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TECHNOLOGY INTEGRATION IN TEACHER EDUCATION: UNPACKING TRAINEE TEACHERS' PERCEPTIONS, BENEFITS, AND BARRIERS

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Abstract:

This study examines trainee teachers' perceptions of technology integration in classroom instruction, focusing on its perceived benefits and challenges. Using a mixed-methods approach, data were collected from 100 trainee teachers at Universiti Selangor through questionnaires and open-ended responses. The findings reveal that most respondents view educational technology positively, recognising its role in enhancing student engagement, supporting differentiated instruction, and streamlining classroom management. Frequently used platforms include Google Classroom, Kahoot, and Canva. However, despite their enthusiasm, many respondents identified significant barriers to effective implementation. These include insufficient training, limited access to digital infrastructure, and a lack of consistent institutional support, particularly during practicum placements. While many trainees expressed confidence in using technology, gaps in hands-on training and institutional backing remain pressing concerns. The study concludes that for successful technology integration, teacher education programmes must provide structured, experiential digital training and address infrastructural limitations. These efforts are essential to preparing future educators for the demands of digitally enriched learning environments.

Keywords:

Technology Integration, Trainee Teachers, Educational Technology, Teacher Education, ICT in Education, Teaching Challenges, Digital Competencies.

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Introduction

The integration of technology into classroom instruction has significantly transformed teaching practices, offering innovative approaches to long-standing pedagogical issues. For trainee teachers, this transformation brings both promising opportunities and notable challenges. Contemporary teacher education programmes increasingly focus on developing the technological competencies of future educators, equipping them with both the theoretical foundation and practical skills necessary to navigate the complexities of 21st-century learning environments (Papadakis et al., 2025).

Digital tools such as computers, tablets, learning management systems, and interactive platforms like Canva, Quizizz, and Kahoot have become essential in fostering personalised and interactive learning experiences. As noted by James, Oates, and Schonfeldt (2024), such tools enhance student engagement and contribute positively to academic performance. Nevertheless, the adoption of these tools among trainee teachers remains inconsistent. While many are enthusiastic about the possibilities offered by educational technology, their practical usage is often limited due to a reliance on conventional teaching methods and a lack of familiarity with emerging digital tools (Abel et al., 2022).

Despite the clear advantages, such as heightened student participation, differentiated instruction, and creative delivery methods, technology integration still faces several barriers. Key challenges include insufficient training, limited technological resources, budget constraints, and resistance to adopting new pedagogical approaches. As education systems continue to transition towards digital teaching models, trainee teachers, particularly those placed in underfunded schools, encounter structural obstacles that hinder successful implementation (Akram et al., 2022). Issues like poor infrastructure, lack of training opportunities, and inadequate funding not only restrict technology use but also widen educational disparities. In fact, institutional culture and systemic readiness play a decisive role in supporting (or obstructing) integration, with digital transformation requiring coordinated leadership, policy frameworks, and school-level motivation (Timotheou et al., 2023; Stumbrienė et al., 2024).

This study is grounded in the recognition that technology plays a central role in shaping contemporary education. With digital literacy now a critical skill across academic contexts, trainee teachers must be well-prepared to integrate technology effectively into their classroom practices. Understanding their perceptions, exploring the benefits, and identifying the obstacles they encounter are essential to evaluating the quality of existing teacher education programmes. According to Basilotta-Gómez-Pablos et al. (2022), teachers with positive attitudes towards technology tend to adopt more engaging and innovative teaching methods. However, these benefits can be undermined when educators lack sufficient training or digital proficiency. As noted by Papadakis et al. (2025), hands-on digital training embedded within pre-service programmes is essential for long-term integration success.

Therefore, strengthening teacher education programmes is vital, particularly when trainee teachers acknowledge the value of technology but lack the necessary skills for effective implementation.

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Research Objectives:

1. To investigate trainee teachers' perceptions of technology use in the classroom.
2. To identify the benefits of using technology in teaching and learning.
3. To examine the challenges trainee teachers encounter when incorporating technology.

Research Questions:

1. What are trainee teachers' perceptions towards using technology in the classroom?
2. What are the benefits of technology integration in the classroom?
3. What are the challenges trainee teachers face when using technology?

Literature Review

The integration of digital technology has become a fundamental component of modern education. Trainee teachers are now expected to acquire digital competencies that support the effective application of educational technology to enhance teaching and enrich the learning experience. Although the benefits of using technology in the classroom are widely acknowledged, its meaningful integration remains a challenge, particularly for pre-service teachers who lack hands-on experience. A growing body of literature has examined the advantages, challenges, and perceptions surrounding the use of technology in education. This section reviews key findings related to these three aspects.

Benefits of Technology Integration in the Classroom

A considerable number of studies support the integration of technology as a means to boost student motivation and active participation. Zaphiris and Kosmas (2023) argue that technology-enhanced classrooms foster increased student interest, collaboration, and engagement, which positively influence learning outcomes.

In addition, technology supports differentiated instruction tailored to various learning preferences. As Shepherd (2020) notes, digital tools such as multimedia content, interactive activities, and simulations can effectively support auditory, visual, and kinaesthetic learners. This flexibility enables students to interact with learning materials in a way that suits their individual styles, thereby promoting better understanding and retention.

Collaborative learning is also strengthened through the use of technology. Online platforms facilitate teamwork, communication, and peer feedback, contributing to the development of essential interpersonal skills (Oskarita & Arasy, 2024).

Another key benefit lies in the provision of real-time feedback. According to Abboud and Rogalski (2021), digital tools allow for immediate assessment of student performance, helping educators identify gaps and adjust instruction accordingly. This promotes reflective learning and supports ongoing academic progress.

Moreover, technology enhances students' digital literacy—an essential competency in today's workforce. Kalyani (2024) highlights that exposure to digital tools in educational settings prepares learners for technology-driven professional environments.

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Despite these advantages, researchers such as Efremova (2023) caution that issues like distraction, technical glitches, and unfamiliarity with digital platforms can hinder effectiveness. Nonetheless, these concerns can be mitigated with appropriate training and supportive infrastructure.

In summary, the benefits of technology in the classroom including improved engagement, diverse instructional strategies, collaborative learning opportunities, timely assessment, and digital readiness, demonstrate its value in contemporary education.

Challenges Faced by Trainee Teachers in Integrating Technology

While technology brings many advantages, pre-service teachers continue to face numerous challenges in integrating it effectively. One of the most common issues is the lack of practical exposure. Basilotta-Gómez-Pablos et al. (2022) assert that although many teacher training programmes include ICT-related content, they often fail to provide meaningful, hands-on experiences. This gap leaves trainee teachers unsure of how to apply digital tools in real-world classrooms.

Papadakis et al. (2025) support this observation, arguing that digital competence should be developed through sustained, context-based practice during school placements. Without practical engagement, theoretical knowledge about technology remains disconnected from its classroom application.

Attitudinal barriers, often referred to as second-order barriers, also affect technology adoption. Joseph and Thomas (2022) explain that even when access to digital tools is available, some teachers remain hesitant due to lack of confidence, fear of failure, or uncertainty about its instructional value. Targeted professional development is needed to address both technical skills and mindset.

Another common limitation is the inconsistency of training. Joya, Merchán, and Barrera (2025) observe that many institutions provide unstructured or fragmented digital training, leading to a surface-level understanding among pre-service teachers. As a result, they may struggle to apply technology strategically.

The COVID-19 pandemic further revealed these deficiencies. According to Janssen (2020), the rapid transition to remote learning during the pandemic highlighted the lack of readiness among many trainee teachers and exposed significant gaps in infrastructure and training.

Importantly, the school context also plays a role. Hébert, Jenson, and Terzopoulos (2021) emphasise the importance of a collaborative school culture. Peer support, mentoring, and shared platforms help build confidence and competence in technology use. Papadakis et al. (2025) also argue that trainee teachers are more likely to embrace digital tools when they work in schools that encourage experimentation and provide access to adequate infrastructure.

In conclusion, the barriers trainee teachers face go beyond hardware limitations. They include gaps in professional development, psychological readiness, and the quality of support systems. Overcoming these requires well-structured, experiential training that aligns closely with classroom realities.

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Perceptions and Attitudes of Trainee Teachers Towards Technology Integration

Trainee teachers' perceptions and beliefs play a crucial role in how they approach technology use in education. Digital confidence is often a strong predictor of successful integration. Fernández-Batanero et al. (2022) found that those who feel confident using digital tools are more likely to adopt and experiment with them in teaching.

Positive attitudes toward technology also influence willingness to innovate. Mohebi and Meda (2021) report that many trainee teachers believe technology increases student engagement and teaching effectiveness. This perception tends to enhance their motivation to use such tools (Minh, 2024).

However, not all perceptions are positive. Hsieh et al. (2022) found that some pre-service teachers worry that digital tools may distract students or oversimplify content. These concerns highlight the need for training that addresses responsible and pedagogically sound technology use.

Institutional factors, such as school policy and administrative support, significantly shape perceptions. Yavich and Davidovitch (2024) assert that well-defined technology policies and supportive leadership can positively influence teachers' readiness to integrate technology. In contrast, a lack of clear guidelines or encouragement can lead to underuse of technology in classroom (Timotheou et al., 2023).

Leadership also plays a pivotal role. Stumbrienė, Jevsikova, and Kontvainė (2024) note that institutions that prioritise digital literacy and invest in ongoing professional development foster a more positive culture of technology integration. Papadakis et al. (2025) reinforce this by stating that trainee teachers thrive in environments that provide consistent opportunities for practice and mentorship.

In essence, trainee teachers' attitudes, confidence levels, and institutional environments are closely intertwined. A comprehensive approach that includes technical training, peer support, and strong leadership is essential to foster positive perceptions and successful integration.

Methodology

Research Design

This study employed a mixed-methods research design to comprehensively explore trainee teachers' perceptions, benefits, and challenges related to the integration of educational technology. The combination of quantitative and qualitative methods allowed for a broader and deeper understanding of the issue. Quantitative data helped capture general trends and frequencies, while qualitative responses provided rich, contextualised insights into the trainee teachers' lived experiences with technology in their teaching practicum. This methodological triangulation strengthens the reliability and credibility of the findings, as suggested by Creswell (2020).

Population and Sampling

The target population comprised trainee teachers from the Bachelor of Education (TESL) programme at Universiti Selangor. A total of 100 respondents participated in the study. Stratified random sampling was used to ensure diversity in terms of age, gender, teaching level

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(primary, lower secondary, and upper secondary), and geographical placement within Selangor. This sampling technique enhanced the representation of various demographic groups. However, it is important to acknowledge that the sampling was institution-specific, and the findings may not be fully generalisable to trainee teachers in other teacher education institutions across Malaysia.

Instrument Development and Validation

The research instrument was a self-administered questionnaire comprising two sections. Section A gathered demographic information from the respondents, including their age, the district of their teaching placement, and the type of school (primary or secondary). Section B featured 20 closed-ended items using a 5-point Likert scale, ranging from "Strongly Disagree" to "Strongly Agree." These items explored areas such as digital confidence, perceived impact on student engagement, classroom management, and the adequacy of teacher training programmes. Section C contained three open-ended questions designed to capture respondents' personal views on the benefits and challenges of technology integration and their suggestions for improvement.

To establish instrument validity, the draft questionnaire was reviewed by two content experts in educational technology. They assessed the instrument for clarity, relevance, and alignment with the study's research objectives. Following expert feedback, a pilot test was conducted with 15 trainee teachers who were not part of the final sample. Their responses and feedback led to minor revisions in wording and sequencing. The reliability of the questionnaire was confirmed with a Cronbach's alpha coefficient of 0.87, indicating high internal consistency.

Data Collection Procedure

Data were collected online using Google Forms over a period of two weeks. Participants were briefed about the purpose of the study and assured of anonymity and confidentiality. Informed consent was obtained digitally before completing the questionnaire.

Data Analysis and Triangulation

Quantitative data were analysed using SPSS (Statistical Package for the Social Sciences) to generate descriptive statistics such as frequencies and percentages. For qualitative data, thematic analysis was conducted based on Braun and Clarke's (2021) method of coding, categorising, and interpreting patterns. To ensure data triangulation, the qualitative findings were systematically compared with the quantitative results to identify consistencies and divergences. This allowed for a more robust interpretation of the research questions and increased the study's overall trustworthiness.

Findings

Demographic Profile of Respondents

A total of 100 trainee teachers from Universiti Selangor responded in the study. The majority were aged between 23 and 24 (44%), followed by 28% aged 21–22, 24% aged 25–26, and 4% aged 19–20. Female respondents accounted for 61% of the sample, while 39% were male. The respondents were placed in various districts during their practicum, including Kuala Selangor (27%), Gombak (25%), Klang and Petaling (each 14%), Hulu Langat (9%), Hulu Selangor (7%), Sepang (5%), Kuala Langat (3%), and Sabak Bernam (2%). Most were assigned to

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secondary schools, with 51% teaching lower secondary and 47% upper secondary. Only 2% were posted to primary schools.

Perceptions Towards Technology Integration

In relation to the first research objective, the data indicated generally positive perceptions among trainee teachers regarding the use of technology in classrooms. A large proportion (81%) expressed confidence in using digital tools effectively, with platforms such as Google Classroom, Quizizz, Kahoot, Canva, Padlet, and YouTube frequently mentioned. Many respondents appreciated how these tools complemented traditional teaching and supported lesson interactivity. Additionally, 78% believed that technology increased student engagement, while only a small minority expressed disagreement. Notably, 79% reported a favourable overall view of educational technology, suggesting a readiness to adopt tech-based practices.

Qualitative responses reinforced these findings. Several trainee teachers shared that digital platforms allowed them to experiment with interactive content, facilitate real-time responses, and maintain better classroom discipline. Some also reported that their confidence grew as they received positive feedback from students when using visual and game-based content.

Benefits of Technology in Teaching and Learning

Trainee teachers consistently reported that digital tools enhanced their teaching effectiveness and students' learning experiences. In response to the second research objective, 81% stated that technology improved instructional quality, and 80% favoured its use in English language teaching, particularly for its flexibility and ability to personalise learning. Tools like Google Classroom and Duolingo were highlighted as especially effective in managing tasks and tracking student progress.

A significant proportion (82%) agreed that technology facilitated differentiated instruction by supporting diverse learning styles. Moreover, 74% believed it promoted the development of 21st-century skills such as collaboration, creativity, and critical thinking. Qualitative data further illustrated how technology enabled active learning, particularly through video content, group tasks, and student-led projects. Many respondents recounted positive experiences using online platforms to deliver more dynamic, student-centred lessons.

Challenges in Technology Integration

Despite the positive attitudes, the third research objective revealed that trainee teachers faced notable challenges when incorporating technology into their teaching. 75% of respondents reported encountering difficulties. The most common issues were technical in nature: 65% cited unstable internet connections, malfunctioning equipment, and inconsistent access to school-provided devices. Although 74% were satisfied with the training they had received, several noted that it lacked sufficient practical exposure.

Resource limitations were also highlighted, with 71% of participants reporting that their schools lacked adequate infrastructure to support effective technology use. Although some classrooms were equipped with basic facilities, shared access and outdated devices often hampered lesson delivery. A further 75% noted that students' limited access to personal digital devices restricted the implementation of planned digital activities.

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From the qualitative responses, trainee teachers described instances where their lessons were disrupted due to inconsistent internet connectivity, non-functional projectors, or insufficient computer lab time. Others noted that their attempts to use technology were sometimes discouraged by senior teachers or not prioritised by school administrators.

Additionally, 71% reported issues with student misuse of devices, such as browsing unrelated websites or engaging in non-educational activities during class. These concerns reflect the need for stronger digital citizenship education and classroom management strategies tailored to tech-based instruction.

Summary of Findings

Overall, the findings indicate that while trainee teachers hold positive perceptions of educational technology and recognise its benefits, their capacity to implement it effectively is constrained by infrastructural, institutional, and practical limitations. The integration of quantitative and qualitative data underscores the importance of improving training programmes, ensuring equitable access to digital tools, and fostering a supportive culture for technology adoption in schools.

Discussion

This study investigated trainee teachers' perceptions, perceived benefits, and challenges associated with technology integration in the classroom. The findings revealed a generally positive outlook among trainee teachers, with high levels of confidence in using digital tools. However, this optimism was affected by concerns regarding infrastructure limitations, insufficient training, and uneven access to digital resources. These themes are consistent with all three research objectives and are discussed in relation to both the quantitative and qualitative results.

In relation to the first objective, the findings showed that 81% of trainee teachers reported feeling confident in using digital tools, and 79% had a favourable overall perception of educational technology. This aligns with Fernández-Batanero et al. (2022), who highlighted that digital confidence is a strong predictor of successful technology integration. Qualitative responses further revealed that trainee teachers felt digital platforms such as Google Classroom, Canva, and Kahoot made lessons more interactive and improved student participation. These sentiments reinforce the notion that personal experience with digital tools during teacher training enhances willingness and readiness to adopt such tools in actual practice (Záhorec et al., 2025).

In support of the second objective, which aimed to examine the benefits of using technology, 86% of respondents indicated that digital tools increased student motivation, while 82% believed these tools supported differentiated learning. Respondents highlighted that educational technology enabled them to address varied learning styles and deliver content more creatively. This corresponds with findings by Oskarita and Arasy (2024), who emphasised the value of technology in promoting collaborative learning and inclusivity. Additionally, the qualitative data revealed that tools like Quizizz and YouTube helped make abstract concepts more accessible, reinforcing Kohnke et al.'s (2023) argument on the role of technology in enhancing instructional quality.

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The third research objective focused on identifying challenges, which were evident in both sets of data. While 74% of participants were satisfied with their training, many noted its lack of practical exposure. This mirrors findings by Kasneci et al. (2023), who found that theoretical instruction alone does not equip teachers for the complexities of digital classroom environments. Furthermore, 75% of trainee teachers reported facing difficulties in implementing technology due to factors such as poor internet connectivity, limited access to devices, and lack of technical support—echoing concerns raised by Akram et al. (2022) and Efremova (2023). Notably, qualitative feedback stressed the need for stronger institutional backing and mentoring, suggesting that peer collaboration and administrative support are key to overcoming integration barriers.

An emerging concern raised in the open-ended responses involved overreliance on digital tools or AI-based resources, which some respondents felt could potentially compromise pedagogical integrity if not carefully managed. This underscores the importance of embedding critical digital literacy into teacher education curricula, as highlighted by Papadakis et al. (2025), who advocate for balanced approaches that integrate technology without undermining traditional instructional goals.

In conclusion, this study affirms that while trainee teachers recognise the value of educational technology, they also face multifaceted challenges that hinder effective integration. To address this gap, teacher education programmes must offer sustained, hands-on training, enhance digital infrastructure, and promote a culture of collaborative support. These measures are crucial in equipping future educators to navigate digital teaching environments confidently and responsibly.

Conclusion

This study provided valuable insights into trainee teachers' perceptions of technology integration in classroom instruction. The findings indicate that most participants hold favourable attitudes towards digital tools and report confidence in using them for teaching and learning. This positive disposition aligns with growing trends in teacher education that prioritise digital competence. However, practical challenges such as limited infrastructure, inconsistent institutional support, and insufficient professional development temper this optimism, continuing to hinder meaningful technology integration in many educational settings.

The research objectives which were to investigate perceptions, identify benefits, and examine challenge, were met through both quantitative and qualitative data. The widespread use and endorsement of platforms such as Google Classroom, Canva, and Kahoot highlight trainee teachers' increasing familiarity with interactive digital tools. Many respondents recognised the value of these tools in improving student engagement, streamlining lesson delivery, and supporting differentiated instruction. Nevertheless, the study confirms that access alone does not ensure effective implementation. Practical, hands-on training and a school culture that promotes digital literacy are necessary to maximise the pedagogical impact of educational technology.

The findings underscore several implications for teacher education programmes and policymaking. First, curriculum designers must embed structured digital training within teacher preparation frameworks, ensuring that future educators can apply these tools confidently and

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appropriately. Second, policymakers and institutional leaders must prioritise investments in ICT infrastructure, especially in underfunded schools, to reduce inequities in access. Third, educators should be encouraged to adopt blended pedagogical approaches that integrate digital innovation while upholding critical thinking, creativity, and instructional integrity.

Despite its contributions, the study has certain limitations. The sample was restricted to trainee teachers from Universiti Selangor, which may limit generalisability. The reliance on self-reported data may also introduce response bias. Additionally, the study did not explore the long-term impact of technology use on teaching quality or student achievement. Future research should consider longitudinal approaches, include diverse institutional contexts, and examine the ethical, relational, and pedagogical implications of digital tool use, especially in the context of AI-driven education.

In conclusion, this research adds to the growing body of literature on technology in teacher education. By recognising trainee teachers' willingness to adopt digital tools and by addressing systemic barriers, stakeholders can advance towards more inclusive, innovative, and effective classroom environments. Well-supported and digitally literate teachers are central to realising the full potential of educational technology in shaping future-ready learners

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