

Lecturers' Perceptions of Classroom Technology Integration in Kolej PERMATA@Pintar Program, Universiti Kebangsaan Malaysia

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Abstract: *Generation Z's learning experience has changed significantly due to advances in technology and digital education. This generation has grown up with technology at their fingertips and naturally embraces its use in daily life. Over the past few decades, there have been numerous shifts in teaching practices involving educators in both secondary and primary schools. One of the most innovative changes introduced is the integration of technology, where teachers are encouraged to incorporate digital tools in the teaching and learning process (T&L). Through in-depth interviews with three experienced teachers, it was found that they use technology such as online resources, digital learning platforms, and collaborative tools. The integration of technology in T&L has become increasingly crucial, especially in realizing 21st Century Learning (PAK21). However, these teachers face challenges such as a lack of training, time constraints, and skepticism toward technology. This study highlights the need for ongoing support from school administrations and the provision of training to enhance the use of technology in schools. It also aims to assist policymakers and school leaders in developing more effective strategies. Addressing these challenges is essential to ensure that experienced educators can effectively utilize technology in their teaching. This study explores the strategies and challenges experienced teachers face in integrating technology in the classroom.*

Keywords: Technological Advancement; Digital Education; Technology Use; Teaching and Learning Process (T&L); 21st Century Learning (PAK21)

1. Introduction

Innovation in teaching has become a defining feature of contemporary education systems, where technology plays a crucial role in reshaping pedagogical practices and learning environments. Around the world, governments and educational institutions are increasingly emphasizing digital transformation as part of their national education agendas. The Malaysian Education Blueprint (2013–2025), for instance, highlights the importance of integrating information and communication technology (ICT) to enhance teaching and learning outcomes. Similarly, the Malaysian Digital Education Policy (2021–2030) reinforces the vision of producing digitally competent educators who can leverage emerging technologies to support student-centered learning. Within this context, the integration of technology into classroom practices is no longer optional it has become a core component of educational excellence.

As Syed Ismail and Ahmad Subkhi (2019) note, the use of electronic media and digital tools enables schools to become more progressive and future-oriented, aligning with the global shift toward digital literacy and 21st-century competencies. Kamus Dewan (2010) defines technology as the application of scientific knowledge to solve human problems, while Rowntree (1974) describes educational technology as a systematic approach to addressing teaching and learning challenges. These definitions emphasize that technology is not merely about tools, but about using innovation strategically to improve the quality and accessibility of education.

The growing body of research on educational technology highlights the central role of teachers in ensuring successful integration. The Technological Pedagogical Content Knowledge (TPACK) framework by Mishra and Koehler (2006) underlines that effective technology use depends on a teacher's ability to combine content expertise, pedagogical understanding, and technological knowledge. However, technology adoption in the classroom varies widely depending on teacher readiness, confidence, and institutional support. For experienced educators, particularly those trained before the widespread digital revolution the transition from traditional, teacher-centered methods to interactive, technology-enhanced learning can be complex. Bhatti et al. (2019) argue that such pedagogical shifts are essential to enhance engagement and motivation among students, while Law and Zamri (2021) note that these approaches are particularly relevant under the evolving national curriculum such as the Kurikulum Standard Sekolah Menengah (KSSM), which promotes inquiry-based and experiential learning.

The current generation of learners, often referred to as Generation Z, are digital natives who have grown up surrounded by smartphones, apps, and online information. Their learning preferences differ significantly from those of previous generations, demanding active, visual, and technology-supported experiences. In response, the 21st Century Learning (PAK21) framework emphasizes collaboration, creativity, critical thinking, and communication skills that are best developed through meaningful integration of digital tools in education. Teachers are therefore expected to adopt innovative pedagogies that combine traditional wisdom with digital fluency.

Despite these advancements, studies reveal persistent barriers that hinder effective technology integration. Among them are limited access to infrastructure, insufficient professional training, time constraints, and varying attitudes toward technology (Ertmer, 2005; Hew & Brush, 2007). For senior or pre-retirement educators, these challenges can be magnified by generational gaps in digital familiarity and institutional expectations for innovation. Nevertheless, their long-standing experience offers unique insights into pedagogical adaptation, mentoring younger colleagues, and balancing innovation with foundational teaching values.

Given this background, the present study focuses on lecturers in the Kolej PERMATA@Pintar Program, an elite educational initiative under Universiti Kebangsaan Malaysia. This program caters to gifted and talented students, where technology plays a vital role in supporting advanced, inquiry-driven, and collaborative learning. By examining the perceptions, strategies, and challenges of experienced lecturers in integrating technology, this research aims to contribute to a deeper understanding of how veteran educators adapt to the digital transition. It also provides valuable implications for future training programs, institutional planning, and policy formulation aimed at empowering teachers to thrive in an increasingly digital learning environment.

2. Background

The integration of technology in education has become a major focus of educational reform globally. Over the last two decades, technological advancement has reshaped how teachers teach and how students learn, transforming the classroom into a dynamic, interactive, and student-centered environment. Digital tools such as laptops, tablets, learning management systems (LMS), and artificial intelligence (AI)-based applications are now essential components of the teaching and learning ecosystem. The shift from traditional to technology-driven education marks a paradigm change in pedagogical approaches—one that emphasizes collaboration, inquiry, and digital fluency over rote learning and memorization.

Globally, initiatives such as UNESCO's ICT Competency Framework for Teachers (ICT-CFT) and the OECD's Education 2030 project advocate the integration of digital literacy as a core educational goal. These frameworks stress that teachers must not only understand how to use technology but also how to integrate it meaningfully into pedagogy and curriculum. In Malaysia, the same commitment is reflected through the Malaysia Education Blueprint 2013–2025, which identifies ICT as one of the key levers for transforming education. The blueprint emphasizes enhancing access to quality education through digital learning, improving teachers' ICT competency, and promoting innovative pedagogical approaches aligned with 21st Century Learning (PAK21). Furthermore, the Digital Education Policy 2021–2030 reinforces this direction by outlining strategies to develop digitally empowered educators and learners.

However, despite these initiatives, the implementation of educational technology is not without challenges. Many teachers, especially those with long teaching experience, often face barriers such as inadequate infrastructure, limited access to digital resources, and insufficient professional development opportunities. As noted by Ambigapathy Pandian (2003), veteran educators may lack the necessary exposure and confidence to use information technology effectively in the classroom. This digital competency gap often stems from generational differences in training and professional preparation. Without continuous training and support, these teachers may struggle to keep pace with the rapid evolution of digital tools and platforms. The issue becomes more pressing in specialized programs such as Kolej PERMATA@Pintar, where technology plays a vital role in nurturing gifted and talented students. This institution emphasizes advanced learning strategies that rely heavily on inquiry-based, research-driven, and collaborative learning approaches. In such environments, lecturers are expected to employ digital technologies to support differentiated instruction, real-time assessment, and creative problem-solving. However, for many experienced lecturers nearing retirement, adapting to these expectations can be challenging. Their long teaching history often centers around traditional pedagogies that value structured delivery and teacher authority, which may contrast with the participatory and technology-rich learning culture of modern classrooms.

Previous research by Jaafar and Mohd Nor (2016) showed that experienced history teachers in Malaysia still rely heavily on conventional methods, citing a lack of training and technological exposure. Similarly, studies by Ertmer (2005) and Inan & Lowther (2010) found that teachers' attitudes and self-efficacy significantly influence their willingness to integrate technology. Those with low confidence or negative perceptions toward ICT tend to avoid using digital tools even when resources are available. Therefore, understanding teachers' perceptions—particularly those of senior educators—is crucial in identifying both the enablers and barriers to effective technology integration.

The PERMATA@Pintar context is particularly significant because it represents an intersection of traditional academic rigor and innovation-driven pedagogy. Lecturers here are not only responsible for delivering content but also for fostering creativity and critical thinking among high-performing students. Integrating technology effectively can enhance the teaching process through interactive simulations, online research tools, and digital collaboration platforms. Yet, this requires educators to possess a blend of technological, pedagogical, and content knowledge—commonly conceptualized as the TPACK model (Mishra & Koehler, 2006). For lecturers who began their careers before the digital era, developing this integrated competency may require targeted training, mentorship, and administrative support.

In addition, the COVID-19 pandemic has accelerated the digital transformation of education, forcing even the most experienced educators to adapt rapidly to online and hybrid teaching models. This sudden transition exposed both the strengths and weaknesses of current ICT integration efforts. While many teachers demonstrated resilience and adaptability, others struggled with digital fatigue, inadequate infrastructure, and insufficient institutional support. These experiences underscore the need for ongoing capacity building and policy intervention to sustain effective technology use beyond emergency contexts.

Hence, this study builds upon the understanding that successful educational technology integration depends not merely on availability of tools, but on teachers' readiness, attitudes, and institutional culture. By exploring the perceptions of experienced lecturers in Kolej PERMATA@Pintar, this research seeks to uncover how veteran educators navigate the intersection of experience and innovation, tradition and transformation. The insights derived will contribute to improving professional development strategies, guiding policy implementation, and enhancing the sustainability of digital learning practices in Malaysia's educational system.

3. Problem Statement

In today's rapidly evolving digital era, integrating technology into teaching and learning has become increasingly vital to ensure the effectiveness of modern education. While technology presents numerous opportunities to enhance instructional quality, several issues must be addressed to ensure successful and beneficial integration. One of the key challenges is

teachers' attitudes toward the use of technology in the classroom. Studies have shown that teacher attitudes play a crucial role in determining the effectiveness of technology use (Ertmer, 2005). Teachers who have a positive attitude toward technology are more likely to use it frequently and effectively in their teaching. However, many teachers remain skeptical or lack confidence in their ability to integrate technology successfully (Inan & Lowther, 2010).

Second, issues related to teacher readiness and training are also significant. Teachers often report that they do not receive sufficient training to use technology effectively in the classroom (Hew & Brush, 2007). Inadequate training can leave teachers feeling unprepared and less confident in implementing technology in their lessons. In addition, school technology infrastructure remains a critical concern. Although technological innovations are widespread, not all schools have access to adequate technological equipment or stable internet connections (Bebell & O'Dwyer, 2010). These limitations can hinder teachers from effectively utilizing technology in their instruction.

Lastly, there are challenges concerning students' acceptance of technology. While Generation Z tends to be more tech-savvy, some students may still struggle to adapt to technology-enhanced learning environments (Prensky, 2010). Differences in students' digital literacy levels can impact the overall effectiveness of technology integration in the classroom. Therefore, this study aims to assess teachers' knowledge and capabilities, examine the strategies and approaches used, and analyze the challenges faced by teachers in integrating technology into the learning process. By understanding these issues, this research seeks to provide clearer guidance on how technology can be effectively integrated into the classroom to improve educational quality.

4. Research Purpose

The purpose of this study is to evaluate the level of knowledge and competency of experienced teachers in integrating technology into their teaching practices, to identify the strategies and approaches they employ, and to analyze the challenges encountered in the process. This study also aims to provide guidance and recommendations for schools, administrators, and policymakers on more effective ways to support and enhance the use of technology in teaching—particularly in terms of providing the necessary training and ongoing support (Ertmer, 2005; Inan & Lowther, 2010; Hew & Brush, 2007). By understanding these challenges, the study hopes to offer clearer insights into how technology can be effectively integrated into the classroom to improve the quality of education.

5. Research Objective

- i. To examine the development of technology use by experienced teachers in the classroom.
- ii. To explore the strategies and approaches employed by teachers in integrating technology into their teaching.
- iii. To analyze the challenges faced by teachers in adopting technology in education.

6. Methodology

6.1 Research Design

This study employed a qualitative research design to explore the strategies and challenges experienced by veteran educators in integrating technology into classroom instruction, specifically within the context of the PERMATA@Pintar Program. The qualitative design was chosen to allow for an in-depth exploration of participants' experiences, perceptions, and interpretations. This approach is especially relevant when investigating complex educational phenomena that require rich, descriptive data to understand how and why certain practices are adopted. It enables the researcher to gather nuanced insights into how experienced lecturers perceive and implement technology in their teaching.

6.2 Research Approve

A case study approach was adopted to examine in detail the strategies and challenges associated with technology integration among experienced educators. This method is particularly appropriate for the PERMATA@Pintar Program, where teaching practices are highly contextualized and influenced by institutional goals, student needs, and curriculum demands. By focusing on a specific group of lecturers within this elite educational initiative, the study gains a deeper understanding of how technological tools are used, adapted, or resisted in real-life teaching contexts. The case study design supports a comprehensive analysis of real-world

experiences and allows the researcher to investigate practical applications and reflective practices in depth.

6.3 Population and Sampling Method

The participants in this study consisted of three experienced lecturers involved in the PERMATA@Pintar Program, all of whom had integrated technology into their instructional practices. A purposive sampling method was used to ensure that participants had substantial teaching experience and direct involvement with technology in the classroom. The selection criteria specified lecturers who were nearing retirement (within three years), as they offered valuable perspectives on the evolution of technology use over time. This targeted sampling ensured the inclusion of rich, experience-based insights that aligned with the study's objectives. Although the sample size was small, it is suitable for qualitative research, which prioritizes depth over breadth.

6.4 Data Collection

Data were collected through semi-structured interviews, which allowed the researcher to probe into participants' individual experiences while maintaining the flexibility to explore emerging topics during the conversations. Each of the three participants was interviewed in sessions lasting approximately 15 minutes. Depending on participant availability, interviews were conducted either in person or online. Efforts were made to ensure a comfortable and private environment to encourage openness and honest reflection. The interview guide focused on participants' strategies for using technology, their personal challenges, perceptions of institutional support, and the impact of technology on student engagement and learning outcomes. Semi-structured interviews provided both consistency and adaptability in the data collection process.

6.5 Data Analysis

The data gathered from interviews were analyzed using thematic analysis, supported by NVivo qualitative data analysis software. Thematic analysis enabled the researcher to systematically identify, interpret, and report recurring themes across the data set. The process began with familiarization, where interview transcripts were read multiple times to gain an intimate understanding of the content. Initial codes were then generated by highlighting key phrases, responses, or concepts that reflected important aspects of the participants' experiences.

Using NVivo, these codes were organized into potential themes that captured the essence of lecturers' approaches to technology integration, as well as the barriers they encountered. The software facilitated efficient data management and visualization, helping to uncover relationships among themes. Themes were continuously reviewed, refined, and validated to ensure they accurately represented the data and were aligned with the study's research questions. Each theme was clearly defined and supported by direct quotations from participants, adding credibility and richness to the findings.

This rigorous analytical process provided a comprehensive understanding of how experienced lecturers in the PERMATA@Pintar Program navigate the challenges and opportunities of technology integration. The insights derived from this study can inform future teacher training, institutional planning, and educational policy aimed at enhancing digital learning in elite academic programs.

7. Findings

The study on the strategies and challenges faced by experienced teachers in integrating technology within school settings employed the NVivo application to assist in the qualitative data analysis process. NVivo proved particularly valuable when dealing with large and complex datasets, enabling the researcher to identify recurring patterns and develop thematic insights in this qualitative study.

The findings were organized based on several core research questions, each of which was categorized under specific themes. In total, three main research questions were identified and divided into three primary sections. The analysis process led to the development of distinct categories and themes corresponding to each research question.

Research Question 1: Development of Technology Use in Teaching

To what extent has technology use developed among experienced teachers in the classroom?

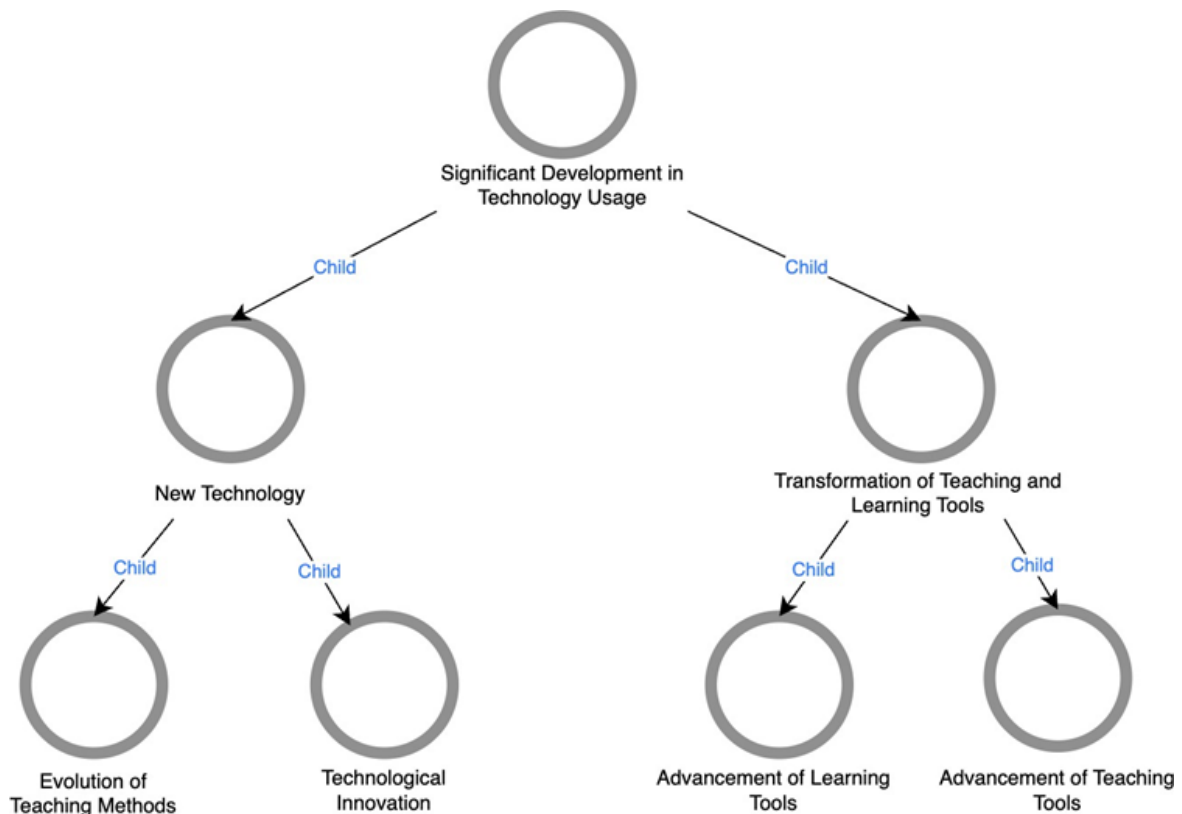


Figure 1: Development of Technology Use in Teaching

Based on the interviews conducted with three experienced teachers, one main theme emerged to address the first research question.

Theme 1: Significant Development in Technology Integration

In recent years, experienced teachers have increasingly integrated advanced technologies into their classrooms, marking a significant transformation in educational practices. The emergence of new technologies particularly the widespread adoption of artificial intelligence (AI) has revolutionized how educators approach teaching and learning.

AI-powered tools such as personalized learning platforms, intelligent tutoring systems, and automated grading systems have enhanced teaching efficiency and effectiveness. These technologies allow teachers to tailor instructional strategies to meet individual student needs, offering a more personalized learning experience. The integration of AI also enables the analysis of large volumes of educational data, providing insights into students' performance and helping educators identify areas that require additional attention.

Another prominent theme is the advancement of learning tools, with a noticeable shift from traditional books to modern smartphones and tablets. This shift has made learning more accessible and engaging for students. Digital textbooks, interactive apps, and online resources have replaced bulky physical books, offering students instant access to a wealth of information. The use of smartphones and tablets in the classroom has also facilitated collaborative learning which enables students to work together on projects and assignments in real time. Moreover, these devices have allowed the integration of multimedia elements such as videos and animations into lessons, making complex concepts easier to understand and retain. Their portability ensures that learning can take place anytime and anywhere thus breaking the boundaries of the traditional classroom.

Teaching tools have also evolved from blackboards and chalk to advanced devices such as computers and LCD projectors. This transformation has enhanced the delivery of educational content, making it more dynamic and interactive. Teachers can now incorporate multimedia presentations, virtual simulations, and online resources into their lessons, catering to diverse learning styles. The use of e-learning platforms and Learning Management Systems (LMS) has further revolutionized teaching methods by enabling educators to create and manage digital course content, track students' progress, and facilitate online discussions. These platforms provide a structured and flexible learning environment that accommodates different schedules and learning paces.

This evolution in teaching approaches is driven by technological advancement which has led to more engaging and effective instructional practices, ultimately contributing to improved educational outcomes.

Research Question 2 – Teaching Strategies and Approaches

How do experienced teachers use technology to teach various subjects and instructional topics?

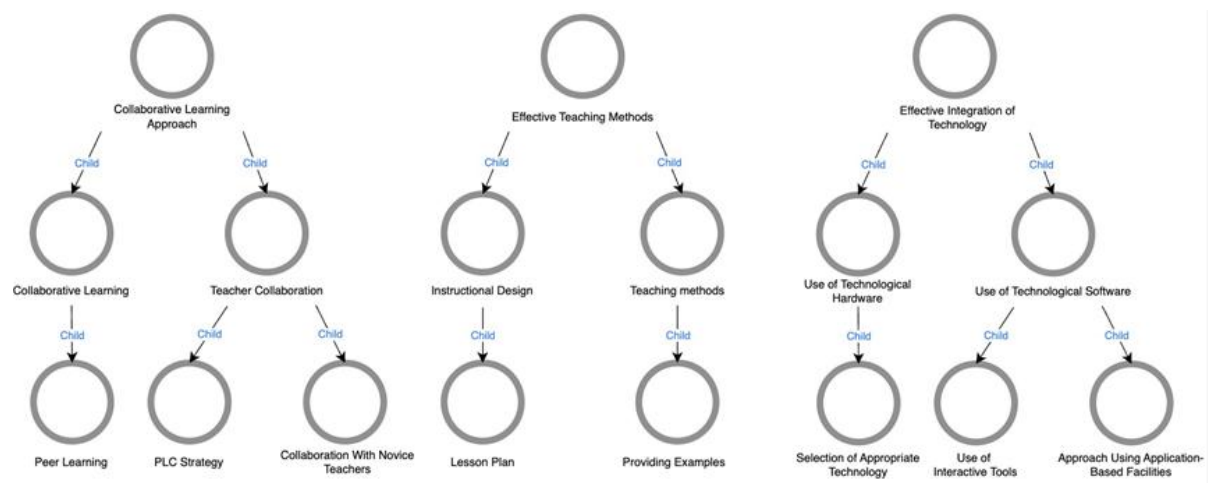


Figure 2: Teaching Strategies and Approaches

Based on the second research question, three main themes were identified through this analysis: collaborative learning approaches, effective teaching methods, and effective technology integration.

Theme 1: Collaborative Learning Approach

Collaborative learning between novice and experienced teachers emphasizes peer-to-peer interaction. Strategies like Professional Learning Communities (PLC) allow experienced teachers to gain input on using technology in teaching. Through this, teachers share knowledge, offer support, and enhance teaching quality together. PLCs help experienced teachers reflect, receive feedback, and improve their practices. Collaboration with novice teachers also promotes mentoring and knowledge transfer, enriching the experience for both sides. This approach strengthens teachers' professionalism and effectiveness. When combined with technology integration, it builds a dynamic system where experienced teachers guide the use of both collaboration and technology to improve learning outcomes.

Theme 2: Effective Teaching Methods

Instructional design and teaching methods are key to effective learning. Examining how experienced teachers use technology reveals how they plan and deliver lessons. Good instructional design ensures teaching activities align with objectives and student needs. With tools like smartboards, apps, and online platforms, teachers can foster interactive and collaborative learning. Technology makes lessons more engaging and boosts student motivation. When integrated into well-planned instruction, it enhances both the teaching process and student outcomes. With thoughtful planning and the right tools, teachers can create more meaningful and productive learning experiences.

Theme 3: Effective Technology Integration

Integrating technology in teaching involves choosing the right tools such as projectors, smartboards, and tablets and relevant software. These tools help build interactive and engaging classrooms. Educational games, simulations, and project-based apps keep students actively involved and encourage creativity. Technology supports collaborative learning and boosts student interest and motivation. When used in well-designed lessons, it makes learning more effective. Matching tools to learning goals is essential for success. Effective technology use depends on choosing suitable hardware and software and applying strategies that encourage active learning. This greatly enhances the learning experience and teaching quality.

In conclusion, findings show that experienced teachers integrate technology through collaborative learning, effective methods, and purposeful tool use. Collaboration via PLCs supports mentoring and professional growth. Well-planned lessons, enhanced with smart technologies, raise motivation and teaching effectiveness. Effective technology use means choosing the right tools to build engaging learning environments. Together, these elements create a dynamic system where experienced teachers lead the way in improving student learning outcomes.

Research Question 3 – Challenges in Implementing Technology

What are the main challenges faced by experienced teachers in using technology in the teaching process?

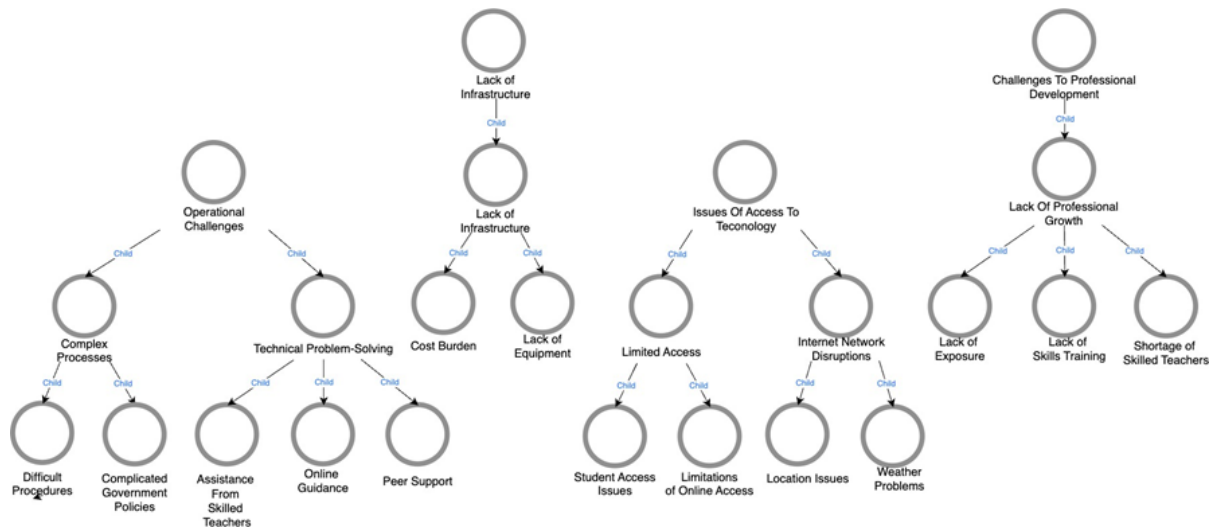


Figure 3: Challenges in Implementing Technology

Based on the third research question, four main themes were identified through the analysis: operational challenges, infrastructural constraints, issues of access to technology, and challenges to professional development.

Theme 1: Operational Challenges

As shown in the figure above, the analysis reveals that this theme includes complex processes and technical problem-solving arising from difficult procedures, complicated government policies, support from skilled teachers, online guidance, and peer assistance. Experienced teachers often face challenges in integrating technology into the teaching process due to these factors. The complex procedures demand significant time and effort to master, while government policies are often unclear and inflexible. Although support from skilled teachers, online guidance, and peer assistance is available, experienced teachers still need to adapt to new technologies and address technical issues that may arise. These findings highlight that the main challenges faced by experienced teachers include navigating complex procedures, dealing with complicated government policies, and fully utilizing the available support. This forms the core of operational challenges, which require deep understanding and continuous support.

Theme 2: Infrastructural Constraints

Experienced teachers face significant challenges due to infrastructural constraints, primarily high costs and lack of equipment. High costs refer to the expenses involved in acquiring, maintaining, and updating technological tools, which often exceed the available budget. The lack of equipment refers to the absence or inadequacy of the necessary technological tools for effective teaching. This category suggests that without sufficient financial support and access to required equipment, efforts to implement technology in teaching become more difficult and less effective. It can be concluded that the main infrastructural challenges include high costs and equipment shortages. This emphasizes the importance of financial support and access to adequate resources to achieve effective, technology-based teaching.

Theme 3: Issues of Access to Technology

Experienced teachers also face challenges in using technology due to limited access and unstable internet connections. These issues stem from various factors, including students' lack of necessary devices or reliable internet, online access restrictions that limit the ability of teachers and students to utilize educational resources effectively, and geographical or weather-related factors that affect internet stability. All of these contribute to the broader category of technology access issues. Without effective solutions to these problems, efforts to integrate technology into teaching will continue to face significant obstacles.

Theme 4: Challenges to Professional Development

Experienced teachers encounter challenges in using technology due to a lack of professional development, including limited exposure, inadequate skills training, and a shortage of skilled mentors. Limited exposure refers to the lack of opportunities for teachers to familiarize themselves with the latest technologies and understand their educational applications. Inadequate training refers to the absence of sufficient programs to help teachers acquire the necessary technological skills. Furthermore, the shortage of skilled teachers means there are few experts available to guide and support others in integrating technology. These factors contribute to the overarching theme of professional development challenges. Without proper support in this area, the integration of technology in teaching will continue to be hindered.

Overall, the study found four key challenges faced by experienced teachers in using technology in their teaching: operational issues, infrastructural limitations, access barriers, and professional development shortcomings. Operational challenges include complex procedures and rigid government policies. Infrastructural barriers are linked to high costs and lack of equipment. Access issues arise from limited connectivity and internet problems. Finally, challenges in professional development stem from a lack of exposure, insufficient training, and a shortage of skilled teachers. Addressing these issues requires deep understanding, continuous support, adequate financial resources, equipment access, and effective training programs to empower experienced teachers in successfully integrating technology into their classrooms.

8. Discussion

This study explores the strategies and challenges experienced teachers face in using technology, offering deep insights into how technology integration has evolved, the instructional methods used and the obstacles encountered. The findings are compared with past research to examine similarities, differences, strengths and weaknesses. The study shows that experienced teachers have significantly embraced technology, including AI, tablets, and smartphones. This supports Blikstad-Balas and Davies (2021), who found that technology enhances personalized learning and student interaction. However, this study adds a focus on emerging technologies like AI, which were not central in earlier research.

Findings also highlight collaborative learning, effective pedagogy, and efficient technological integration. These align with Lim and Khine (2006), who emphasized teacher collaboration for professional growth. Yet, this study extends that view by showing how technology enhances collaboration through real-time interaction and access to online resources. Key challenges identified include operational issues, infrastructure limitations, limited access and gaps in professional training. These support Ertmer (2005), who noted similar barriers to technological adoption. However, this study adds further depth by identifying issues such as restrictive government policies and insufficient equipment which offer a more current perspective.

While previous studies stressed on the importance of technology and the barriers to its use, this research adds new dimensions particularly the impact of AI and interactive apps which is less prominent in earlier literature. A major strength of this study is the use of Nvivo software which enabled detailed analysis of large data sets and helped uncover key patterns and themes. Its limitations include ongoing infrastructure and access issues that hinder effective implementation. Additionally, the persistent lack of training and support continues to be a significant barrier to successful tech integration in classrooms.

9. Implications

The findings of this study reveal valuable insights into the evolving integration of educational technology, especially among experienced teachers. The gradual development in their technology use signals a shift in pedagogy, where seasoned educators increasingly recognize the value of digital tools in enhancing learning. As they grow more proficient and confident, their example encourages broader adoption within their institutions, driving a steady transformation in teaching practices aligned with the digital age. Notably, the strategic methods employed such as collaborative learning, effective teaching strategies and seamless tech integration reflect the depth and adaptability of experienced educators. Collaborative learning promotes student interaction and engagement, while the fusion of pedagogy and technology can significantly boost learning outcomes. These approaches highlight the importance of continuous professional development to stay updated with best practices and innovations.

However, the study also uncovers key challenges. Operational issues such as technical disruptions and managing digital tools can hinder teaching flow and cause frustration. Infrastructure gaps, including unreliable hardware, software and internet access prevent many schools from realizing the full benefits of technology thus underscoring the need for substantial investment in educational resources. Access inequality remains another major hurdle. Even with infrastructure, disparities persist, often reflecting broader socioeconomic divides. Some students enjoy full access at home while others face severe limitations thus deepening educational inequality. Tackling this digital divide requires comprehensive efforts, policy reform, community involvement and creative solutions to ensure equitable access.

Finally, a lack of professional training in technological use poses a serious concern. Without proper support, even experienced teachers may struggle with rapid technological changes. In future, targeted professional development is essential not only for technical skills but also for pedagogical integration to ensure meaningful technological use that enhances learning. Empowering educators through strong training programs will unlock the true potential of educational technology and improve learning experiences for all students. These findings call for urgent, collaborative action to overcome the challenges and fully realize the promise of technology in education.

10. Conclusion

This study shows that Generation Z requires technology for teaching and learning. Positive teacher attitudes, adequate training, good infrastructure, and student acceptance of technology are key components that ensure successful integration of technology in the classroom. Sufficient training equips teachers with the necessary knowledge and skills, while a positive outlook on technology use can boost their confidence in applying it in teaching. Moreover, good infrastructure such as stable internet access and technological equipment ensures that

the educational process is not disrupted. Students' familiarity with technology is also crucial, as it determines how effective it will be for their learning.

Improving teacher training, investing in technological infrastructure, adapting teaching strategies, and providing adequate support and resources are all critical actions needed to ensure future success. Continuous and comprehensive training is essential to ensure teachers remain up to date with the latest technological developments. To guarantee that all educational institutions have access to the necessary tools and facilities, investment in technological infrastructure must be increased. Furthermore, teaching approaches should be adapted to meet the needs and characteristics of Generation Z learners, who are more tech-savvy. Finally, sufficient resources and support must be provided to help both teachers and students overcome any obstacles that may arise in using technology. Technology has the potential to enhance education and prepare students for future challenges.

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Conflict of Interest Statement

The authors declare that there is no conflict of interest regarding the publication of this research. This study was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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