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Technology's Perception and Challenges among Malaysian Educators' in Teaching Mathematics

Vadivalagi Manimaran & M. Khalid M. Nasir

Faculty of Education, Universiti Kebangsaan Malaysia (UKM)

Email: vadivalagi@hotmail.com

Corresponding Author Email: mdkhalid@ukm.edu.my

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Abstract

Mathematics educators, particularly teachers, possess unfavorable opinions and encounter challenges when it comes to effectively incorporating technology into their teaching methods. Teachers in government school classrooms are encountering a shortage of resources and expertise when it comes to teaching Mathematics. This research seeks to understand the factors contributing to instructors' limited awareness of incorporating technology into their mathematics classes. The questionnaire was adjusted according to the Technology Acceptance Model Theory. One hundred mathematics instructors from secondary schools in Johor state, including both urban and rural areas, were given survey questionnaires as part of the research's quantitative technique. According to the Head of Department, mathematics teachers are encountering significant difficulties when it comes to utilizing technology for teaching Mathematics in the classroom, as evidenced by the participation and outcomes of teachers in the mathematical area. This study provides practical insights for the Malaysia Education Ministry to analyze the data and enhance the well-being of teachers, hence facilitating effective and convenient teaching.

Keywords: Challenges, Perceptions, ICT, TAM, Teaching Mathematics

Introduction

Undoubtedly, technology has revolutionized various aspects of human existence. The standard of human existence has markedly improved, and what was before unachievable has now become attainable. The influence of technology has permeated all facets of human existence. From this perspective, the transformative capabilities of technology have likewise influenced the field of education, making it no different.

Utilizing contemporary technology as a means of gathering, organizing, and assessing information to address problems and develop important concepts in real-life situations may potentially impact the way subjects are taught in classroom settings (Young, 2017). The educational benefits of technology, such as interactive whiteboards, graphical calculators, dynamic mathematical software, programming visualizations, computer algebra systems, and others, are widely recognized by many mathematics instructors (Tanujaya et al., 2017). Nevertheless, the level of technology utilization extends beyond mere usage and

encompasses the integration of the selected technology into specific teaching materials.

The subject of mathematics is often referred to as the "queen of all subjects" (Das, 2019). It is often essential to comprehend ideas that oppose technology and go against what the mathematical theory suggests or shows, even in cases when the math teacher lacks the required expertise. Technology has the potential to be effective in the mathematics classroom, but its performance will mostly be influenced by several aspects, including instructors' attitudes toward teaching mathematics, teachers' assessments of their own technology skills, and teachers' attitudes toward their students' mathematical learning. The study conducted by Baya'a and Daher (2013) found that teachers' eagerness to include technology in the classroom, their feeling of empowerment and self-esteem when utilizing it, and their objective to seamlessly integrate technology into their teaching practices are all evident. These technological tools facilitate the integration of recommended teaching methods into mathematics classes.

The previous study examined the utilization of technology in teaching Mathematics in a broad context and did not present any specific findings from public schools. The majority of research has mostly concentrated on instructing mathematics during remote learning in the midst of the pandemic, without giving adequate attention to the incorporation of technology into teaching and learning in the aftermath of the pandemic. Moreover, there is a dearth of research that has not incorporated the perspective of instructors in the context of teaching Mathematics with the use of technology. Given this information, the present study examines the reasons why teachers are hesitant to integrate technology into their mathematics instruction. Prior studies failed to include the categorization of schools, hence this investigation would specifically concentrate on educators at public secondary schools. In other words, it would significantly enhance the existing knowledge base in the field of study on teachers' perspectives and challenges in utilizing technology for teaching mathematics.

Objectives of the Study

This study aimed to investigate the perceptions of Public Secondary Mathematics teachers regarding the integration of technology in Mathematics instruction, as well as their willingness, attitudes, and the challenges they face. Hence, the study aims to achieve the following main objectives:

- to assess the teachers' opinion of using technology tools in the Mathematics classroom.
- to identify the difficulties encountered when using technology tools in the Mathematics classroom.

Research Questions

- What is the perception level among school teachers of utilizing technology tools in the mathematics classroom?
- What are the challenges of Utilizing technology tools in the mathematics classroom among the school teachers?

Literature Review

Technology Acceptance Model (TAM)

Several theoretical frameworks have been established to comprehend the behavioral intents of students when it comes to using technology (Abedalla, 2015). Marangunic and Granic

(2015) conducted a comprehensive analysis of 85 scientific articles published between 1986 and 2013, focusing on the Technology Acceptance Model (TAM). Their findings repeatedly revealed the discovery of new constructs that significantly influence the two primary variables of TAM, namely perceived usefulness and perceived ease of use. Multiple investigations have substantiated the validity of TAM, providing the researcher with a solid basis for its utilization in this study.

Davis et al. made modifications to Ajzen and Fishbein's "Theory of Reasoned Action" (TRA) in 1989 to develop TAM Davis (1989), which aims to predict consumers' technological adoption. The Technology Acceptance Model Chen (2016) is a rigorous yet economic theory that can be used to define a particular information system or technology. According to Chaichi & Kei (2021), TAM outperformed TRA in various aspects, offering a strong theoretical basis for studying the elements that affect users' adoption of new technology.

Integration of Technology in Teaching

Information and Communications Technology (ICT) integration in education refers to the successful and productive utilization of ICT in every area of the educational process, encompassing the curriculum, teaching and learning environments, and infrastructure (Earle, 2002). ICT utilization is regarded as a potentially influential tool, especially for the reformation and transformation of education (Tinio, 2003). The successful development and application of ICT will aid both instructors and students in the classroom. As stated by Council (2000), some scholars who have analyzed the literature on ICT and learning have determined that it holds significant promise for enhancing both teacher and student learning. In accordance with Palak & Walls (2002), technology can be utilized to enhance traditional classroom learning.

The Use of Technologies in Teaching Mathematics

The progress in mathematics within dynamic technologies promotes the application of innovative mathematical methods in many domains, such as dynamic geometry, statistics, and robotics (Olive, et al., 2009). Moreno and Ciscar (2018) delineate three techniques for integrating technology resources: To enhance the effectiveness of mathematical instruction, it is advisable to minimize the significance of students' mathematical activities and instead focus solely on employing dynamic representations of issues to illustrate mathematical relationships. There is a need to create lessons that integrate mathematical activities and technology to solve problems. Studies on the application of technology in teaching mathematics have examined the specific digital tools utilized, the pedagogical principles and goals of the activities, and the extent to which technology is integrated into mathematical education (Bray & Tangney, 2017).

Nevertheless, there has consistently existed a disparity between the theoretical frameworks employed in the development of technological instruments and their practical application in research, hence posing difficulties in formulating generalizations (Lagrange et al., 2001). The instructor plays a vital role in efficiently incorporating technology into mathematics instruction (Forsström, 2019). The study conducted by Gui et al (2018) has shown that the characteristics and accessibility of technological resources have an impact on the utilization of technology in educational settings. Despite the presence of advanced technological resources in secondary schools and higher education institutions, teachers often possess inadequate or moderate levels of digital proficiency (Guillén-Gámez & Mayorga-Fernández, 2020).

Teaching Mathematics in Malaysia

The Malaysia Ministry of Education (MOE) implemented a policy in 2002 to teach mathematics in English from elementary school to matriculation. The implementation of the policy began in 2003, starting with the primary school levels of Standard One and Standard Four, and the secondary school levels of Form 1, Form 4, and Form Lower 6, as well as the matriculation centres. The selection of English as the medium of instruction aims to enhance the linguistic competence of educated individuals in this country. Given that all knowledge is expected to be easily accessible in English, it is believed that acquiring proficiency in English is essential for fostering the comprehension of science and mathematics among educated individuals (Kharuddina & Azid, 2021).

In 2017, the Ministry of Education (MOE) revised the national curriculum for elementary, middle, and high schools. As part of these revisions, the medium of instruction was changed from English to Malay. Through the implementation of educational institutions, educators, learners, and caregivers, as well as the creation and administration of school curricula, these adjustments aim to foster student independence and ingenuity. The intention is to contrast and compare the national, district, school, and individual levels (Kharuddina & Azid, 2021). In Malaysia, mathematics is compulsory for all students. Mastering mathematics is crucial for success in the future job market.

Other Related Studies

This section examines previous research on the use of ICTs in teaching to illustrate the benefits of including ICT in the classroom and to explore teachers' perspectives on integrating ICT into their teaching. The use of technology in education is becoming increasingly significant and will continue to develop in the twenty-first century due to the rapid transition of the world to digital media and information (Amin, 2013). The right utilization of information technology fosters and enhances a diverse array of skills in pupils, encompassing mathematics, communication, critical thinking, problem- solving, teamwork, and research (Reinhold et al., 2020).

Multiple international studies have shown that the use of ICT can lead to improved student learning and more efficient teaching methods. A study conducted by the National Institute of Multimedia Education in Japan found that integrating the curriculum can greatly improve students' access to instructional ICT and positively impact their academic performance, particularly in subjects such as science, math, and social studies. Delivering cost-effective digital resources, meeting teachers' technological needs, and catering to students' requests for technology access to enhance their learning can pose significant challenges. Proficient teachers in digital literacy and ICT use not only assist students in developing higher-order thinking skills and expressing their understandings creatively but also equip them to effectively navigate the ongoing technological advancements in the workplace and society (Pradhan et al., 2019; Hernandez, 2017).

Teachers hold varying perspectives on the utilization of ICT in the classroom. The efficacy of incorporating ICT into education is primarily contingent upon instructors' viewpoints (Adhikari, 2021a). Academics must acquire a deeper understanding of the worry's instructors have regarding the utilization of ICT in the classroom due to its significance. The decision of whether and how to incorporate ICT in education lies with the classroom or subject instructors.

Zamir and Thomas (2019) discovered a substantial correlation between instructors'

perspectives on the incorporation of ICT into the teaching-learning process. The findings of this study align with previous research that demonstrates a robust and positive correlation between the viewpoints of university professors and the integration of information and communication technology (ICT) (Sang et al., 2018; Shah et al., 2018). Due to the positive perspectives, probability has the potential to devise innovative methods for enhancing learning. Consequently, teachers incorporate ICT into their practices by acquiring fundamental computer skills and employing application software for work-related tasks. Teo et al. (2019) found that instructors' perspectives on technology can aid in promoting the effectiveness of the teaching and learning process. In addition, the built-in capabilities of computers provide learning opportunities that align with the advancements of the twenty-first century, so supporting the professional progress of instructors (Regan, et al., 2019). The favorable correlation between ICT abilities and views facilitates effective teaching and learning (Baydas & Goktas, 2016).

Research Methodology

Research Design

The study employed a cross-sectional survey design. Questionnaires are used to gather data pertaining to the study issues using a quantitative approach. This questionnaire survey is suitable for understanding the reasons teachers are facing issues with integrating technology while teaching mathematics.

Sample

A purposive sample approach was used to choose the study's respondents. This survey was primarily created for public secondary school teachers in Johor. Therefore, 100 teachers from different areas and genders who teach mathematics in Johor secondary schools are involved in this study. Ten schools around Johor state were selected, and six urban schools and six rural schools teachers participated in this study.

Instrument

The instrument used to assess Teachers' Perceptions and Teachers' Challenges was derived from a study conducted by Adhikari in 2021 (Adhikari, 2021b). The researcher modified a structured questionnaire to serve as the instrument for the investigation. The study assessed the views and obstacles that prevent mathematics teachers in government secondary schools from effectively using appropriate digital technologies in the classroom. This was done via an online survey applying a validated questionnaire. The initial section of the questionnaire comprised the respondents' gender, teaching specialization, and extent of formal ICT training. The second component assesses teachers' attitudes and perceptions regarding the use of ICTs in mathematics instruction. It consists of nine items, rated on a five-point Likert scale ranging from strongly agree to strongly disagree. This scale measures the extent of positive or negative attitudes towards ICT utilization. The third section comprises nine aspects that specifically focus on the issues or difficulties faced by teachers when using ICT in their maths lectures.

Data Analysis

The data obtained from the questionnaire was analyzed using the Statistical Package for Social Science (SPSS). The analysis utilized descriptive statistics to collect the frequencies, means, standard deviation, and normality tests in order to address research questions 1 and 2.

Validity and Reliability

A pilot study was done on ten mathematics teachers with a background in ICT to assess the validity and reliability of the instrument. The purpose of this study was to serve as a reference for the subsequent comprehensive investigation (Gupta, 2011). The preliminary version of the survey was modified using previously released literature.

The pilot study's findings indicate that the instrument's overall dependability was recorded as a good Cronbach's Alpha (α) of 0.84. The alpha coefficient for teachers' perception is 0.8, indicating a high level of reliability. Similarly, the alpha coefficient for instructors' challenges is 0.95, indicating a very high level of reliability. A pilot test was conducted to serve as a reference for the subsequent comprehensive study (Gupta, 2011). The preliminary version of the survey was modified using previously released literature. The questionnaire had a high level of internal consistency, as indicated by the alpha values of all scales over .70, as recommended by several academics (Takegata et al., 2017; Field, 2013; Pallant, 2020; Pallant, 2016; Adhikari, 2021b).

Result and Discussion

This part presents the conclusions derived from two components: 1) teachers' perspectives on the implementation of technology in Mathematics instruction, and 2) obstacles encountered while using technology for teaching Mathematics.

Table 1
Summary of Teachers' Perception construct

	N Statistic	Minimum	Maximum	Mean	Std. Deviation	Skewness	
						Statistic	Std. Error
Perception	86	3.78	4.22	4.0013	.06922	-.605	.260
Valid N	86						

The descriptive statistics for the variable measuring teachers' view of employing technology tools in teaching Mathematics indicate that it follows a normal distribution, as presented in Table 1. Fourteen responses were identified as being biased and therefore eliminated. A mean of 4.00 suggests a heightened level of perception.

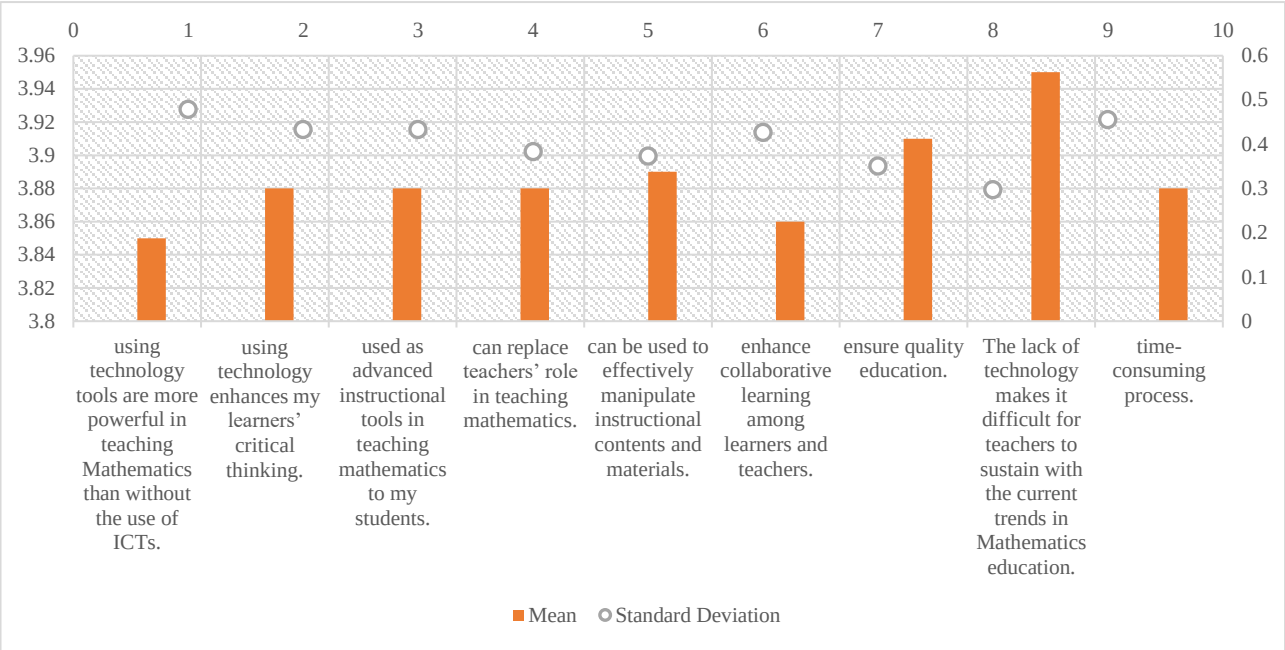

Figure 1: Teachers' Perception related items

Figure 1 demonstrates that teachers have a favorable impression of using technology tools for teaching mathematics. They believe that these tools are highly effective and can serve as sophisticated instructional aids. ICT can guarantee the standard of education. The majority of participants possess a strong inclination towards improving their students' critical thinking skills and promoting collaborative learning between teachers and students. Nevertheless, many held a favorable opinion that technology will supplant the function of teachers. Moreover, the use of technology is a time-intensive process, and the absence of technology poses challenges for teachers to keep up with the latest developments in mathematics teaching. The average level of the perception statement ranged from 2.21 to 3.54. The average value is 3.89, and the measure of the amount of variation from the average is 0.29, suggesting a favorable assessment.

Figure 1 reveals that secondary school teachers in Johor hold favorable views regarding the incorporation of ICT into mathematics instruction. The outcome suggests that the teachers value the proper utilization of ICT in teaching and learning activities in mathematics classrooms of the 21st century. The results of the present study support Fu's (2013) assertion that utilizing ICTs is a more effective method of instruction compared to teaching without the use of ICTs. This is particularly relevant in the context of education reform and transformation, as it contributes to the provision of high-quality education.

The study's conclusions are further corroborated by research demonstrating that ICT can serve as an instructional tool, hence augmenting the effectiveness of teaching (Pardede, 2020). In addition, ICT has the potential to substitute the teacher's function in education and facilitate collaborative learning (Das, 2019). This indicates that the favorable opinion of incorporating ICT in mathematics lectures was highly relevant in their individual classrooms. Consequently, students' favorable opinions of professors were influenced by how well they utilized modern information and communication technologies (ICTs) to improve and streamline the teaching and learning experiences in mathematics classrooms. The

implementation of ICT in the classroom is significantly impacted by the motivation and willingness of the teachers. Cultivating a positive disposition among educators towards utilizing ICT could potentially influence the way teachers are regarded. The main reason for this is the advantageous function of ICT in education (Saxena, 2017). Hence, it is imperative for the Malaysian government's Ministry of Education to promote and support educators in cultivating a favorable attitude towards the integration of ICT in mathematics classrooms to enhance teaching and learning.

Table 2
Summary of Teachers' Challenges Construct

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness	
						Statistic	Std. Error
Challenges	76	3.56	3.89	3.7208	.08214	.148	.276
Valid N	76						

Table 2 displays the statistical information describing the difficulties linked to the implementation of
ICT in mathematics courses. The data exhibits a normal distribution, with a mean value of 3.72, suggesting a significant difficulty level.

This section is dedicated to comprehending the difficulties faced by educators when implementing technology. Insufficient computer resources and limited Internet connection are perceived by educators as obstacles to the implementation of technology in education. Another notable obstacle in incorporating technology into teaching was the limited duration required to acquire proficiency in new applications. Furthermore, the teachers' greatest difficulty was their insufficient tolerance for instructing children in the integration of technology, a concern that 76% of teachers acknowledged. Several studies have indicated that teachers lack the necessary expertise to effectively utilize new technological tools in their teaching practices (Gu et al., 2013; Mishra & Koehler, 2006; Orlando & Attard, 2016). Moreover, several other studies have shown that the barriers preventing instructors from using ICT in the classroom are limited time, insufficient training, and limited availability of these technologies (Asongu & Roux, 2017; Tabira & F.X., 2017; Bornman, 2015).

A significant obstacle to implementing ICT was the lack of software problems. The computer labs had unreliable and illegally copied software that was frequently altered, rendering it unusable for educational purposes. A scarcity of ICT resources was found to be prevalent in most settings, compelling instructors and students to share resources with other educators. Becta (2003) argues that the inaccessibility of ICT resources in an institution is not just due to the absence of hardware, software, or other ICT materials. Possible causes for this issue include insufficient resource allocation, outdated technology, incompatible software, or limited access for instructors. In accordance with Osborne and Hennessy (2003), teachers' willingness to use ICT in the classroom was influenced by limitations on their ability to acquire hardware and software resources.

Based on the survey, despite the fact that many teachers possess computer skills in the classroom, they do not make extensive use of them due to a lack of available time. A significant number of educators identified time constraints as a hindrance to providing sufficient computer time in classrooms and as a challenge in utilizing ICT for teaching and learning. According to Becta (2003), teachers face difficulties in managing their time effectively in different aspects of their work, which impairs their ability to complete tasks. Several participating instructors have stated that they need time to search for resources online, design courses, experiment with and become proficient in using technology, resolve technical problems, and receive adequate training. Recent research has found that a shortage of time is a major obstacle that affects the utilization of new technologies in ICT education (Al-Alwani, 2005).

Conclusion

The objective of this study was to determine the perceptions of secondary government school mathematics teachers in Johor regarding the challenges they encountered while incorporating digital tools in their classrooms. Regarding the aforementioned findings and debate, the researcher determined that although teachers shown a favorable disposition towards incorporating technology into mathematics classrooms, it is imperative to note that technological tools are unable of supplanting teachers as vital exemplars for students. Nevertheless, the teachers faced various obstacles like limited expertise, diminished self-assurance, insufficient experience, inadequate training, lack of enthusiasm, and limited access to ICT equipment. Additionally, they met a lack of technical assistance and genuine ICT resources. The biggest obstacles encountered in adopting ICT tools in the mathematics classroom at the school level were software issues and an unstable and unpredictable internet connection.

Therefore, it is reasonable to assert that the utilization of ICT is essential and efficient as supplemental material in the teaching and learning process of the mathematics classroom. Frequently, educators have not extensively utilized ICT in the classroom to significantly modify their instructional methodologies. Therefore, educators should persist in broadening their ICT knowledge and expertise. One such approach may be to provide suitable training and enhance the technical expertise of instructors through ICT colleges. In addition, the government should formulate an appropriate strategy to mitigate the challenges related to the utilization of ICT in mathematics classrooms. This study focuses on examining the perceptions of government secondary school teachers regarding the utilization of ICTs in the instruction of mathematics, as well as the challenges they encounter. Further investigations may examine other relevant subjects, such as policies and managerial strategies, in order to alleviate the challenges that instructors have while incorporating ICT into the mathematics classroom. If the challenges faced by instructors can be minimized or addressed, it is certain that the learning results of our students will improve.

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