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Challenges in Digital Technology Use Among Science Teachers in Perak, Malaysia

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Abstract

This study aims to identify the current challenges in using digital technology among Science teachers in Perak, Malaysia. The study sample was selected by simple random sampling involving 110 respondents of Science teachers in Kinta Utara, Kinta Selatan and Manjung districts of Perak. The questionnaire contains two parts: Part A requires gender and teaching experience, while Part B involves the challenges of using digital technology. Results revealed that the respondents are experiencing moderately high levels of challenges in using digital technology (M=2.69, SD=0.577). Additionally, there was a significant relationship between teaching experience and the challenges [r (110) = 0.282, p = 0.003]. The findings suggest that as teaching experience varies, so do the constraints and difficulties associated with using digital tools, underscoring the need for targeted support and training based on teachers' experience levels.

Keywords: digital technology, science teachers, teaching experience

Introduction

In line with the rapid expansion of digital technology, teachers must be equipped with the necessary knowledge and skills to address emerging challenges in today's educational environment. According to [1], digital technology offers a flexible platform that supports both online and face-to-face teaching and learning (TnL), allowing these activities to be conducted anytime and anywhere. This flexibility boosts students' motivation and deepens their understanding, especially in science.

The abstract nature of scientific concepts calls for appropriate digital pedagogical approaches [2]. Consequently, the integration of digital tools, such as videos and simulations, has become crucial in enhancing science lessons. Indeed, the adoption of digital technology is now integral to modern education [3], particularly in the field of information and communication technology (ICT) [4]. Technologies including blogs, Google Classroom, websites, 3D animations, and interactive platforms (Wordwall, Quizzie, Kahoot) have proven effective in capturing student interest, improving academic performance, and streamlining the TnL process [5]. Studies also highlight that tools like multi-touch boards can stimulate engagement and increase enjoyment in science lessons [6].

Furthermore, digital technology enhances two-way communication between teachers and students, fostering student independence and enabling teachers to create engaging, interactive teaching materials [7, 8]. Nevertheless, successful technology integration requires knowledgeable and skilled teachers to ensure seamless TnL [4]. By leveraging applications like PowerPoint, Canva, and YouTube, lessons can be made more effective and engaging. Digital technology not only elevates students' motivation and comprehension but also improves overall educational quality by making learning more relevant,

meaningful, and enjoyable.

Despite these advantages, teacher adoption of digital technology remains low [9]. Only 2.2% of teachers achieve a high level of digital competence, prompting Malaysia's Ministry of Education to intensify training and professional development to enhance teachers' capability in using digital technology [10]. Teachers with a lot of teaching experience are more likely to use traditional teaching methods due to the lack of proper technological training in their early careers [11], which leads to pressure and difficulties when incorporating digital technology into the TnL process.

Materials and methods

Study design

This research employs a quantitative survey design. The quantitative approach uses a questionnaire to identify respondents' demographic profiles and the challenges in using digital technology among science teachers.

Population and sample

The population involved comprises 154 secondary school Science teachers in Perak state, specifically in the districts of Kinta Utara, Kinta Selatan, and Manjung. The sampling method used was a simple random sampling technique to ensure a fair and unbiased representation of the target population. A total of 30 respondents participated in the pilot test and 110 were involved in the actual study.

Research instruments

The instrument used in the study was a questionnaire adapted from [12]. There are two sections to the questionnaire. Demographic data, including gender and teaching experience, were included in Part A, whereas the challenges of using digital technology were included in Part B. A 4-point Likert scale was employed in the questionnaire: 1 for "strongly disagree," 2 for "disagree," 3 for "agree," and 4 for "strongly agree." Three lecturers from the Department of Biology, Faculty of Science and Mathematics, UPSI verified the questionnaire. Additionally, a pilot test with 30 respondents was conducted to assess the questionnaire's reliability.

Data analysis

Statistical Package for Social Science (SPSS) ver. 29.0 was used to analyse the data retrieved from the questionnaire. Demographic data of the respondents were analysed descriptively using percentages, while the challenges in the use of digital technology among science teachers involved mean scores and standard deviations. Table 1 shows the mean score interpretation that is used to compare the level of challenges experienced by the teachers. Subsequently, Pearson's correlation was used to examine the relationship between teaching experience and the challenges of using digital technology.

Table 1: Mean score interpretation of challenges level in the use of digital technology among science teachers

Mean score	Level	Interpretation
1.00-1.74	Low	Teachers do not face challenges in using digital technology
1.75-2.49	Medium-low	Teachers face digital technology usage challenges on a small scale and can overcome them
2.50-3.24	Medium-high	Teachers face large-scale challenges in using digital technology and are unable to overcome them

3.25-4.00	High	Teachers face larger-scale challenges in using digital technology and are entirely unable to overcome them

Results and discussion

In this study, three experts were involved in validating the questionnaire. The content validity index (CVI) value for all three experts was 0.95, which implied the relevance of the questionnaire in the survey [13]. Following that, a pilot study was conducted involving 30 science teachers from secondary schools in the Kinta Utara district of Perak to measure the reliability of the questionnaire based on Cronbach's Alpha coefficient value. Cronbach's Alpha coefficient value has a range between 0.0 to 1.0. If the obtained value approaches 1.0, it shows high reliability [14]. The Cronbach's Alpha coefficient value for this questionnaire was 0.884, which indicated that the questionnaire could be confidently used in the actual test to determine the level of challenges in using digital technology among science teachers.

Table 2 shows the demographic information of the actual study. Of the 110 respondents, most were females (n = 61, 55.5%) and 49 (44.5%) were males. In terms of teaching experience, most respondents had taught for 11-15 years (n=29, 26.4%), followed by the category of 20 years or more (n=26, 23.6%), 16-20 years (n=24, 21.8%), 6-10 years (n=19, 17.3%) and 5 years or less (n=12, 10.9%).

Table 2: Demographic information

Variable	Items	Percentage
Gender	Male	44.5 %
	Female	55.5 %
Teaching experience	<5 years	10.9%
	6-10 years	17.3%
	11-15 years	26.4%
	16-20 years	21.8%
	>20 years	23.6%

According to Table 3, the mean score related to current challenges in using digital technology is 2.69, with a standard deviation of 0.5505. The findings show that science teachers in Perak face moderately high challenges in using digital technology due to factors like limited infrastructure, time constraints, and inadequate technical support. Digital technology can foster two-way communication in the classroom [7], yet teachers often cannot maximize its benefits because of insufficient support and the lengthy preparation time required. Similarly, [15] argue that teachers use digital technology less when they lack adequate resources and assistance.

Other significant obstacles include a shortage of necessary devices (e.g., tablets, interactive whiteboards), as noted by [16], and low digital literacy among teachers, as reported by [17]. Many teachers also lack comprehensive digital content in the national language, which hinders their ability to help students grasp complex scientific concepts. Additionally, limited training leads to difficulties in using various digital tools, further emphasizing the need for ongoing professional development [18].

Finally, managing space and time at school poses further constraints, as teachers juggle non-teaching responsibilities that reduce the time available for preparing digital materials [4]. Despite these hurdles, digital technology remains crucial in enhancing science education by creating engaging learning experiences. Therefore, addressing the shortages of resources, increasing training opportunities, and

improving technical and administrative support are essential steps in enabling science teachers to fully integrate digital tools into the teaching and learning process.

Table 3: Mean score and standard deviations of challenges experienced by the science teachers in using digital technology

Item	Mean score	Standard deviation
Lack of computers	2.55	1.114
Lack of computers with internet access	2.50	1.082
Slow internet	2.76	1.031
Lack of interactive whiteboards	3.26	1.064
Lack of tablets	3.32	1.031
Limited storage capacity and/or devices in need of repair	2.30	1.010
Insufficient skills among teachers	2.42	1.017
Inadequate technical support for teachers	2.74	1.098
Inadequate digital pedagogy support for teachers	2.79	1.084
Lack of sufficient digital content	3.01	1.000
Lack of digital content in the national language	3.49	0.751
Difficulty integrating the use of digital technology into the curriculum	2.78	1.026
Lack of pedagogical models for using digital technology in learning	3.03	0.953
Constraints in school time management (e.g., fixed teaching and learning schedules)	2.98	0.995
Constraints in school space management (e.g., classroom size, furniture, etc.)	3.04	1.188
Pressure to prepare students for exams and tests	2.62	0.967
Most parents do not support the use of digital technology in schools	2.06	0.998
Teachers lack interest in using digital technology	2.47	1.139
No clear advantages of using digital technology in learning	1.55	0.786
Using digital technology in teaching and learning is not a school goal	2.23	1.064
	2.69	**0.577**

Table 4 shows the correlation between teachers' years of teaching experience and the challenges faced in using digital technology among science teachers in Perak. Based on the findings, there was a weak but significantly positive correlation between the two variables, r (110) = 0.282, p = 0.003. This indicates that as teachers' years of teaching experience increase, the challenges they face in using digital technology is also increase.

Table 4: The Pearson correlation coefficient between teachers' years of teaching experience and the challenges in using digital technology

		Challenges	Teaching experience
Challenges	Pearson Correlation	1	0.282**
	Sig. (2-tailed)		0.003

	N	110	110
Teaching experience	Pearson Correlation	0.282**	1
	Sig. (2-tailed)	0.003	
	N	110	110

**Correlation is significant at the 0.01 level (2-tailed)

Teachers are aware that science is a challenging topic that significantly benefits from the pictures, sound, and hands-on experiences that digital technology can offer. However, those with extensive teaching experience face moderately high challenges using digital tools. One reason is that, in the past, such technology was not widely developed or accessible, limiting their early exposure and training. As a result, seasoned teachers are less confident and often feel pressured to use digital resources without sufficient support.

Furthermore, teachers who have served for more than 20 years typically juggle more responsibilities, such as meetings and administrative tasks, leaving them limited time to prepare tech-based teaching materials (BBM). Their lack of early digital training also means they need more help to integrate these tools into the TnL process confidently.

Conclusion

This study highlights the moderately high challenges faced by science teachers in Perak when integrating digital technology into their teaching, with resource constraints, limited training, and inadequate support being the primary barriers. The results reveal a weak but significantly positive correlation between teaching experience and these challenges, indicating that more experienced teachers tend to face greater difficulties. These findings underscore the need for targeted training programs, improved infrastructure, and ongoing technical and pedagogical support. Addressing these issues will enable teachers—new and seasoned alike—to leverage digital tools more effectively, thereby enhancing the overall quality of Science education.

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