

The Relation between Student's Interest and Academic Performance of Secondary Students in Learning Mathematics Online

Litty Thomas, Lubna Ali Mohammed

Faculty of Social Science, Arts and Humanities, Lincoln University College, Malaysia

Corresponding Author Email: lubnaali@lincoln.edu.my

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Abstract

The transformative shift in education due to technological advancements has prompted educators worldwide to swiftly adapt to online teaching and learning modalities. This quantitative correlation study aimed to examine the relationship between the interest and academic performance of secondary students in learning mathematics online. A total of 100 secondary school students and 100 mathematics teachers from secondary schools in the CBSE curriculum in the UAE were selected to participate in the study. Two types of questionnaires were used to collect data from students and teachers. Pearson's correlation coefficient was used to analyze the significant relationship between students' interests and academic performance. The findings showed that most students were interested in learning mathematics online, and their mathematics performance exceeded the attainment standards. However, correlational analyses confirmed that students' interest in mathematics was correlated with their performance in mathematics online. This study offers a comprehensive understanding of the impact of online education on the mathematical academic achievement of secondary school students, thereby contributing to the advancement of effective pedagogical practices in the ever-changing educational landscape.

Keywords: Mathematical Academic Achievement, Interest, Engagement, Online Learning, Technology.

Introduction

Current trends in education confirm that instructors are shifting away from authoritarian and non-interactive methods Galy et al (2011) to a learner-centered approach that includes the use of technology. Educational trends are rapidly adapting to new teaching methodologies and learning environments. Online education has become popular because it provides more flexible access to content and instructions from any location. The use of e-learning platforms is growing as the education industry moves toward virtual or remote education. The transition to online teaching and learning is becoming a new reality in the global education system. Additionally, according to Oye et al (2012), e-learning has become an increasingly popular learning approach in higher education. Modern classrooms, whether online or conventional,

use e-learning tools and learning management systems that capture student cognition and engage them in the learning process (Galy et al., 2011).

Educational researchers have extensively examined the challenges and benefits of online education, highlighting its potential to bridge geographical gaps and enhance accessibility (Bao, 2020). Educational institutions worldwide are embracing online education for instructional purposes, and educators and students find themselves in the realm of online teaching and learning. This transition has raised crucial questions about its implications for students' academic achievements, particularly in subjects that demand robust conceptual understanding and critical thinking, such as mathematics. The switch to online education presents a unique confluence of opportunities and challenges. While online media offers flexibility and accessibility, it also introduces novel pedagogical demands that affect student engagement, interaction, interest, and learning outcomes. Mathematics is vital in several academic, professional, and daily life areas. As mathematics education is inherently reliant on interactive problem solving and conceptual mastery, the impact of this transition on secondary school students' mathematical academic achievement is of paramount importance. As an intricate discipline demanding active participation and dynamic problem solving, mathematics education serves as a poignant lens through which to examine the impact of this paradigm shift. The primary aim of this research was to determine the interest and academic performance of secondary school students in learning mathematics online. This research focuses on a retrospective analysis of online mathematics education for secondary students.

Mathematics plays a pivotal role in fostering critical thinking, problem-solving skills, and analytical abilities among students (Jones, 2018). However, the swift implementation of online education has introduced a host of challenges, ranging from digital inequalities to pedagogical adjustments (Brown, 2019). Mathematics teachers are challenged in delivering instruction, especially on topics that require practical applications. According to Kitta (2004), most teachers indicate mathematics as one of the subjects that they find difficult to teach. Thus, according to Saad (2004), mathematics at the secondary level is not taught well because some mathematics teachers lack pedagogic content knowledge and materials, especially in large classes. Understanding the challenges and successes of online mathematics education can guide the development of practical pedagogical approaches that align with students' needs. Teachers' teaching methodologies and varying levels of access to technology may influence students' engagement with mathematical content and subsequently, affect their academic achievement and interest. However, the transition to virtual classrooms has not been without obstacles and has triggered a pressing inquiry into its implications for student's interests and learning outcomes. While some students excel in virtual classrooms, others experience challenges adapting to remote settings (Bao, 2020). Subjects such as mathematics, are difficult to teach and learn through online modules. Due to its inherent difficulty of complex methods and calculations, it is said to have challenges in achieving effective learning (Bringula et al., 2021; Karuppanan & Mohammed, 2020; Sornasekaran et al., 2020).

Mathematics education is uniquely affected by the transition to online teaching; the subject demands interactive engagement, hands-on problem solving, and conceptual understanding (Hannafin & Hill, 2014). Several studies have investigated the relationship between online education and learning outcomes. For instance, Smith and Johnson (2018) found that online learners achieved similar or better outcomes than traditional classroom settings in terms of

academic performance; students' readiness for online education played a pivotal role. The findings of Mata et al (2012) shed light on the relationship between math achievement and interest in mathematics and are consistent with research showing that good achievers develop more interest than lower achievers. Learning interest is one factor that influences mathematics learning achievement (Fitriyani, 2019). Students with high learning interests will have greater academic effort (Trautwein et al., 2015), can organize their learning well (Lee et al., 2014), focus their attention, and get involved in an activity (Winne & Nesbit, 2010). Student's learning interests can predict the decline and increase in academic performance of students, and teachers play an active role in improving learning interests (Kpolovie, 2014).

Johnson and Williams (2016) highlighted the significance of technological literacy, that students proficient in using digital tools exhibit higher levels of engagement and academic success in online learning environments. According to Onyema et al. (2020), technology has modified teachers' methods from the traditional approach, which often places them as dispensers of knowledge, to a more flexible system, where they act more as facilitators, mentors, and motivators to inspire students to participate and learn. The implementation of online learning has several strengths and limitations. The weaknesses of online learning implementation tend to reduce student interest in learning (Kusumaningrum et al., 2021). Interest in learning is a crucial factor in learning. Without any student learning interest, the learning objectives will not be achieved (Sutriyani, 2020). In the context of mathematics Li (2020) reported that online education positively influences students' problem-solving skills and conceptual understanding. A lack of physical classroom environments may hinder students' opportunities for collaborative problem-solving and immediate feedback (Bannister, 2020). Several researchers have explored interventions to mitigate the challenges posed by online mathematics education. Smith (2023) proposed the integration of interactive virtual simulations to enhance hands-on learning experiences, whereas Johnson (2023) the use of collaborative online platforms to foster peer interactions and problem-solving discussions. The online mode of instruction has led to differences in student engagement levels, which in turn influences academic outcomes (Freeman et al., 2014). Students reported decreased motivation and increased feelings of isolation in virtual classrooms, which affected their overall participation and performance (Rice and Carter, 2020). Educators must scaffold student motivation by being explicit about expectations and ground rules for online discussion forums, which sets the framework for interaction, peer collaboration, and dialogue (Xia et al., 2013). Numerous studies have explored the effects of online teaching and learning on student academic performance. As observed by Smith and Johnson (2020), the shift to virtual classrooms resulted in varying outcomes, with some students excelling in the online environment while others struggled to adapt. Similarly, Smith et al (2022) found that the online mode of instruction led to differences in student engagement levels, which in turn influenced academic outcomes. Mathematics education poses unique challenges in an online environment.

The Technological Pedagogical Content Knowledge (TPACK) framework Mishra et al (2006) addresses the complex interactions among technology, pedagogy, and content knowledge in the context of education. It recognizes that technology should not be seen as an isolated tool, but as an integral component that enhances the delivery of content and pedagogy. According to the framework, effective teaching occurs when educators seamlessly integrate technological knowledge, pedagogical skills, and subject matter expertise. In the context of online mathematics education, educators must possess a deep understanding of

mathematical concepts (content knowledge), pedagogical strategies that facilitate effective learning (pedagogical knowledge), and technological tools and platforms that enhance the learning experience (technological knowledge). This study helps us to understand how educators' technological competence, pedagogical expertise, and mathematical content knowledge influence students' experiences in online mathematics education. Educators who effectively integrate technology to enhance content delivery and instructional strategies are more likely to foster positive outcomes in terms of mathematical skill development and academic achievement. This study aimed to investigate the following objectives:

1. To find the relation between the learning interest and academic performance of secondary school students learning mathematics online.
2. To find the views of teachers on online education at the secondary school level in mathematics.

Methodology

This was a quantitative correlational study in which the association between the two variables was investigated. This study used a descriptive survey method to gather data. A total of 100 secondary school students and 100 secondary mathematics teachers from the CBSE curriculum in the UAE participated in the study. The current study collected primary data using a questionnaire previously implemented by Tanola et al (2023) which was specifically developed to measure students' interest and academic performance in learning mathematics online. The teacher questionnaire was adapted from Mailizar et al (2020) and was developed to investigate secondary school mathematics teachers' views on e-learning implementation barriers. The questionnaire included five sections using a 5-point Likert scale. The choices for the questions ranged from strongly disagree to strongly agree.

Informed consent was obtained from all participants, and confidentiality and anonymity were ensured. This study ensured that all participating members followed widely accepted standards for the ethical, professional, and scientific conduct of the study design. The insights and data collected from the participants will be kept private to avoid any biased intake by other participants.

Results and Discussion

Objective 1: To find the relation between secondary student's interests and academic performance.

This research was conducted to determine the interest and academic performance of secondary school students in learning mathematics online. The responses were solicited from 100 students. Table 1 presents the respondents' responses concerning finding the interest level of secondary students in learning mathematics online.

As presented in Table 1, all the indicators of students' interest in learning mathematics online posted a mean interpreted and in percentage. The indicator 9: "I would like to spend more time doing exercises in mathematics" shows the highest percentage of Agreed with 60.6% with a weighted average of 2.08. In addition, most of the students disagree with indicator 3: I should spend more time doing mathematics online. Has the highest weighted average of 2.94. The indicator 5: "I look forward to upcoming activities in mathematics" has the lowest weighted average of 1.92. Generally, the student's interest in learning mathematics online obtained a 2.503 weighted average mean with an adjectival equivalent of "Agree", with

40.47%, this shows the interest of secondary school students. The analysis shows that the p-value is 0.016 and the r is 0.943. A strong interest in mathematics can significantly impact an individual's motivation to comprehend and grasp mathematical concepts. This study is in line with Kpolovie, who states that students' learning interests can predict the decline and increase in academic performance of students, and teachers play an active role in improving learning interests. The study also agrees with Kihwele and Mkomwa, (2022) study on academic achievement and interest. Data were collected using a questionnaire and was analyzed using T-test and Anova. Successful students had a higher interest in their studies than failed students, according to the study.

The student's academic performance in mathematics was based on the grade of 100 student-respondents. Students' academic performance in mathematics measures their success in learning mathematics. A test instrument is a tool that can be used to measure and assess students' mathematical absorption while studying. Based on the test results, students' mathematical achievement whether low or high, can be analyzed.

As shown in Table 2, 40% of the students garnered a grade of 90-100 interpreted as outstanding; 25% of the students achieved a grade of 70-89 interpreted as very satisfactory. However, 23% of the students obtained satisfactory grades of 50-69 and only 12% obtained a grade below 49. Hence, the table indicated that most of the students had good academic performance in learning mathematics online since 40 out of 100 students obtained a grade of at least 90%, indicating that a large majority of students have good academic performance.

Table 1

Interest of Secondary School Students in Learning Mathematics Online.

S.No	Indicators	Mean	St. Deviation	Adjectival Equivalent	Interpretation (in Percentage)
1.	Learning Mathematics online is fun.	2.84	1.061	Neutral	36.4%
2.	Learning Mathematics online is boring.	2.90	1.176	Neutral	34.3%
3.	I should spend more time doing Mathematics online.	2.94	1.236	Agree	30.9%
4.	If I had a choice, I would not attend online classes in Mathematics.	2.77	1.377	Agree	25.5%
5.	I look forward to upcoming activities in Mathematics.	1.92	0.939	Agree	47.5%
6.	I would like to spend more time listening to the teacher in Mathematics class online.	2.56	1.042	Neutral	36.1%
7.	When I cannot understand something in Mathematics, I always find a way to understand it.	2.01	0.882	Agree	46.5%

8.	In my Mathematics class online, I would like to spend more time explaining solutions to the class.	2.60	0.974	Agree	37.4%
9.	I would like to spend more time doing exercises in Mathematics.	2.08	0.825	Agree	60.6%
10.	I would like to spend more time consulting textbooks in Mathematics.	2.41	1.016	Agree	49.5%
	Mean	2.503	1.0528	Agree	40.47%

Table 2

Mathematics Performance of Secondary Students based on their Marks in the Last Quarter

Academic Performance		Percentage
Range of marks	Frequency	
90-100	40	40%
70-89	25	25%
50-69	23	23%
0-49	12	12%
Total	100	

Mean- 62.25

Objective 2. To find the views of teachers on online education at secondary school.

The questionnaire was administered to 100 secondary school mathematics teachers to determine their view on secondary school mathematics online education. This indicates that the students are sufficiently knowledgeable and skilled in online learning. The purpose of this questionnaire was to bring clarity that in online education, the use of e-learning techniques is not an obstacle to students' learning, it is more to the interest of students. The table 3 shows that 64.7% of teachers disagree that their students have internet issues. The weighted mean for the indicator "Because of my workload, I do not have enough time to prepare e-learning materials" is the highest at 4.21. In this study, 44.1% of teachers agreed that "the contents of my subject are difficult to understand by students through e-learning." Of the teachers who responded to the questionnaire, 63% disagreed that "My students are not interested in using e-learning". The mean of all items is 2.88. Hence, the teacher's response explains that the study is not about the use of technology but is more related to the interest of students and academic performance.

The analysis shows that the p-value is 0.016, which is less than 0.05, which shows that there was a significant relationship between students' learning interests and mathematics achievement for secondary school students in online education. The teacher has given the response the conclusion that lack of device or internet is not a factor for academic performance in online education for secondary school students. It is about how interest is developed in students in online education. Low student interest will make students not excited about learning mathematics, learning interest is one factor that influences

mathematics learning achievement (Fitriyani, 2019). The teacher can provide students with approaches, or strategies that effectively encourage them to learn mathematics and create a comfortable learning environment.

Table 3

Reflective responses of teachers at the Secondary School level related to online teaching.

S.no	Indicators	Mean	St. Deviation	Adjectival Equivalent	Interpretation (in percentage)
1.	My students do not have sufficient knowledge and skill in the use of e-learning.	2.85	1.009	Agree	35.5%
2.	My students do not have devices (i.e. laptops and tablets) for the use of e-learning	2.14	0.645	Disagree	59.4%
3.	My students are not interested in using e-learning	2.32	0.733	Disagree	63%
4.	My students do not have an internet connection.	1.83	0.598	Disagree	64.7%
5.	My students are not able to access the e-learning system.	2.52	0.641	Disagree	47.5%
6.	The contents of my subject are difficult to be understood by students through e-learning.	3.23	0.782	Agree	44.1%
7.	The contents of my subject are difficult to be taught using e-learning.	3.45	0.698	Agree	51.5%
8.	Because of my workload, I do not have enough time to prepare e-learning materials.	4.21	0.635	Agree	61.8%
9.	The contents of my subject cannot be taught using e-learning.	2.96	0.744	Neutral	48.5%
10.	Learning and teaching resources that are available on the e-learning system are not by the curriculum.	3.31	0.965	Agree	56.9%
	Mean	2.882	0.745	Agree	53.29%

Table 4

Pearson Correlation Coefficient Test on the Significant Relationship between Students' Interest and their Mathematics Performance in Learning Mathematics Online

		Interest	Grades
Interest	Pearson Correlation	1	0.943
	Significance		0.016
	N	100	100
Grades	Pearson Correlation	0.943	1
	Significance	0.016	100
	N	100	

Parameter	Value
Pearson correlation Coefficient (r)	0.943
r^2	0.8896
P- value	0.01611

A significant relationship was established between students' interest and mathematics performance for the 100 students. The relationship between students' interests and mathematics academic performance was explored using Pearson's correlation coefficient. Interaction is key to achieving high-quality learning and a successful learning process. Learner-teacher interaction is important for the experience, satisfaction, and motivation of the learner; academic achievement; and education quality. Learner-teacher interaction can be achieved in the environment by ensuring the active participation of students throughout the learning process.

This agrees with the findings of Mata et al (2012) the relationship between Math achievement and interest in mathematics is consistent with research showing that good achievers develop more interest than lower achievers. A similar study has been conducted, and students with high learning interests will have greater academic effort Trautwein et al (2015), can organize their learning well Lee et al (2014), focus their attention, and get involved in an activity (Winne & Nesbit, 2010).

Limitations and Recommendations

The study was conducted in the CBSE school in the UAE with a sample size limited to 100 students and teachers. Despite its localized setting, the study's outcomes are extrapolated to a broader context. The recommendation is for higher grades in schools to identify the connection between interest and academic performance. This study also emphasizes the importance of igniting interest among students with lower mathematics performance. And further study on, how to create a learning environment that promotes interest and academic performance.

Conclusion

In conclusion, based on the study conducted on 100 secondary school students and teachers of the CBSE curriculum in UAE, it can be concluded that there is a significant relationship between the student's grades and their level of interest in mathematics for secondary school students during online learning. The results reveal that there is a strong relationship and that students' interests will improve if their grades are recognized. Therefore, learning and achieving grades only affect students' interest in learning mathematics online. Findings indicate that the effectiveness of online teaching and learning heavily depends on the extent of interaction, engagement, and level of interest developed among students. As educational paradigms evolve, the insights gleaned from this research can drive positive change, ensuring that the virtual realm becomes a space of thriving academic growth rather than a hindrance. Students must be able to make connections between their learning experiences and see how they can apply what they are learning in their daily lives. By addressing the intricacies of the digital age through an empirical lens, this research aims to contribute to the collective effort of harnessing technology to empower students and nurture their educational journey. This research is significant as it illustrates how technology influences students' motivation and involvement in online math learning. It explores the effects of different teaching pedagogies on students' academic performance and their level of involvement in online mathematics education. It examines how much integrating digital tools may enhance students' math ability and understanding. This study examined the importance of instructor guidance and support in online math instruction. Teachers are encouraged to assess students' prior knowledge, misconceptions, and areas of difficulty while utilizing efficient instructional strategies to improve their understanding of concepts, as mathematics is a demanding topic. To improve students' online learning experience, instructors must implement effective pedagogical strategies.

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