learning, and this can be momentarily difficult for those exhibiting mathematics anxiety.

The fear of COVID-19 may make adaptation to this new learning context more difficult for some pre-service teachers, and this can increase their mathematics anxiety. As a result of fear of COVID-19, pre-service teachers' constant study habits and routines might have been disrupted and this could have potentially led to increased mathematics anxiety as they battle to adapt to the online learning environment. The COVID-19 pandemic promoted social isolation for many pre-service teachers and this could impact negatively their mental health status as mathematics anxiety can be impacted by a lack of peer support and a sense of solitude in combating mathematical difficulties. Some pre-service teachers may exhibit COVID-19-connected health anxiety, which may interact with mathematics anxiety. Pre-service mathematics teachers that are overwhelmed with health concerns, might not be able to fully concentrate on mathematical tasks and this can create an iota of mathematics anxiety in them. It should be noted that the possible relationship between mathematics anxiety and fear of COVID-19 among pre-service mathematics teachers in this study should not be seen as being universal as their responses to the COVID-19 pandemic and exhibition of mathematics anxiety may vary broadly. Importantly, lowering these perturbing elements of anxieties might need diametrical schemes, like engaging professional assistance for anxiety and altering learning milieus to greatly conform to pre-service mathematics teachers' needs.

The study showed that there is a moderate and positive relationship between depression and mathematics anxiety among pre-service mathematics teachers. This shows that depression has a significant role in the formation of mathematics anxiety among pre-service mathematics teachers. The relationship observed between depression and anxiety among pre-service mathematics teachers is consistent with some of the previous studies (Kim-Cohen *et al*., 2003) in which individuals suffering from adult anxiety are probable with a depression history. COVID-19 had a debilitating effect on pre-service teachers' mental health thereby causing elevated rates of anxiety and depression in many of them. Factors such as social isolation, loss of loved ones, illness, financial instability, and penury can result in depression. When a pre-service teacher is haunted by depression, there is every likelihood for the appearance of other forms of anxiety, mathematics anxiety inclusive. Notably, depression affects cognitive performance, including the capacity to remember information, engage in

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rational thinking and concentrate on tasks in which mathematics anxiety is linked with mental difficulties in mathematics-related undertakings (Awofala & Awolola, 2011; Awofala, 2017; Awofala & Odogwu, 2017; Awofala, 2019; Awofala & Akinoso, 2017; Awofala *et al*., 2024; Sopekan & Awofala, 2019). As depression depletes cognitive performance, it makes it uneasy for the pre-service mathematics teachers to be fully engrossed in mathematics and this can increase their anxiety towards mathematics. Pre-service mathematics teachers who are embroiled in depression may lack interest and motivation in mathematics activities (Awofala & Falolu, 2017; Awofala, 2016; Awofala *et al*., 2020; Lawal & Awofala, 2021) and this lack of engagement may lead to increased anxiety towards mathematics. Globally, symptoms of depression include lack of energy, fatigue, and insomnia and these can impair pre-service mathematics teachers' capacity to pursue effective learning and conformable study habits. This impairment can result in learning difficulties among the pre-service mathematics teachers and exacerbate their mathematics anxiety.

There is no doubt that one of the consequences of COVID-19, as indicated through social isolation (Awofala *et al*., 2022; Awofala *et al*., 2021a; Awofala *et al*., 2021b), may have resulted into isolation and loneliness for many pre-service mathematics teachers and this might have contributed to depression among them. Social support could also be seen as an effective mechanism for curbing anxiety, mathematics anxiety inclusive. However, a lack of social interaction can amplify sensitivity to mathematics anxiety. There could be a response eyelet between mathematics anxiety and depression among the pre-service mathematics teachers in the study in which one amplifies the other. This is possible where a pre-service mathematics teacher with mathematics anxiety evades mathematics-related tasks as a result of worry, anxiety, and fear, which can result in poor achievement in mathematics and afterward lead to sensitivity to depression.

The findings also established that there is a strong, positive, and significant relationship between fear of COVID-19 and depression among pre-service mathematics teachers. The relationship observed between fear of COVID-19 and depression from COVID-19 is consistent with some of the previous studies (Ahorsu *et al*., 2020; Alyami *et al*., 2020; Bitan *et al*., 2020). The fear associated with being infested with COVID-19 can result in worry and chronic anxiety among the pre-service mathematics teachers and the protracted and aggravated anxiety can lead to the growth and evolution of depression with time. The fear associated with COVID-19 may cause pre-service mathematics teachers to live in isolation to minimize the danger of exposure to the virus. Being isolated can result in sensitivity to sadness and loneliness which can lead to depression among the pre-service mathematics teachers. There is no doubt that depression is connected with feelings of despair and hopelessness, self-doubts, and negative and inauspicious thought patterns and these mental patterns can amplify fears associated with COVID-19, thus, compounding the problem with dire consequences for the pre-service mathematics teachers.

From the results shown, the interpretation that can be made is that 22.9% of the variance in mathematics anxiety among pre-service mathematics teachers can be explained by the fear of COVID-19. The table also showed that the analysis of variance for the multiple regression data produced an F- ratio of 58.94 which is significant at the 0.01 level. This indicated the effectiveness of the predictor variable. This supports the finding of Coelho *et al*. (2020) who maintained that the COVID-19 pandemic is shrouded in varied forms of fear including fear of the virus and fear of death and it is regarded as an anxiety-inducing factor. It was also established from the analysis that 15.2% of the variance in mathematics anxiety among pre-service mathematics teachers can be explained by depression from COVID-19. The table also showed that the analysis of variance for the multiple regression data produced an F- ratio of

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35.359 which is significant at the 0.01 level. This indicated the effectiveness of the predictor variable. However, depression from COVID-19 as a predictor of mathematics anxiety is yet to be investigated in the literature. This is an original contribution to knowledge in this field. However, it is understood that both mathematics anxiety and depression from COVID-19 are debilitating conditions that have serious consequences for the pre-service mathematics teachers' well-being and learning outcomes in mathematics. Interest, motivation, determination, resilience, and cognitive functioning in mathematics may be significantly affected by depression among the pre-service mathematics teachers as depressed pre-service mathematics teachers may find it difficult to engage in mathematics activities which can result in amplified mathematics anxiety. In addition, the adverse and detrimental thought patterns connected with depression can amplify the adverse and detrimental self-perception often associated with pre-service teachers engulfed in mathematics anxiety.

The present investigation provided important insights into the associations among mathematics anxiety, depression, and fear of COVID-19 among future teachers of mathematics. The results of this study amplify the significance of managing mental well-being and anxiety-dependent worries in instructional milieus, specifically in periods of crisis engendered by the COVID-19 pandemic. More research and marked interventions along this line are needed to improve the academic attainment and mental health of pre-service mathematics teachers. Mathematics anxiety is a function of an assemblage of elements, including pre-service mathematics teacher intellectual factors, teaching strategies, instructional milieu, and experiences. It is noted that while depression from and fear of COVID-19 are significant predictors of mathematics anxiety, they may not be the only contributors as other factors such as quality of mathematics instruction, mathematics self-efficacy beliefs, and prior mathematics performance may be considered crucial.

The existence of social reinforcement and management strategies may help in curbing the influence of depression and fear of COVID-19 on anxiety towards mathematics. For instance, pre-service mathematics teachers who have the opportunity to access support mechanisms and mental health resources can be more armored to cope with and decrease their mathematics anxiety, even in the face of depression from and fear of COVID-19. Conclusively, while fear of COVID-19 and depression from COVID-19 can be important forecasters of mathematics anxiety, they should be well thought out within the wider circumstances of a pre-service mathematics teacher's experiences, dealings, and contexts. Factors such as coping strategies, previous mathematics attainment, and pre-service teachers' instructional experiences may play significant roles in the growth and tenacity of mathematics anxiety. Managing mathematics anxiety often entails an all-encompassing approach that gives consideration to these multifaceted elements and adapts interventions to the particular needs of the pre-service mathematics teacher. It is noted that fear of COVID-19 and depression from COVID-19 may lower the critical thinking of preservice teachers towards mathematics. Critical thinking is an important element in preservice mathematics teachers' success in mathematics (Okunuga *et al*., 2020; Awofala & Lawal, 2022).

4. CONCLUSION

This study promotes the significance of probing into the anxiety-related concerns and psychological well-being of pre-service mathematics teachers, particularly during periods of crisis such as the COVID-19 pandemic. Engagement and reinforcement plans of action should be enacted to reduce the effect of fear and depression from COVID-19 on mathematics anxiety, importantly enhancing the mental health and educational attainment of pre-service

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mathematics teachers. Future research in this area can promote and identify rich insights into the developing challenges encountered by educators in an increasingly mutable world.

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6. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. Authors confirmed that the paper was free of plagiarism.

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