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Challenges and strategies in integrating educational technologies: Perspectives of public-school teachers

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A B S T R A C T

The integration of technology in classroom instruction plays a vital role in enhancing teaching effectiveness and student engagement in the 21st-century learning environment. This study examined the challenges encountered and strategies employed by public school teachers in integrating technology. This study utilized a qualitative descriptive design. Data were collected from (15) teachers at Florentino Camaquin Integrated School through an open-ended questionnaire and follow-up interviews and analyzed using thematic analysis. The findings revealed key challenges, including insufficient technological resources, technical challenges, lack of training and support, and time constraints. To address these, teachers employed strategies such as continuous professional development, self-directed learning, problem-solving, and alternative teaching methods. The study concludes that, despite teachers' adaptability, enhanced institutional support, better infrastructure, and ongoing training are needed to improve technology integration in classrooms.

JEL Classification: I21

Introduction

The integration of technology in classroom instruction is widely recognized as essential for developing learners' 21st-century competencies. In contemporary education, information and communication technology (ICT) has transformed traditional teaching practices by promoting interactive, learner-centered, and inquiry-based learning environments (Tondeur et al., 2017). Effective integration of technology goes beyond access to digital tools; it requires teachers to meaningfully incorporate these tools to enhance student learning outcomes.

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For instance, the study of Baharudin, Chandrasegaran, and Rajasegaran (2024) underscores that despite resource limitations and technical challenges, teachers can enhance technology integration through targeted professional development, collaborative planning, and adaptive instructional practices that align digital tools with learning objectives. With emphasis on using technology in classroom instructions, it is important to understand the difficulties and challenges that teachers may encounter.

In the Philippine context, teachers demonstrate strong commitment to improving instruction despite various constraints. However, integrating ICT remains a challenge, particularly in public schools where access to technological resources and infrastructure is often limited (Mendez & Santos, 2019). Teachers frequently encounter barriers such as insufficient devices, unstable internet connectivity, limited technical support, and gaps in digital competence (Salgado & Paglinawan, 2025). These challenges hinder the effective implementation of technology in classroom instruction.

The synthesis of these empirical insights highlights the importance of examining both the challenges encountered and the strategies employed by public school teachers in order to design effective support mechanisms for technology integration in classroom instruction. While previous studies have explored either the challenges or the strategies associated with technology integration, limited research has examined both dimensions simultaneously within teachers' lived experiences, particularly in rural public-school contexts in the Philippines. Existing literature tends to focus separately on challenges such as limited resources, inadequate infrastructure, and low digital literacy (Kizil & Kizil, 2025; Bazer et al., 2019), or on coping strategies including self-directed learning and the use of alternative teaching methods (Alpuerto, 2022; Pedida & Diaz, 2023). However, there remains a significant gap in studies that integrate both perspectives to provide a more comprehensive and contextualized understanding of teachers' experiences (Sumaoy et al., 2026).

This study aims to examine both the challenges encountered and the strategies employed by public school teachers in integrating educational technology into classroom instruction. The findings reveal that teachers experience resource limitations, technical difficulties, and a lack of training, yet demonstrate resilience through continuous learning, problem-solving, and alternative instructional strategies. The findings of this study intend to inform policy development, teacher training programs, and school-level interventions to improve ICT integration in education.

Review of related literature and studies

This chapter presents a review of selected local and foreign studies on the difficulties encountered and strategies employed by public school teachers in integrating technology into classroom instruction. It provides a foundation for understanding the challenges teachers face, as well as the coping mechanisms and strategies they adopt to use technology effectively in instructional settings.

Teacher competencies in information technology use

The level of teachers' technological proficiency plays a significant role in how effectively technology is integrated into classroom instruction. Educators who possess strong digital skills and combine them with

pedagogical knowledge are better equipped to use ICT tools to enhance teaching and learning. As emphasized in the study of Abella, J. L., & Rosa, E. D. (2023), providing teachers with access to ICT resources and training opportunities enhances their preparedness and confidence in using digital tools.

For instance, Turbanada et al. (2025) found that using the Technological Pedagogical Content Knowledge (TPACK) framework helps assess teachers' ability to integrate content, pedagogy, and technology. Participation in ICT-related seminars further improved their competence and confidence. These findings highlight the importance of continuous exposure to both theory and practice in technology integration.

Moreover, Celeste and Osias (2024) emphasized that digitally competent teachers are more effective in integrating technology into instruction, allowing them to present lessons in more interactive and understandable ways that enhance classroom engagement. This suggests that teachers' ability to use digital tools plays a significant role in improving the quality of instruction and learner participation. Overall, strengthening teachers' ICT competence benefits both instructional quality and student achievement.

Technology integration in teaching strategies

The integration of technology in education is widely acknowledged as crucial for developing the competencies needed in the 21st century. As stated to the Department of Education (DepEd Order No. 42, s. 2017), the use of Information and Communication Technology (ICT) in classroom instruction significantly contributes to fostering essential 21st-century skills, including digital literacy, critical thinking, collaboration, and communication. These skills equip learners to meet the demands of future academic and professional environments.

For instance, the study Casilao, Satojito, and Martir (2025) reveals that teachers who undergo professional development and align digital tools with lesson objectives observe increased learner motivation. This suggests that effective use of ICT can create more meaningful learning experiences for students. When technology is used appropriately, it encourages active participation and collaboration among learners.

Furthermore, the use of multimedia resources has been identified as an effective approach in improving learning outcomes. Taoc and Ramirez (2025) emphasized that incorporating video-based lessons and PowerPoint presentations significantly enhances students' engagement and academic performance. Multimedia tools help present information in a more dynamic and visually appealing manner.

Significantly, teachers' perceptions and attitudes toward technology play a crucial role in its successful implementation. In Buabeng-Andoh (2021), the author stated that positive attitudes toward ICT encourage teachers to adopt and integrate digital tools more effectively. Nevertheless, negative perceptions may limit their willingness to innovate and experiment with new teaching methods. Teachers who are confident in using technology are more likely to explore its full potential in the classroom.

Challenges of technology integration in teaching strategies

The integration of ICT in education has become essential in enhancing teaching and learning processes. Recent studies show that challenges are both technical and related to teachers' readiness and confidence with ICT. Many educators demonstrate only moderate levels of digital competence, which limits their ability to make full use of technological resources in the classroom. Internal barriers, such as attitudes toward technology and limited knowledge, significantly affect classroom integration (Kizil & Kizil, 2025).

Professional development plays a crucial role in addressing challenges and improving ICT integration among teachers. Continuous and sustained training programs have been found to significantly enhance teachers' digital competencies and instructional effectiveness. Research shows that ICT-related professional development is most effective when it is ongoing, context-specific, and supported by mentoring and collaboration rather than being limited to one-time training sessions (Seumo, 2023; Amemasor et al., 2025).

Moreover, infrastructural limitations continue to pose major barriers to effective ICT integration. This is supported by Salgado and Paglinawan (2025), who revealed that teachers frequently experience poor internet connection, a lack of devices, and recurring power interruptions. These conditions disrupt lessons and discourage teachers from relying on technology. Thus, this suggests that both internal and external factors must be addressed to achieve successful technology integration in education.

Teaching strategies employed in integrating technology

Despite the challenges in technology integration, teachers continue to adopt various strategies to effectively incorporate ICT into classroom instruction. These strategies reflect adaptations to restricted access to digital tools and differing digital competencies. Teachers demonstrate resilience by finding alternative ways to make the most of available tools and technologies. Their efforts highlight the importance of adaptability in modern teaching practices.

Moreover, professional development plays a pivotal role in facilitating effective ICT integration. As emphasized by Linda Darling-Hammond, Maria E. Hyler, and Madelyn Gardner (2017), professional development consists of structured learning experiences designed to enhance teachers' knowledge, skills, and instructional practices. In the educational context, such programs equip teachers with both technical and pedagogical competencies necessary for the effective use of technology in the classroom. Through workshops, coaching, collaborative learning, and hands-on practice, educators develop the confidence and capability to integrate ICT meaningfully into their instruction.

In addition, continuous training programs further strengthen teachers' ability to integrate technology in their lessons. According to Casilao et al. (2025), workshops, mentoring, and coaching significantly improve teachers' confidence and competence in using ICT. These structured programs provide hands-on experience and practical applications that support classroom integration. Teachers who participate in regular training are better able to align technology with their instructional goals.

Meanwhile, Santos (2018) emphasized that teachers, particularly in rural areas, adopt flexible strategies such as preparing backup lesson plans and combining traditional and digital methods. These approaches ensure continuity of instruction even when technical issues arise.

Statement of the problem

This study seeks to explore the experiences of public-school teachers integrating technology into classroom instruction. Specifically, it aims to identify the challenges teachers encounter and the strategies they employ to address these challenges. The study seeks to answer the following research questions:

1. What are the challenges encountered by public school teachers in integrating educational technologies?

2. What strategies do they employ to address these challenges?

Methodology

This chapter presents the research design and data sources, including the study locale, population, and sampling procedures; data-gathering instruments; methods of data analysis; and the ethical standards observed throughout the study.

Research Design

The study employed a qualitative descriptive research design to examine the challenges and opportunities teachers face in integrating digital technology into classroom instruction. Data were gathered through an open-ended questionnaire and follow-up interviews, enabling participants to discuss their experiences, perceptions, and instructional practices regarding the use of digital tools in teaching and learning.

Locale of the study

The study was conducted at Florentino Camaquin Integrated School (FCIS) in Vintar, Ilocos Norte, which offers education from elementary through senior high school. The school maintains a strong partnership with the School Division of Ilocos Norte (SDOIN) and the Local Government Unit (LGU) as it moves toward implementing 21st-century learning initiatives.

Population and sampling

The study involved secondary teachers from Florentino Camaquin Integrated School (FCIS), who actively integrate technology into their classroom instruction. The participants were selected based on their teaching experience, willingness to participate, and familiarity with educational technologies, including multimedia presentations, online learning platforms, and interactive software.

Data gathering instrument

The primary data collection instrument in this study was semi-structured interviews, which allowed participants to share their experiences, challenges, and strategies while enabling follow-up questions for clarification. The interview guide covered key areas such as access and infrastructure, technological competence, instructional strategies, professional development, and support systems. These areas helped identify common difficulties in technology integration, including insufficient resources, technical challenges, lack of training, and time constraints. The interviews also explored strategies used by teachers, such as continuous learning, self-directed use of digital tools, troubleshooting, and alternative teaching methods. These discussions generated themes that explain both the difficulties teachers face and the adaptive strategies they use to integrate technology.

Data gathering procedure

Data were collected through face-to-face interactions, allowing participants to engage directly in the process. Participants engaged in face-to-face semi-structured interviews guided by prepared interview questions. This approach not only accommodated participants' needs but also ensured a more comprehensive and inclusive data collection process.

The questions were thoughtfully constructed to encourage detailed, accurate, and reflective responses. They covered key areas such as technology integration, access to resources, technical skills, instructional strategies, and support systems.

To further ensure the accuracy and completeness of the data, any unclear or incomplete responses were addressed through brief in-person follow-up discussions. This helped clarify participants' answers and strengthened the reliability of the collected data.

Data analysis tool

The data collected from interviews, observations, and document analysis were examined using thematic analysis based on Braun and Clarke (2006). This approach follows six key steps: becoming familiar with the data, generating initial codes, identifying themes, reviewing and refining these themes, defining and naming them, and finally presenting the findings in a clear narrative form. To ensure credibility and accuracy, member checking was conducted by sharing the initial themes with participants to confirm that the interpretations accurately reflected their experiences.

Ethical considerations

The study strictly adhered to ethical research standards. Participants' identities were kept confidential, and pseudonyms were used in reporting the findings. Informed consent was obtained prior to participation, and all data were securely stored to prevent unauthorized access. The study respected participants' rights to withdraw at any time without penalty. Furthermore, the researcher ensured that the results were reported honestly, without fabrication, falsification, or misrepresentation of data.

Data presentation and analysis

The findings were presented thematically, highlighting the difficulties teachers encounter in integrating technology and the strategies they employ to address these challenges. Direct quotes from participants

were used to provide depth and authenticity to the findings. Tables, figures, and narrative descriptions were utilized to clearly convey patterns, themes, and significant insights. The discussion also connected findings to the reviewed literature, offering a comparative analysis between local and global perspectives on technology integration in education.

Problem 1: What are the challenges encountered by public school teachers in integrating educational technologies?

Table 1. Challenges

Themes	Categories	Frequency
Theme 1: Access to technological resources	Internet connectivity problems	8
	Lack of devices or equipment	4
	Outdated technological resources	3
Theme 2: Technical challenges in using educational technologies	Connectivity issues during lessons	6
	Old or slow devices/software errors	5
	Limited technical skills in troubleshooting	4
Theme 3: Need for training and technical support	Need for training in using educational technologies	7
	Difficulty learning new applications quickly	4
	Lack of available IT or technical support	4
Theme 4: Time and workload in technology integration	Limited time due to heavy workload	6
	Extra preparation time for digital materials	5
	Technology helps make work easier	4

Note: *Data were collected from open-ended questionnaire responses and follow-up interviews with 15 teachers from Florentino Camaquin Integrated School.*

Theme 1: Access to technological resources

This theme explores the challenges public school teachers face in accessing the technological resources needed to integrate ICT into classroom instruction. Teachers identified three key issues affecting their use of technology: internet connectivity problems (P4), lack of devices or equipment (P1), and outdated technological resources (P7). Among these, internet connectivity issues emerged as the most frequently mentioned, highlighting the difficulty of delivering technology-supported lessons in environments with unstable or limited internet access. Teachers also emphasized the lack of sufficient devices such as computers and smart TVs, which restricts their ability to implement digital activities. In addition, outdated equipment further limits the effectiveness of technology integration due to slow performance and technical limitations. The following statements by the participants illustrate these challenges:

"Limited availability of computers and gadgets and unstable internet connection." (P1)

"I encountered challenges in accessing the internet because there is no free internet access in our school." (P4)

"Usually, some of the smart TVs are not functioning, and the school WiFi rarely reaches my room." (P7)

The results indicate that insufficient infrastructure and limited access to technological resources continue to pose significant barriers to effective ICT integration. This finding is supported by Karunakaran and Dhanawardana (2023) and Cabansag (2025), who emphasized that inadequate ICT resources hinder successful classroom implementation.

Theme 2: Technical challenges in using educational technologies

This theme focuses on the technical difficulties teachers experience while using educational technologies. Teachers identified issues such as connectivity disruptions during lessons (P6), software errors and slow devices (P1), and outdated equipment (P7). Among these, connectivity disruptions during lessons were the most frequently reported, as they directly interrupt the flow of instruction and affect student engagement. Teachers also noted that slow or malfunctioning devices often delay lesson delivery and require additional time to resolve technical problems. The following participant statements reflect these challenges:

"Connection issues, software errors, and slow devices." (P1)

"When technology suddenly stops working, such as problems with internet connection or device compatibility." (P6)

"The equipment is often old or slow, which causes it to lag or freeze during lessons." (P7)

The data reveal that technical issues significantly disrupt instructional processes and reduce the effectiveness of ICT integration. This aligns with UNESCO (2023) and Atabek (2019), who noted that unreliable infrastructure and recurring technical difficulties hinder the use of technology in education.

Theme 3: Need for training and technical support

This theme explores the challenges related to teachers' need for training and technical support in using educational technologies. Teachers identified challenges such as a lack of ICT skills (P2), reliance on self-learning to troubleshoot (P9), and difficulty learning new applications (P14). Among these, the need for training in the use of educational technologies emerged as a major concern, indicating gaps in teachers' preparedness and confidence in ICT integration. The following participant statements illustrate these experiences:

"Sometimes I am not computer literate." (P2)

"Sometimes I still need to search on the internet or YouTube to troubleshoot the problem." (P9)

"Learning new applications quickly is challenging without enough training or technical support." (P14)
These responses imply the importance of structured training and accessible technical support systems. This supports UNESCO (2021) and Darling-Hammond et al. (2020), who emphasized that continuous professional development is essential for improving teachers' ICT competence.

Theme 4: Time and workload in technology integration

This theme examines how time constraints and workload affect teachers' ability to integrate technology. Teachers identified issues such as limited time due to heavy workload (P6), increased preparation time for digital materials (P8), and mixed perceptions of technology efficiency (P10). Among these, limited time due to workload emerged as the most significant concern, as teachers struggle to balance instructional preparation with administrative responsibilities. The following participant statements demonstrate these perspectives:

"Due to heavy workload, I sometimes have limited time to prepare technology-based activities." (P6)

"Preparation time is doubled when creating digital assets or PowerPoints." (P8)

"*Technology makes my work easier and saves time." (P10)*

These findings suggest that workload and time constraints significantly influence teachers' use of ICT in instruction. This is supported by OECD (2020) and Dhawan (2020), who noted that technology integration requires additional planning time and effort.

Problem 2: What strategies do they employ to address these challenges?

Table 2. Strategies

Themes	**Categories**	**Frequency**
Theme 1: Continuous learning and professional development	Attending seminars, webinars, and training related to education technology	7
	Exploring and practicing different digital platforms and tools	5
	Learning through collaboration and sharing ideas with fellow teachers	3
Theme 2: Self-directed learning through online platforms	Watching tutorials on YouTube, Tiktok, and other social media	8
	Searching online resources, applications, and techniques	7

Theme 3: Problem-solving and preparedness in managing technical issues	Performing basic troubleshooting during technical problems	6
	Staying calm and quickly finding solutions during technical difficulties	5
	Preparing backup material or alternative teaching strategies	4
Theme 4. Use of alternative or traditional teaching strategies	Using printed materials such as modules, handouts, or textbooks	6
	Using board work, discussion, and traditional teaching methods	5
	Preparing alternative activities, such as group discussion or hands-on tasks	4

Note: *Data were collected from open-ended questionnaire responses and follow-up interviews with 15 teachers from Florentino Camaquin Integrated School.*

Theme 1: Continuous learning and professional development

This theme explores how teachers engage in continuous learning and professional development to improve their ICT integration skills. Teachers identified strategies such as attending seminars and training (P1), exploring digital tools (P5), and combining multiple learning approaches (P14). Among these, participation in seminars and training programs emerged as the most common strategy, reflecting teachers' efforts to stay up to date with technological advancements. The following participant statements illustrate these experiences.

"By attending seminars, webinars, and training." (P1)

"I enhance my skills by exploring online tutorials and practicing the use of different educational technologies." (P5)

"I enhance my skills and improve my technology integration by attending webinars and training, watching tutorials, and practicing the use of different educational tools." (P14)

These findings imply that continuous professional development and self-learning play an important role in helping teachers improve their technological competence. This is supported by Baharuddin et al. (2024), Belay et al. (2020), and Artacho et al. (2020), who underscore the importance of promoting teachers' professional development in ICT skills through both initial and ongoing training.

Theme 2: Self-directed learning through online platforms

Another theme that emerged from the responses is self-directed learning using online platforms and social media. Teachers identified strategies such as watching tutorials on YouTube and TikTok (P7), using social media to enhance skills (P10), and searching for online resources (P4). Among these,

watching tutorials emerged as the most frequently used strategy due to its accessibility and practicality. The following participant statements support this idea:

"I mostly learn by watching YouTube tutorials and on TikTok." (P7)

"By watching reels or TikTok videos to enhance my skills and improve my technology integration practices." (P10)

"I researched some methods online and techniques or searching apps for another source of knowledge that I will apply to my work." (P4)

The results demonstrate that digital platforms serve as valuable learning resources for teachers. By utilizing online tutorials and educational videos, teachers can independently develop their skills and explore new methods for integrating technology into their lessons. This aligns with Farjon et al. (2019) and Tomczyk et al. (2021), who emphasized the role of technological competence and self-efficacy in ICT integration.

Theme 3: Problem-solving and preparedness in managing technical issues

This theme examines how teachers apply problem-solving skills and preparedness to manage technical difficulties. Teachers identified strategies such as performing basic troubleshooting (P1), switching to alternative methods (P7), and maintaining composure during disruptions (P14). Among these, basic troubleshooting emerged as the most common approach. The following participant statements illustrate these strategies:

"Basic troubleshooting and preparing backup materials." (P1)

"If the file won't open or the power goes off, I immediately switch to the chalkboard." (P7)

"I manage technical problems during instruction by staying calm and finding quick alternatives." (P14)

The analysis indicates that problem-solving skills and preparedness are essential for teachers when integrating technology in the classroom, as they ensure continuity of instruction despite disruptions. This underscores the role of adaptability and preparedness in maintaining effective teaching practices. This is supported by Trust and Whalen (2020) and Tondeur et al. (2017), who assert that successful technology integration requires teachers to anticipate technical challenges and implement alternative instructional strategies to sustain learning.

Theme 4: Use of alternative or traditional teaching strategies

Another theme from the responses is the use of traditional teaching strategies when technology or internet access is unavailable. Teachers identified approaches such as using printed materials (P1), relying on discussions (P5), and implementing hands-on activities (P15). Among these, the use of printed materials emerged as the most frequently applied strategy. The following participant statements illustrate these practices.

"I print modules and textbooks to continue the lesson effectively." (P1)

"When technology or internet access is unavailable, I use traditional teaching methods such as printed materials and discussions." (P5)

"I use board work, group discussion, and hands-on tasks so the lesson can continue effectively even without technology." (P15)

The data reveal that traditional teaching strategies remain an important support system in technology-integrated classrooms. This aligns with Hodges et al. (2020) and Kim and Asbury (2020), who reported that teachers adapted their instructional practices by combining traditional and digital strategies to overcome resource limitations.

Results and discussion

The findings reveal that public school teachers face multiple, interconnected challenges in integrating educational technology, including limited resources, technical difficulties, insufficient training and support, and time constraints. These results are consistent with existing literature highlighting how infrastructural and competency-related barriers hinder ICT integration in education (UNESCO, 2023).

From a theoretical perspective, the results strongly support the Technological Pedagogical Content Knowledge framework proposed by Punya Mishra and Matthew J. Koehler (2006), which emphasizes integrating technological, pedagogical, and content knowledge. The identified challenges—particularly in technological skills and access—highlight gaps in teachers' technological knowledge, limiting their ability to effectively integrate ICT. This aligns with the framework's assertion that successful integration depends on a balanced interplay of these domains. The findings also reflect principles of Constructivist Learning Theory associated with Lev Vygotsky (1978), which emphasizes active, learner-centered instruction. While technology has the potential to support such approaches, existing barriers constrain teachers' ability to implement interactive learning, leading them to rely on alternative strategies such as group discussions and hands-on activities to sustain meaningful instruction.

In practice, the findings underscore the importance of continuous professional development in enhancing teachers' digital competence and confidence (Darling-Hammond et al., 2020; Artacho et al., 2020). Teachers' reliance on self-directed learning through online platforms further reflects their proactive efforts to address skill gaps. At the same time, their use of alternative strategies highlights the importance of flexibility and adaptability in sustaining instruction despite technological limitations, consistent with Kim and Asbury (2020). Overall, effective technology integration requires not only teacher competence but also strong institutional support, adequate infrastructure, and sustained professional development; without these, the potential of ICT in education cannot be fully realized.

The findings also carry important implications for policy and practice. Inadequate infrastructure underscores the need for reliable internet access and up-to-date technological resources, as emphasized

by UNESCO (2023), which suggests that policymakers should prioritize ICT investments, particularly in public schools. The need for sustained professional development aligns with Darling-Hammond et al. (2020), highlighting the importance of long-term training programs rather than one-time workshops. Workload and time constraints, supported by OECD (2020), indicate the need for policies that reduce administrative burdens or allocate dedicated time for lesson preparation. Furthermore, the reliance on alternative teaching strategies aligns with Kim and Asbury (2020), suggesting that flexible and blended approaches should be recognized and supported in educational policies.

Despite these contributions, the study has several limitations. The sample was limited to 15 teachers from a single public school, which may affect the generalizability of the findings. The use of self-reported data may introduce response bias, and the focus solely on teachers' perspectives excludes insights from students and school administrators, limiting the scope of analysis. Future research should therefore include larger and more diverse samples across multiple schools and regions, as well as comparative studies between rural and urban contexts. Adopting mixed-methods approaches and incorporating perspectives from students, school leaders, and policymakers would provide a more comprehensive understanding. Further studies may also examine the long-term impact of professional development and evaluate targeted interventions, such as mentorship programs or ICT support systems, to determine their effectiveness in improving technology integration.

Conclusion

This study examined the challenges encountered and strategies employed by public school teachers in integrating technology into classroom instruction. The findings revealed that teachers face several challenges, including insufficient technological infrastructure, technical difficulties with digital tools, insufficient training and technical support, and time constraints due to heavy workloads. These difficulties emphasized the ongoing need for improved technological infrastructure, reliable internet connectivity, and continuous professional development for teachers.

Despite these challenges, teachers demonstrated adaptability and resilience by employing various strategies to sustain technology integration in their classrooms. These strategies include participating in seminars and training programs, engaging in self-directed learning through online platforms, performing basic troubleshooting for technical issues, and using alternative or traditional teaching methods when technology is unavailable. Such strategies enable teachers to continue delivering effective instruction even when technological resources are limited.

Overall, the findings indicate that while technology integration remains a challenge for many public-school teachers, their proactive efforts to develop their skills and adapt instructional practices contribute to more effective teaching and learning. Strengthening institutional support, providing regular ICT training programs, and improving access to technological resources can further enhance teachers' ability to integrate technology meaningfully into classroom instruction.

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***Ethical statement*:** The study followed ethical guidelines, and participants' privacy was protected.

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