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TikTok as a Teaching Platform: Measuring Its Effectiveness in Teaching Mathematics Concepts to Secondary School Students

Siti Nur Maisarah Mokhtar[1], Raudzatul Fathiyah Mohd Said[2,*], Mohammad Norzamani Sahroni[2], Zazaleena Zakariah[2]

[1] Faculty of Education, University Teknologi MARA, Cawangan Selangor, Kampus Puncak Alam,42300 Puncak Alam, Selangor, Malaysia
[2] Center of Foundation Studies, Universiti Teknologi MARA, Cawangan Selangor, Kampus Dengkil,43800 Dengkil, Selangor, Malaysia

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ABSTRACT

Many secondary school students continue to experience difficulties in understanding fundamental mathematical concepts. It is due to traditional teaching methods that inadequately engage learners and are hard to understand. This study examined the effectiveness of TikTok as a supplementary teaching platform in enhancing students' motivation and academic performance in mathematics. It is also to identify the obstacles to its implementation in the classroom. A quantitative research design was employed involving 89 Form Two students from two selected classes in a secondary school in Selangor. Data collected using motivation and barriers questionnaires, as well as pre- and post-tests. Inferential analysis and descriptive statistics, such as Pearson correlation and paired-samples t-tests, were performed. The findings indicate a statistically significant improvement in students' academic performance after the TikTok-based intervention, demonstrating the platform's potential to support understanding of mathematical concepts. However, students' motivation remained at a moderate level, suggesting that while TikTok enhances engagement through visual and interactive content, it does not necessarily cultivate intrinsic interest in mathematics. The obstacles, such as data protection and exposure to improper content, are among the barriers mentioned. In conclusion, TikTok can be a valuable supplementary tool in mathematics education, aiding in the development of 21st-century teaching methods with proper supervision and content moderation.

1. Introduction

Many secondary school students struggle to understand fundamental mathematical concepts, a challenging subject that is difficult to master [9]. Traditional teaching methods, which are typically reliant on memorization, do not always engage students or help them connect mathematical ideas

* *Corresponding author.*
E-mail address: raudzahfathiyah@uitm.edu.my

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to their everyday lives [10]. Consequently, students' motivation to learn mathematics diminishes, and their academic performance remains below expectations.

In the era of digital media, integrating technology and familiar platforms into the learning process can help bridge this gap. Social media, particularly TikTok, has come to life and become a promising alternative teaching tool. With its engaging and visually dynamic short videos, TikTok captures students' attention and offers new ways of explaining complex mathematical concepts [4,6]. Several studies have demonstrated that when used effectively, social media can enhance students' interest and motivation in learning mathematics [2,8].

Furthermore, this combination of teaching lessons together with any digital media aligns with the broader demands of 21st-century education, which emphasize creativity, critical thinking, and digital literacy skills [12]. In fact, students nowadays are digital natives who are already familiar with social media platforms; thus, TikTok's format can be leveraged to make learning mathematics more interactive and enjoyable [1]. Nevertheless, it also presents challenges, such as privacy issues and exposure to irrelevant or inappropriate content [5,10]. Therefore, specific studies are required to determine whether TikTok can be used effectively and responsibly as a supplementary learning platform in mathematics education.

This study aims to (i) examine students' motivation when learning mathematics using TikTok, (ii) determine whether there is a significant difference in students' academic performance before and after exposure to TikTok-based learning materials, and (iii) identify barriers faced by students when using TikTok for learning mathematics. The primary objective of this study is to determine whether TikTok can serve as an effective supplementary learning platform and aid educators in implementing 21st-century education, technology-enhanced instructional pedagogy in modern mathematics education.

2. Statement of the Problem

This study is grounded in the Expectation Confirmation Model (ECM), which provides a theoretical framework for understanding users' acceptance and continued use of technology [11]. Under this model, users' satisfaction and continued usage intention are influenced by their perceived usefulness of the system and the confirmation of their initial expectations. Perceived usefulness refers to students' beliefs that a learning platform enhances their understanding and academic performance, while confirmation reflects the extent to which actual learning experiences meet or exceed expectations.

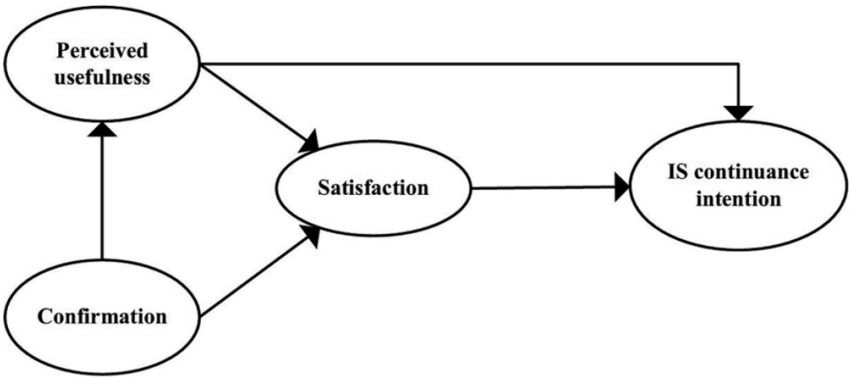

Fig. 1. Expectation Conformation Model (ECM)

Since this study is using TikTok-based mathematical learning, perceived usefulness refers to students' evaluation of TikTok's effectiveness in supporting their understanding of mathematical concepts through short videos and visual explanations. When students' expectations regarding TikTok as a learning tool are achieved, then satisfaction will increase. Students' satisfaction may influence their motivation and academic performance. It has also been demonstrated in a previous study that perceived usefulness and satisfaction are positively correlated with learning engagement and achievement in technology-enhanced learning environments [12]. By applying ECM, a direct theoretical link exists between TikTok usage, student motivation, and academic performance, enabling an assessment of TikTok's effectiveness as a supplementary mathematics learning platform.

Despite its benefits, several barriers exist associated with using TikTok for educational purposes. These include data privacy concerns, exposure to inappropriate content, and distraction resulting from the platform's entertainment-oriented nature. Such barriers may negatively affect students' satisfaction and disrupt the confirmation of expectations. It will reduce the perceived usefulness of TikTok as a learning tool. Therefore, it is important to understand these barriers, as they form a component of the ECM framework and influence students' overall evaluation of the learning experience.

Although studies have demonstrated TikTok's potential as an educational and edutainment platform, previous research using the ECM framework, specifically in secondary school mathematics education, remains limited. Hence, this study addresses this gap by examining students' motivation, academic performance, and barriers associated with TikTok-based mathematics learning guided by the ECM.

2. Research Objectives and Hypothesis

This study aims to investigate the effectiveness of using TikTok as a supplementary learning platform for mathematical lessons to secondary school students. There are three (3) main research objectives for this study.
These are the following research questions were formulated:

(1) What is the level of motivation among secondary school students in learning mathematics using TikTok?
(2) Is there a significant difference in students' academic performance before and after learning mathematics concepts from TikTok?
(3) What barriers do secondary school students face in using TikTok to learn mathematics concepts?
The research hypotheses specifically address the second research question:

Null Hypothesis (H_o): There is no significant difference in secondary school students' academic performance before and after learning mathematics concepts using TikTok.
Alternative Hypothesis (H_1): There is a significant difference in secondary school students' academic performance before and after learning mathematics concepts using TikTok.
These objectives and hypotheses were used for this study regarding TikTok's potential as a 21st-century teaching tool for mathematics education.

3. Methodology and Data Collection

This study employed a quantitative research design, incorporating a pre-test and post-test, to assess the effectiveness of TikTok as a learning platform specifically for mathematics. The target respondents comprised all Form Two students in a selected secondary school in Selangor. However, it is subject to administrative approval from school authorities to get the students as respondents.

Due to ethical and administrative constraints, permission was granted to involve only two Form Two classes in the study. Therefore, these two classes, comprising 89 respondents, were selected as the accessible population within the overall target population. Then, stratified random sampling was used to ensure that students from each selected class were fairly represented. Each class was treated as a separate group, and students were randomly selected from each group to reduce sampling bias and improve internal validity. This method was employed to ensure representation from the different classes and enhance the validity of the findings [8].

The study utilised three primary instruments: a motivation questionnaire, a barriers questionnaire, and a mathematics test as pre- and post-tests. The motivation and barriers questionnaires were adapted from existing validated instruments [6,8]. While mathematics instructors designed the mathematics tests to assess students' understanding of core concepts. During the intervention period, selected students watched selected TikTok videos that explained mathematical topics relevant to their curriculum.

Descriptive statistics, including mean and standard deviation, were used to summarise the motivation levels and barriers faced by students. To evaluate the impact of the TikTok intervention on academic performance, a paired samples t-test was conducted, comparing pre-test and post-test scores. Furthermore, Pearson correlation analysis was employed to explore the relationship between students' motivation and their academic performance after using TikTok.

This methodology is used to assess students' motivation, determine the difference in academic performance before and after using TikTok, and identify potential barriers to its implementation. The data gathered will help determine whether TikTok can effectively engage students and improve learning outcomes in mathematics. Hereby ensuring whether integrating social media as an educational tool is possible.

4. Results

This section presents the results of assessing student motivation, evaluating academic performance before and after the TikTok intervention, and identifying barriers to using TikTok for learning mathematics.

Table 1
Students' motivation in learning mathematics using TikTok

	N	Mean	Std. Deviation
I like the mathematics subject	89	2.8652	1.06804
I enjoy learning mathematics on TikTok	89	3.1236	1.08523
I can understand all the mathematical concepts through TikTok	89	3.2360	1.07685
I think learning mathematics through TikTok is easy	89	3.5618	.99949
Participating in TikTok is interesting in learning mathematics	89	3.1011	1.12860

I considered TikTok as a learning initiative that can boost my motivation in learning mathematics	89	3.1573	1.10679
Overall		**3.1255**	**1.08252**

For the first research objective in Table 1, descriptive analysis revealed that secondary school students reported a moderate level of motivation for learning mathematics using TikTok, with an overall mean of 3.13 (SD = 1.08). Students perceived learning mathematics through TikTok as easy (mean = 3.56, SD = 0.99), enjoyable (mean = 3.12, SD = 1.08), and interesting (mean = 3.10, SD = 1.13). However, their overall interest in mathematics remained relatively low (mean = 2.87, SD = 1.07). This analysis showed that although TikTok's engaging visual and interactive features may foster external motivation, they do not necessarily strengthen students' intrinsic interest in the subject.

Table 2
Paired samples statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Score of Pre-Test	10.9888	89	7.38625	.78294
	Score of Post-Test	18.8427	89	6.61936	.70165

Table 3
Paired samples correlation

		N	Correlation	Sig.
Pair 1	Score of Pre-Test & Score of Post-Test	89	.801	.000

The second research objective focused on academic performance. Based on Tables 2 and 3, the Paired samples t-test results showed a statistically significant improvement in students' performance after exposure to TikTok-based learning content. The mean pre-test score was 10.99 (SD = 7.39), while the mean post-test score increased to 18.84 (SD = 6.62).

Table 4
Paired samples T-test

		Paired Differences				t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference			
					Lower	Upper		
Pair	Score of Pre-test – Score of Post-test	-7.85393	4.47353	.47419	-8.79629	-6.91157	-16.563	88

As shown in Table 4, the paired sample t-test revealed an improvement in academic performance after using TikTok, with post-test scores substantially higher than pre-test scores ($t(88) = -16.56$, $p < 0.001$). From this test, the null hypothesis (H_o) – stating there is no significant difference – could be rejected, and the alternative hypothesis (H_1), which posits a significant difference, is accepted. Based on the ECM, it showed that when students perceived usefulness, it led to satisfaction. Hereby, motivating students to continue engaging with the platform.

Table 5
Correlation coefficient between students' motivation and score of post-test

		Motivation	Score of Post-Test
Motivation	Pearson Correlation	1	0.210
	Sig. (2-tailed)		0.049
	N	89	89
Score of Post-Test	Pearson Correlation	.210	1
	Sig. (2-tailed)	.049	
	N	89	89

A Pearson correlation analysis was conducted to examine the relationship between students' motivation and their mathematical performance after the TikTok intervention. The results in Table 5 revealed a significant positive correlation between motivation and post-test scores ($r = .210$, $p = .049$, $N = 89$). Although the strength of the relationship is modest, it still implies that motivation plays a significant role in supporting students' mathematics learning outcomes. It confirms the existence of a relationship between motivation and performance. This positive correlation between motivation and post-test performance also follows this pattern of ECM pathways.

Table 6
Students' barriers in learning mathematical concepts using TikTok

	N	Mean	Std. Deviation
TikTok has some privacy issues, such as account hacking and account exposure	89	3.2809	1.14801
I need high mobile data when using TikTok	89	3.1798	1.17320
I was exposed to videos that could have "bad", "nonbeneficial", "false", "violent", and "personal" content	89	3.3820	1.10274
Overall		**3.2045**	**1.15796**

The third research objective addressed the barriers that students face when using TikTok. The descriptive analysis presented in Table 6 indicates that students encountered several challenges when using TikTok for mathematics learning, including exposure to inappropriate or misleading content (mean = 3.38, SD = 1.10), high mobile data requirements (mean = 3.18, SD = 1.17), and concerns related to privacy (mean = 3.28, SD = 1.15). These findings are consistent with previous studies that have reported similar challenges associated with the use of social media in educational contexts [1,7]. This highlighted the importance of robust content moderation, privacy protection, and technological considerations to ensure the safe, effective, and sustainable implementation of this 21st-century teaching tool.

This study aligned with the Expectation Confirmation Model (ECM), which emphasizes the roles of perceived usefulness, satisfaction, and continued usage intention [11,12]. The data showed that students found learning mathematics through TikTok to be easy and engaging. It contributed to their perceived usefulness and satisfaction, which are key elements in the ECM framework. Also, the findings of this study align with previous research, which has reported that the use of TikTok can help improve students' understanding of mathematical concepts and stimulate their interest in the subject [6,8].

As a result, TikTok can be a useful supplementary tool for teaching mathematics, as it supports student motivation and performance. However, content control and safe usage practices are crucial

for the sustainable implementation of TikTok in the classroom. It is to ensure that risk can be minimised while harnessing its educational potential.

5. Recommendations and Conclusion

Based on this study's findings, several recommendations are proposed to enhance future research and practical implementation of TikTok as a learning platform for mathematics.

First, the future researcher can use a larger sample from the various schools. Therefore, the suggestion is that the treatment pre-test and post-test can be extended to target groups from different urban and rural school areas. The students from these two different areas had differences in accessibility, familiarity with technology, and cultural perceptions. It may significantly influence the impact of such a study. This would ensure that the study results can be generalized more effectively across diverse student populations.

Second, the next direction for future research is to extend the study to a qualitative design, as well as to explore other variables, not only to identify the barriers students faced in using TikTok to learn mathematics concepts. This aims to identify other challenges or barriers that students face and explore ways to overcome them. This is to ensure the TikTok platform can be utilized effectively in the learning process. The respondents can include teachers who teach mathematics subjects, as well as students. They can determine which mathematical subjects or ideas, such as algebra, geometry, or calculus, are best suited for learning using TikTok. Additionally, it may compare TikTok's efficacy with that of traditional educational resources and other social media platforms, such as YouTube and Instagram.

Lastly, teachers or researchers need to develop or create their own TikTok content. They may create videos that are specifically tailored to their students' interests, learning preferences, and curriculum. Perhaps, by doing this, students may feel closer and more involved when they see their teacher on TikTok, and when their teacher creates the content, students might feel more at ease discussing it or asking questions.

In conclusion, TikTok can be effectively used as a supplementary tool to enhance students' understanding and motivation in mathematics. The visual and interactive features were found to be engaging and supportive in helping students understand mathematical concepts, which in turn improved their academic performance. Although challenges such as exposure to inappropriate content and privacy concerns exist, these can be managed through proper content moderation and teacher guidance. With adequate supervision and thoughtful implementation, TikTok has the potential to be integrated into 21st-century pedagogy, supporting a more dynamic and inclusive learning environment for students.

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