

Online Math Education during Covid-19 and Associated Learning Anxiety at the Tertiary Level in Pakistan

* Namirah Aslam, Assistant Professor (Corresponding Author)

** Shagufta Moghal, Assistant Professor

*** Shabana Manzoor, Assistant Professor

Abstract



A survey method was used to investigate the effect of online math education and students anxiety of learning Mathematics in COVID-19 at university level in Lahore. The basic purpose to design this study was to explore students' anxiety measures and introduce some coping strategies to minimize the students' anxiety in online learning math education. All students of graduate and post-graduate level in all public and private universities of Lahore were considered as population of the study. By using convenient sampling technique 500 students were selected from 4 public and 4 private universities. A standardized instrument 'Mathematics Anxiety Scale' was adapted after validity and reliability tests. The results showed a strong positive relationship between online Math education and students' anxiety of learning mathematics. The online math education has statistically significance variance on students' anxiety of learning mathematics. Therefore, a significant medium effect size was found between public and private universities in online learning mathematics. Therefore Mathematics anxiety effects not only cognitively and physiologically but directly manifests emotionally so to reduce it learners needs to avoid negative talk and focus on positive reinforcement.

Keywords: Online Math Education, Students' Anxiety, COVID-19

Introduction

Nelson described Education as a powerful weapon as it brings dynamic change in the world. Mathematics is generally considered a dull, tough and dry subject. Still, the importance and application of Mathematics in everyday life is profound. Ashcraft and Kirk (2001) explained the role of anxiety in learning Mathematics as it diverts the ongoing task and different activities of working memory, affects its accuracy and reduces performance. This situation may lead a negative state of mind amongst learners, as well as frustration and anxiety.

Numerous studies have revealed that elementary students (Steele & Arth, 1998), secondary level students and college students are facing math anxiety. According to the researcher's experience, our college students are more likely to be observed dealing with this anxiety. Many factors can be the cause of math anxiety such as environmental factors which include myths, role of teachers and parents. In addition, cognitive factors that can be the reason for math anxiety include students' learning styles, persistence, self-doubt, and dyslexia. Some factors related to personality can also contribute towards math anxiety such as low confidence level, shyness, and intimidation (Woodard, 2004).

Most of the researchers have described how the majority of students find it difficult to learn mathematics. In the current situation when the world is facing the COVID-19 pandemic crises, formal education has been the most affected and it has led to the online education being implemented in Pakistan. The Higher Education Commission (HEC) has put in its efforts and played a fundamental role especially for the youth in this critical situation. All educational institutions face a big challenge of ensuring quality education online teaching in the present difficult circumstances. However, the majority of students show lack of attention while taking online classes. Moreover, connectivity issues, frequent low bandwidth internet connectivity, uninformed electricity breakdown, unscheduled load shedding, tripping in hot weather, and lack of access to technological items like computer system, laptop, and smart phones also create anxiety among learners. The Mathematics anxiety of e-learning

* Faculty of Education, Lahore College for Women University, Lahore Email: namirah.aslam@lcwu.edu.pk

** Faculty of Education, Lahore College for Women University, Lahore

*** Faculty of Education, Lahore College for Women University, Lahore

is not only limited to students but it exists in teachers too. Moreover, mathematics anxiety has also influenced the effectiveness of mathematics teachers. The Mathematics subject makes connections between facts, rules, logics, ideas and leads to the generalization of concepts in practical situations (Beinicke, & Bipp, 2018).

Mathematical Content Knowledge (MCK) involves in-depth understanding of principles and terms in the cognitive domain. Online Education makes it harder for teachers to explain complex terms to students, which creates frustration and depression among students in learning Mathematics (Aslam, Siddiquah, & Islam, 2020). Many researchers have been trying to understand the self-belief of e-learning. Mathematics anxiety among students may affect the mode of instruction and the various approaches selected to transfer knowledge explain how mathematics anxiety affects students' quality education (Brown et al., 2011).

The Mathematics Teacher has the ability to transfer knowledge about different terminologies of Mathematics in a proper way by using different domains. Understanding the difficult principles of Mathematics causes anxiety and it is a common fear of students that they will be scoreless in an online task or quiz. Such kinds of anxieties have revealed the real attitude of learners and teachers towards MCK (Aslam & Siddiquah, 2020). Mathematical Content Knowledge means the learnings in the subject of Mathematic with the implicit and explicit understandings of conceptual and procedural based Math learning. MCK helps learners to explain, demonstrate, and illustrate the complex phenomena of mathematical terms, concepts, logics while explaining the solutions of the given problems.

Statement of problem

Mastery of the subject of Mathematics demands a diversity of instructional practices, based on logic and reasoning in order to find solutions to practical problems with an understanding of facts and rules. The researcher being a Mathematics' teacher has observed students' high levels of anxiety in learning an online Mathematics semester. The researcher decided to conduct a study to investigate the effect of online math education and students' anxiety in learning mathematics in the COVID-19 pandemic situation.

Objective of the study

To identify the relationship between the online Mathematics education and students' anxiety of learning mathematics in COVID-19.

Review of the Literature

An advancement of technology is the undeniable truth of the 21st century. This'll technological development has influenced every sphere of life (Alonso, 2019). It is said that technological advancement is reaching its peak nowadays. Technological advancement is not only limited to the IT department, but it has also influenced the educational field. Technological advancement in the educational field is referred to progression of online learning (Hinojo, 2018). In Educational field, ICT provokes informative actions towards learning. The usage of e-learning not only promotes students' attitudes, but also inculcates good morals towards their education which has proven fruitful for bringing into effect the transformation of the classroom (Takada, 2019). In addition, pedagogical events may bring into effect the exclusion of the spatial-temporal hurdles (Pereira, 2019). and promote great availability of informative knowledge through diverse forms in the classroom. It has also encouraged students to motivate and independence towards educational content in current situation (Siebra, 2020).

The COVID-19 situation all over the world has enhanced the importance of this method of teaching . ICT is considered as an appropriate tool for teaching in this situation as it possesses excellent features like flexibility in terms of location and time management (Qian, 2018). Although it is also very cheap. In order to make use of ICT, a teacher must be obsessed with these two types of resources: the first one is digital and the second one is technological. Though, online learning encompasses all digital resources like zoom meeting, google form, podcasts, educational videos and other social networking. Desktop computers, tablets, iPad and smartphones fall in the technological resources category. The use of e-learning is not an easy task to master (Laskaris, 2019).

The proper use of ICT requires an average level of digital competencies otherwise, it will pose an insurmountable challenge for the users (Aznar,2019). Therefore, in e-learning it is a necessary to be trained the proper usage of diverse technologies and digital resources for both instructors and

learners. Hence, it is innovative pedagogical style as compared to other teaching strategies. Few researchers described it as the output of distance learning. Furthermore, e-learning is considered as latest need of time and advance form of pedagogy, it is totally the opposite of traditional methods of teaching which include face-to-face interaction. (Beinicke, 2018).

The features of e-learning comprise nurturing various forms of task, activities and conversation, to make learner’s more interactive fostering cooperation and intra personal relationship between other fellows, the attaining of collective goals related to multiple tasks empowering e-learning through experiences ,aiming for enhancing the technological competence among students, motivating the students, to select himself or herself more appropriate and feasible learning style, encouraging the student’s capacity to learn, being adapting in nature on both personal and occupational platforms (Rakic, 2020), consisting a wide range of digital learning sources, facilitate teachers towards students assessment it also accelerating students’ technological and digital competencies (Bheki, 2021).

In social sciences, the subject of Mathematics possesses an important position as it helps in decoding the surroundings and portraying social problems that happen currently in world. To understand difficult phenomena Mathematics make it easier, whether they belong to the social, economic or historical aspects (Dongol, 2022).

Research Methodology

A descriptive study was designed through survey method to investigate the effect of online Math education and students' anxiety of learning Mathematics during COVID-19 at university level and try to minimize the students’ anxiety in online learning Math education. All public and private graduate students were considered as population of the study in Lahore. By using convenient sampling technique students were selected from 4 public and 4 private universities. Total sample size was 500 from 4 public and 4 private universities. Two hundred and fifty students were male and 250 students were female. A standardized instrument ‘Mathematics Anxiety Scale’ was adapted after validity and reliability tests. The process of data collection was carried out through survey questionnaire at google forms. The reliability of the instrument was 0.89. Researcher used inferential and descriptive statistics to analyze the data (Woodard, 2004).

Results of the study

Table 1

Students’ Mathematics Anxiety of Female and Male

Gender	N	Mean	SD	T	Df	P
Male	250	2.6624	.99490	4.891	498	.000
Female	250	3.1028	1.01832			

Table 1 shows ‘Mathematics anxiety’ the comparison of female and male students and the outcomes show that there is significant difference b/w the male and female online learning mathematics. Mathematics anxiety of female mean scores and S.D were greater than male students, where t-test b/w the scores of the two groups was $t=4.891(498)$, ($P<0.05$). Therefore, the results show that female students experienced more Mathematics anxiety in e-learning as compared to male students.

Table 2

Mathematics Anxiety of Public and Private Institutions

Institution	N	Mean	SD	Mean Difference	Cohen’s d	t	P
Public	250	2.9184	1.04352	0.07	0.44	.777	.010
Private	250	2.8468	1.01620				

Table 2 is showing the t-test to compare the institutional ‘public and private’ students’ Mathematics anxiety. The public students’ math anxiety mean scores were greater than the private students mean scores and t-test b/w two groups was $t=.777(498)$ ($P < 0.050$). Hence, it indicates statistically significant effect between Mathematics Anxiety of Public and Private Institutions. Hence Cohen’s d showed (medium effect size) that the students of public universities experienced more Math anxiety in e-learning as compared to the students of private universities.

Table 3
Student's Math anxiety in understanding Mathematical Content Knowledge (MCK)

Gender	N	Mean	SD	t	P
Male	250	2.7840	.96619	4.356	.000
Female	250	3.1620	.97405		

Table 3 is showing independent-sample t-test calculated to compare the student's Math anxiety in understanding Mathematical Content Knowledge (MCK). The results showed insignificant differences b/w male and female students in less understanding of MCK which creates anxiety among them. The female students anxiety mean scores was greater than the male students and t value b/w the scores of the two groups was 4.356 (P < 0.05). Therefore, the result showed that female students were involved in more anxiety to understand MCK as compared to male students.

Table 4
Relationship b/w Online Math Education & Students anxiety

Variables	Pearson r	P
Online Math Education	.753**	.000
Student's anxiety		

The table 4 is showing the Pearson correlation test between students anxiety in online Mathematical education. Hence, a significant positive relationship was showed b/w the students anxiety in learning online Mathematical education.

Table 5
Pearson Correlation Coefficient measure components of students' mathematics anxiety

Correlations		Students' Math anxiety	Depression	Frustrations	Less understanding of MCK	Fear of losing marks
Students' Math Anxiety	Pearson Correlation	1	.653**	.610**	.669**	.705**
	p		.000	.000	.000	.000
	N	500	500	500	500	500
Depression	Pearson Correlation	.653**	1	.732**	.761**	.933**
	P	.000		.000	.000	.000
	N	500	500	500	500	500
Frustrations	Pearson Correlation	.610**	.732**	1	.774**	.897**
	p	.000	.000		.000	.000
	N	500	500	500	500	500
Less understanding of Math Content Knowledge	Pearson Correlation	.669**	.761**	.774**	1	.909**
	p	.000	.000	.000		.000
	N	500	500	500	500	500
Fear of losing marks	Pearson Correlation	.705**	.933**	.897**	.909**	1
	p	.000	.000	.000	.000	
	N	500	500	500	500	500

Table 5 is showing that Pearson Correlation Coefficient explored the different components of students' Mathematics anxiety in e-learning. The results of the study showed a reasonable, positive and critical connection amongst the students Mathematics anxieties with different components. Therefore, the students were found in such components of anxiety as depression, frustration, less understandings of content knowledge and fear of losing their marks in online learning Mathematics education.

Table 6
Effect of Online Math Education & Student's anxiety

Students anxieties	Sum of Square	Df	Mean Square	F	P
B/w Groups	207.230	2	42944.28	5.017	.000
Within Groups	428.814	497	183881.45	2.761	
Total	636.044	499			

Table 6 is showing that the online Mathematics education has statistically significant variance on student's Mathematics anxiety.

Conclusion

Female students are more anxious towards online learning Mathematics as compared to male students. The results of the study of the comparison of both private and public universities showed significant difference towards online learning mathematics anxieties of students. The Cohen's d showed a medium effect size that in public university students were substantially more effected as compared to students of private universities. A strong positive relation was found between online mathematics education and student's anxiety of learning mathematics. Most of students were found in depression, frustration, less understandings of content knowledge and fear of losing their marks when they have to face different issues in e-learning. Hence, the online mathematics education has statistically significant variance on student's anxiety of learning mathematics.

Discussions

E-learning is a basic component in the future. Young mathematicians need to be equipped with ICT expertise since technology addresses the challenge of the need to grow, for both educators and students. Teachers need to acquire advanced, multidisciplinary knowledge first, in order to teach Mathematics including experimenting in different domains while delivering various topics (Aslam & Siddiquah, 2020). Therefore, teachers need to realize that the current pandemic crisis is contributing towards students' nervous dispositions and fears so teachers need to accommodate use of different stress coping strategies. The teachers need to use self-relaxation, self-management, time management and religious techniques like developing a bond with Allah and the Holy Prophet (PBUH), always trust in Allah, offer prayers etc. After applying coping strategies, it is hoped that students would be able to tackle the current situation of COVID-19. It will be helpful for learners to focus on their tasks and manage e-learning problems. Teachers need to cooperate with students to remove their fear of E-learning. After students' doubts have been addressed, it is assumed that students would be able to handle any critical situation. Learners needs to avoid negative self talk and concentrate on positive reinforcement and mental Mathematics.

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