

Boosting Primary School Teachers' Self-Efficacy through the TPACK Framework: Insights from Tripoli, Libya

Mohammed Khamees Alfadheel Alkadeeki¹, S. M. Ferdous Azam², Siti Rokiah Binti Siwok³

¹Management and Science University, Shah Alam, Malaysia

012023092166@gsm.msu.edu.my

| Abstract | Article Info |
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| <p>This research investigates the adoption and effectiveness of the Technological Pedagogical Content Knowledge (TPACK) framework among primary school teachers in Tripoli, Libya, with a focus on the factors influencing its integration. As educational technology rapidly evolves, its effective incorporation into teaching is essential for enhancing teachers' self-efficacy and improving student outcomes. Using a mixed-methods approach, the study surveyed 750 primary school teachers across six districts in Tripoli, collecting data on self-efficacy, organizational support, technological access, and the perceived usefulness of educational technologies. The quantitative analysis utilized exploratory factor analysis, structural equation modeling (SEM), and path analysis to explore relationships and the mediating role of self-efficacy in TPACK adoption. Results indicate that self-efficacy plays a crucial role in enhancing teachers' confidence in using technology, particularly when teachers believe in their abilities. Moreover, the perceived ease of use and usefulness of technological tools were found to influence the effectiveness of technological support on TPACK integration. Qualitative data, derived from semi-structured interviews, shed light on the challenges and facilitators of TPACK adoption, such as limited infrastructure, insufficient training, and resistance to change. However, collaborative learning environments and strong organizational support were identified as key factors in overcoming these barriers. The study offers valuable implications for policymakers, educators, and administrators, emphasizing the need for targeted professional development, enhanced technological infrastructure, and fostering collaborative teaching practices. These measures will contribute to the effective integration of educational technologies and the improvement of teaching and learning outcomes in Libya's primary education system.</p> | <p>Keywords: TPACK, self-efficacy, technological integration, educational technology, teacher training</p> |

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INTRODUCTION

The integration of technology in education has become a fundamental aspect of modern teaching and learning. As digital tools and resources continue to advance, it is increasingly critical for educators to incorporate technology into their pedagogical practices. However, the successful adoption of educational technology goes beyond simply having access to technological tools; it requires a comprehensive understanding of how to effectively combine technology, pedagogy, and subject content knowledge. The Technological Pedagogical Content Knowledge (TPACK) framework, proposed by Mishra and Koehler (2006), offers a model that integrates these essential components of teaching. It emphasizes that effective technology integration is not just about using digital tools but understanding how technology interacts with pedagogy and content to create meaningful learning experiences.

In Libya, as in many other developing countries, integrating information and communication technology (ICT) into education has become a priority to improve teaching quality and student outcomes. The Libyan Ministry of Education has initiated several reforms aimed at advancing the use of educational technology in schools. However, challenges such as limited technological infrastructure, insufficient teacher training, and socio-cultural barriers hinder the effective implementation of these initiatives. In this context, the TPACK framework presents a promising approach to help Libyan primary school teachers integrate technology effectively into their teaching practices.

The TPACK framework consists of three core knowledge domains: technological knowledge (TK), pedagogical knowledge (PK), and content knowledge (CK). According to Mishra and Koehler (2006), effective teaching requires a combination of these domains, where teachers not only need to understand the subject matter, they are teaching but also how to teach it effectively and how to use technology to enhance both pedagogy and content delivery. The intersection of these three areas of knowledge forms the foundation for successful technology integration, encouraging a more holistic approach to teaching that incorporates technology as an integral part of the learning process, rather than as an addition to it.

Self-efficacy, a concept introduced by Bandura (1997), refers to an individual's belief in their ability to successfully execute tasks. In the context of education, self-efficacy refers to a teacher's confidence in their ability to use technology effectively in the classroom. Teachers with high self-efficacy are more likely to experiment with new teaching methods, adopt innovative technologies, and use these tools to enhance student learning. Conversely, teachers with low self-efficacy may resist using technology, fearing they lack the necessary skills or that technology may not benefit their students.

Incorporating self-efficacy into the TPACK framework is essential for understanding the factors that influence technology adoption in education. A teacher's belief in their ability to use technology successfully significantly impacts their approach to integrating technological tools in their teaching. Teachers who believe they can use technology are more likely to incorporate it into their lessons, even in the face of challenges such as limited resources. On the other hand, teachers with low self-efficacy may hesitate to use technology, even when it is available, due to a lack of confidence in their ability to use it effectively.

In Libya, self-efficacy plays a particularly important role in the adoption of TPACK, as many teachers face barriers such as limited technological resources, inadequate training, and a lack of institutional support. Teachers' perceptions of their ability to integrate technology are shaped both by personal experiences and the external environment in which they work. Research shows that when teachers perceive technology as difficult to use or irrelevant to their teaching needs, their self-efficacy declines, making them less likely to incorporate technology into their pedagogy (Chen, 2021). This underscores the importance of addressing self-efficacy in professional development programs to ensure that teachers not only acquire the necessary skills but also develop the confidence to apply these skills in the classroom.

The adoption of TPACK in Libyan primary schools faces several challenges. A major barrier is the limited access to technology. Although the Libyan government has made efforts to provide ICT infrastructure, many schools still lack the necessary technological tools to support effective teaching. In some schools, computers and other devices are outdated, and internet access is unreliable, complicating the integration of technology into classrooms. Even in schools with access to technology, the lack of technical support and maintenance makes it difficult for teachers to use digital tools consistently.

Another challenge is the inadequacy of teacher training programs. While some training opportunities exist, they often fail to meet teachers' specific needs or provide the support necessary for integrating technology into

subject-specific pedagogy. Many teachers receive basic training in using digital tools, but they are not equipped with the pedagogical strategies needed to use these tools meaningfully. This gap in training can lower self-efficacy, as teachers may feel unprepared to incorporate technology in ways that enhance learning.

Additionally, socio-cultural and organizational factors influence the adoption of technology in Libyan schools. Teachers often face resistance from students and parents who may not fully understand the benefits of educational technology. Furthermore, traditional teaching methods are deeply rooted, and there is resistance to new approaches. Organizational support, such as professional development opportunities, mentoring, and a collaborative work environment, is often lacking, which further impedes teachers' efforts to integrate technology.

In addition to personal factors like self-efficacy, organizational and technological support are crucial for successful TPACK adoption. Teachers need institutional support from their schools and administrators to integrate technology into their classrooms. This support can include access to updated technology, reliable internet, and administrative encouragement for teachers to explore new teaching methods. Schools that foster a collaborative environment where teachers can share best practices and learn from each other are more likely to see successful technology integration.

Technological support, including access to professional development focused on both technical skills and pedagogical strategies for using technology, is essential. Teachers need ongoing training and resources to stay current with the latest technological developments. Without this support, even teachers with high self-efficacy may struggle to integrate technology effectively into their teaching practices.

This study explores how self-efficacy, technological resources, training, and organizational support influence the adoption of TPACK in Libyan primary schools. It examines how self-efficacy mediates the relationship between these factors and technology integration. By addressing these challenges, policymakers, educators, and administrators can develop strategies to equip teachers with the skills, confidence, and support needed to integrate technology effectively into their teaching.

The study also contributes to the literature on TPACK implementation in developing countries, offering insights into how self-efficacy mediates the relationship between contextual factors and TPACK effectiveness. The findings will inform policy, professional development programs, and resource allocation strategies aimed at fostering sustainable educational technology use in Libya. The research underscores the importance of contextually adaptive approaches that empower teachers and align technological advancements with pedagogical goals, ensuring that technology integration enhances teaching and learning in Libyan primary schools.

LITERATURE REVIEW

The integration of technology into education has become a central focus of modern teaching practices, offering significant advancements in enhancing both teaching and learning processes. The Technological Pedagogical Content Knowledge (TPACK) framework, introduced by Mishra and Koehler (2006), provides a comprehensive model for understanding how technology can be effectively integrated into teaching. This framework builds upon Shulman's (1987) Pedagogical Content Knowledge (PCK) model, which emphasized the importance of combining pedagogical strategies with subject-specific content knowledge to improve teaching. While PCK was a robust approach, it did not fully address the transformative potential of technology in the classroom. In response to this gap, Mishra and Koehler (2006) introduced the TPACK framework by adding a third component—technological knowledge. TPACK highlights the dynamic and integrated relationship between technology, pedagogy, and content knowledge, suggesting that effective teaching in the digital age requires an understanding of how these elements interact to create meaningful learning experiences. The TPACK framework envisions technology integration as more than the mere use of tools in isolation. It requires teachers to blend three distinct areas of knowledge: content knowledge (CK), pedagogical knowledge (PK), and technological knowledge (TK). Content knowledge refers to the teacher's understanding of the subject matter, pedagogical knowledge focuses on the methods and strategies used to teach that content, and technological knowledge involves the teacher's understanding of digital tools and how to use them in the classroom. The intersection of these three domains forms the foundation for successful technology integration, encouraging teachers to use technology in ways that align with pedagogical practices and content delivery. Since its introduction, the TPACK framework has been widely adapted across various educational contexts,

exploring its applicability across disciplines, educational levels, and cultural settings. Researchers have identified several factors that influence the effective use of technology in teaching. For instance, Angeli and Valanides (2009) extended the framework by emphasizing the importance of contextual factors, such as student demographics, institutional culture, and the external environment, in shaping technology integration. They argued that TPACK is a context-dependent model that needs to be adapted to the specific challenges and needs of each educational setting. Koh et al. (2013) further refined the framework by highlighting that technology integration is an ongoing process rather than a one-time event. They suggested that as teachers gain experience and as technology itself evolves, the process of integrating technology into teaching also develops over time. The TPACK framework has significantly influenced teacher education programs by emphasizing the need for teachers to integrate technology in a pedagogically sound manner. It guides educators on how to incorporate technology in ways that enhance teaching and learning, making it an essential component of teacher preparation. As digital tools continue to evolve, the TPACK framework remains a relevant and valuable resource for navigating the complexities of technology integration in education. A critical factor influencing the effective implementation of TPACK is teacher self-efficacy, which refers to a teacher's belief in their ability to successfully perform a task. In the context of TPACK, self-efficacy pertains to a teacher's confidence in their ability to integrate technology into their teaching practices effectively. Bandura (1997) emphasized that self-efficacy plays a central role in shaping an individual's behavior and performance. Teachers with high self-efficacy are more likely to experiment with new teaching methods, persist in the face of challenges, and adopt innovative strategies, including technology integration. Conversely, teachers with low self-efficacy may resist using technology, fearing they will not be able to use it effectively. Research has consistently shown that self-efficacy influences not only teachers' willingness to adopt new technologies but also their persistence in overcoming challenges (Chen, 2021). Teachers with high self-efficacy are more likely to explore a wide range of digital tools, adopt technology in their teaching, and modify their pedagogical strategies to incorporate new technological resources. These teachers are also more inclined to seek out professional development opportunities to improve their skills. In contrast, teachers with low self-efficacy may avoid using technology or limit its use to tools they are already familiar with. In contexts where resources are limited and teachers have had minimal exposure to technology, low self-efficacy can become a significant barrier to the effective integration of technology (Lai, 2023).

For the successful adoption of TPACK, it is essential to address the factors that contribute to the development of teacher self-efficacy. These factors include prior experience with technology, access to professional development, peer support, and institutional encouragement. Teachers who receive continuous training in technology integration and who work in supportive environments where they can collaborate with colleagues are more likely to develop high self-efficacy, which, in turn, supports effective technology integration. Moreover, teacher self-efficacy is not a fixed trait; it can be developed over time through ongoing professional development and encouragement. This reinforces the importance of sustained efforts to build teachers' confidence and competence in using technology in the classroom. Research has shown that self-efficacy is crucial in shaping teachers' attitudes toward technology and their willingness to explore new digital tools. Teachers who feel confident in their ability to use technology are more likely to take risks, experiment with new strategies, and view technology as an asset in their teaching. On the other hand, teachers who lack confidence may hesitate to use technology, which can limit the effectiveness of technology integration and hinder their ability to maximize its potential in enhancing student learning. As the role of technology in education continues to grow, fostering high self-efficacy among teachers becomes increasingly important for ensuring that technology is used in ways that improve educational outcomes. In contexts with limited resources or insufficient technological support, developing teacher self-efficacy is even more critical to overcoming challenges and ensuring that teachers can successfully integrate technology into their teaching practices. In summary, the integration of technology into education, guided by the TPACK framework, is a complex and dynamic process that requires a deep understanding of the interplay between content knowledge, pedagogy, and technology. The TPACK framework has proven to be a valuable tool for educators, providing a pathway for integrating technology in ways that align with teaching goals and content needs. However, the successful implementation of TPACK depends on factors such as teacher self-efficacy, access to professional development, and institutional support. Teachers who are confident in their ability to use technology are more likely to embrace it, experiment with new tools, and incorporate it into their teaching strategies. Therefore,

fostering high self-efficacy among teachers is essential for the effective adoption of technology in the classroom and for ensuring that technology integration leads to meaningful improvements in teaching and learning outcomes.

The organizational environment in which teachers operate plays a crucial role in determining the success of TPACK (Technological Pedagogical Content Knowledge) implementation. Key organizational factors such as leadership, access to resources, and institutional support significantly influence how effectively technology is integrated into teaching. Schools with supportive leadership, which actively encourages the use of technology and provides adequate resources, tend to foster higher levels of TPACK proficiency among teachers. Effective administrative support takes many forms, including providing access to necessary technological tools, offering professional development opportunities, and cultivating a culture that encourages innovation and experimentation with new teaching methods. In contrast, schools that lack such leadership and support face significant challenges in integrating technology successfully.

The availability of resources, including digital devices, reliable internet connectivity, and software tools, is another critical factor influencing TPACK adoption. In many developing regions, resource constraints hinder teachers' ability to incorporate technology into their classrooms. Teachers may have limited access to computers, projectors, or other technological tools, making it difficult for them to integrate digital tools into their lessons. In such environments, schools with well-defined Information and Communication Technology (ICT) policies and a commitment to improving technological infrastructure tend to create a more conducive environment for the effective use of TPACK (Xu, 2022). Conversely, the absence of these resources and institutional support can have a detrimental impact on TPACK adoption. Schools with insufficient infrastructure may struggle even with basic technology integration, which can undermine teachers' ability to integrate technology effectively.

Cultural and environmental factors, such as societal attitudes toward technology and its perceived value in education, also shape how technology is adopted and used in classrooms. In contexts where there is resistance to technology or a lack of confidence in its benefits, teachers may be less likely to embrace the TPACK framework, even if they receive training. This resistance can be further compounded in environments where technology is perceived as unnecessary or disruptive to traditional teaching methods, causing teachers to resist integrating technology into their pedagogical practices.

Effective professional development is essential to the successful implementation of TPACK. Research has shown that training programs that combine hands-on experience with technology, collaborative learning, and ongoing support have a higher likelihood of fostering successful technology integration (Zheng, 2022). Collaborative learning environments enable teachers to share knowledge, exchange ideas, and provide mutual support as they experiment with new tools and strategies. These environments help build teachers' confidence and competence in using technology in the classroom. Furthermore, training programs should be tailored to meet the specific needs of teachers and their contexts. Generic, one-size-fits-all programs often fail to address the challenges teachers face in different cultural or educational settings. Contextualized training that takes into account the particular content areas, technological resources, and pedagogical practices of a given school or region is more likely to have a lasting impact on TPACK adoption. Additionally, given the rapid pace of technological change, ongoing training is necessary to ensure that teachers remain up-to-date with new tools and practices.

Training programs should also focus on both technological knowledge (TK) and pedagogical knowledge (PK), as these two areas are essential for effective technology integration. Teachers must not only learn how to use digital tools, but also understand how to apply them to specific teaching contexts and content areas. This requires an integrated approach that combines technical skills with pedagogical strategies aligned with the curriculum. Teachers who receive this type of professional development are better equipped to blend technology seamlessly into their teaching methods, leading to improved learning outcomes.

Resource constraints represent one of the most significant barriers to the effective implementation of TPACK, particularly in developing countries. Many schools, especially those in underserved areas, lack the necessary hardware, such as computers, tablets, and projectors, and may have unreliable internet connectivity. These limitations disproportionately affect primary schools, where educational budgets are often stretched thin, and resources are more frequently allocated to secondary and tertiary institutions. In the absence of adequate technological infrastructure, teachers are unable to effectively integrate technology into their lessons, even if

they possess the requisite skills and knowledge. Moreover, when technology is available, technical issues such as malfunctioning equipment or lack of maintenance can disrupt teaching and create frustration among teachers, further hindering technology adoption.

Another significant challenge to TPACK implementation is teacher resistance to change. Many educators perceive technology as disruptive to traditional teaching methods and may feel overwhelmed by the complexity of integrating new tools into their teaching practices. Teachers who have spent years developing and refining their teaching methods may be reluctant to change their approaches, especially if they view technology as unnecessary or incompatible with their existing pedagogical strategies. This resistance is often exacerbated by a lack of adequate training and support, which leaves teachers feeling ill-equipped to integrate technology into their lessons. Addressing this resistance requires targeted interventions that emphasize the benefits of technology and provide practical solutions to the challenges teachers face in adopting new tools. Professional development programs should focus on demonstrating how technology can enhance teaching and learning, and provide teachers with strategies for integrating digital tools in ways that complement and enhance their existing pedagogical practices.

Despite the considerable body of research on TPACK, gaps remain in understanding its application in specific cultural and contextual settings. Much of the literature has concentrated on developed countries or specific subject areas, but there is a need for more research on TPACK implementation in developing nations, particularly in primary education. Teachers in these contexts often face unique challenges, such as resource limitations and varying levels of teacher preparedness, which may affect their ability to integrate technology effectively. Furthermore, while the role of self-efficacy in TPACK adoption has been acknowledged, more research is needed on how self-efficacy acts as a mediator between external support and successful technology integration. Understanding how teachers' self-beliefs shape their engagement with TPACK can provide valuable insights for designing professional development programs that foster both confidence and competence in technology integration.

This study aims to address these gaps by examining how contextual factors, teacher self-efficacy, and organizational support influence TPACK adoption among primary school teachers in Tripoli, Libya. By investigating these factors in the Libyan context, the study seeks to offer a more nuanced understanding of how TPACK can be effectively implemented in diverse educational settings. The findings may provide valuable insights into how technology can be integrated into teaching practices in primary schools, thereby improving both teaching methods and student learning outcomes. Ultimately, the study seeks to contribute to the development of strategies that can support effective technology integration in primary education, particularly in settings with unique challenges related to resource availability and institutional support.

RESEARCH METHODOLOGY

This study adopts a mixed-methods approach to comprehensively explore the factors influencing the adoption and effectiveness of the TPACK framework among primary school teachers in Tripoli, Libya. By combining both quantitative and qualitative data, the research seeks to provide a holistic understanding of the individual and contextual factors affecting TPACK implementation in the region. The study targets a diverse sample of primary school teachers across six districts in Tripoli, utilizing a stratified random sampling technique to ensure representation from various demographic and professional backgrounds. A total of 750 teachers were selected for participation, with the sample size adjusted for potential non-responses to ensure statistical reliability. The participants represent a variety of experience levels, educational backgrounds, and schools with differing access to resources, offering a comprehensive view of TPACK adoption.

Data collection occurred in two phases: quantitative and qualitative. The quantitative component involved structured surveys to measure key variables influencing TPACK adoption, such as teachers' self-efficacy, organizational support, technological proficiency, and perceptions of technology's usefulness and ease of use. The survey instrument was adapted from established scales, such as Bandura's (1997) self-efficacy scale and Davis's (1989) Technology Acceptance Model (TAM) constructs, modified to suit the context of primary education in Tripoli. This data provided insights into the relationships between organizational factors, teachers' self-efficacy, and their ability to implement TPACK effectively. The qualitative component involved semi-structured interviews with 30 teachers, selected to ensure diversity in teaching experience, school type, and access to technology. These interviews aimed to uncover deeper insights into the barriers and facilitators of

TPACK integration, such as resource constraints, training opportunities, and cultural attitudes toward technology.

Quantitative data were analyzed using various statistical techniques. Descriptive statistics summarized the sample characteristics and key variables, while Exploratory Factor Analysis (EFA) helped identify underlying factors. Structural Equation Modeling (SEM) and Path Analysis were employed to examine the relationships between variables and test the mediating role of self-efficacy in the relationship between organizational support and TPACK implementation. These methods also assessed the moderating effects of perceived usefulness and ease of use, as defined by the Technology Acceptance Model (TAM). Qualitative data were analyzed using thematic analysis, guided by the framework of Braun and Clarke (2006). This approach identified recurring patterns and themes, which were categorized to uncover the factors influencing TPACK implementation. Key themes included resource constraints, professional development, and cultural perceptions of technology. Ethical considerations were central to the study, and informed consent was obtained from all participants. Their anonymity and the confidentiality of their responses were assured, and the data were handled securely with access restricted to the research team. The study was approved by the relevant educational authorities in Tripoli, ensuring compliance with local regulations. While the study offers valuable insights into TPACK adoption in Tripoli, several limitations exist. Self-reported data may introduce response biases, and the cross-sectional nature of the study limits the ability to draw causal conclusions. Longitudinal studies would be beneficial to assess how the factors influencing TPACK adoption evolve over time. Future research could incorporate objective measures, such as classroom observations or student outcomes, to complement the self-reported data. Overall, the mixed-methods approach provided a comprehensive analysis of the factors affecting TPACK adoption among primary school teachers in Tripoli, Libya. The quantitative findings revealed significant relationships between organizational support, self-efficacy, and TPACK adoption, while the qualitative data offered a deeper understanding of the contextual barriers and facilitators of technology use. The study's findings contribute to the broader discourse on educational technology and provide actionable recommendations for improving TPACK implementation in primary schools.

ANALYSIS AND FINDINGS

Quantitative Findings

The quantitative findings of this study offer valuable insights into the factors influencing the implementation of the TPACK (Technological Pedagogical Content Knowledge) framework among primary school teachers in Tripoli, Libya. The analysis highlights the significance of organizational support, self-efficacy, and technological support in shaping teachers' ability to effectively integrate technology into their teaching practices. A key finding is the critical role of organizational support in enhancing teachers' self-efficacy and their ability to implement TPACK successfully. Organizational support includes factors such as access to technological resources, leadership encouragement, and availability of training opportunities. The study found that schools with robust technological infrastructure, such as computers, tablets, projectors, and reliable internet, enabled teachers to integrate technology more effectively into their teaching. Schools with proactive leadership that advocated for technology use and supported teachers in exploring digital tools reported higher levels of TPACK proficiency. Teachers in schools with strong ICT policies and consistent technological support demonstrated significantly better TPACK knowledge, with those involved in regular professional development programs focused on technology integration performing 25% better in TPACK assessments than those who lacked such opportunities. This finding underscores the importance of institutional support in fostering technology adoption.

The study also emphasized the role of self-efficacy in the successful implementation of TPACK. Teachers with high self-efficacy were more confident in using technology and were more likely to adopt innovative teaching practices, such as creating digital lesson plans and incorporating multimedia resources. These teachers also demonstrated greater adaptability in integrating technology into their pedagogical strategies, which contributed to their overall TPACK proficiency. Conversely, teachers with lower self-efficacy were less willing to integrate technology and often avoided unfamiliar digital tools or restricted their use to basic applications. This aligns with Bandura's (1997) work, which highlights the critical role of teacher confidence in technology adoption. Additionally, the study found that perceived usefulness and ease of use moderated the relationship between technological support and TPACK implementation. Teachers were more likely to adopt technology when they

perceived the tools as user-friendly and aligned with their teaching goals. Tools that were easier to integrate into existing teaching strategies saw higher adoption, while more complex platforms were less frequently used. This suggests that for effective TPACK implementation, educational technology should be designed for ease of use, and professional development should focus on equipping teachers with the skills to use these tools efficiently.

Qualitative Findings

The qualitative analysis provided deeper insights into the barriers and facilitators of TPACK implementation, highlighting teachers' personal experiences and perceptions. The thematic analysis of interviews revealed that while teachers were enthusiastic about integrating technology into their classrooms, several obstacles hindered their ability to do so effectively. The most frequently mentioned barrier was limited access to technological resources. Teachers expressed challenges in acquiring and maintaining the necessary tools, such as computers, projectors, and reliable internet connections. One teacher stated, "We have the will to use technology, but the resources and guidance are not there," underscoring the gap between their willingness to integrate technology and the lack of sufficient infrastructure. This reflects the broader challenge that inadequate technological resources pose to the effective implementation of TPACK, despite teachers' enthusiasm.

Insufficient training emerged as another significant barrier in the interviews. While some teachers had access to professional development programs, the quality and consistency of these programs varied greatly. Many teachers reported that training sessions were not tailored to their specific needs or content areas, which left them feeling ill-equipped to use technology effectively. The timing and duration of training programs also posed challenges, with several teachers noting that the demands of lesson planning and classroom management made it difficult to attend extended training sessions. These issues highlight the need for context-specific, flexible training programs that accommodate the diverse needs of teachers, particularly in settings with limited resources.

Despite these challenges, the interviews also revealed positive experiences where organizational support and collaboration played a crucial role in overcoming barriers to technology integration. Teachers who worked in schools with strong peer support networks and a collaborative culture were better able to navigate the difficulties of using technology in the classroom. As one teacher mentioned, "Our team approach to training sessions really helped us overcome initial challenges and explore new teaching strategies." This finding emphasizes the importance of collaborative learning environments, where teachers can share knowledge, discuss challenges, and learn from each other's experiences. Peer-to-peer support emerged as an effective strategy for overcoming resistance to change, fostering confidence in technology use, and enhancing teachers' TPACK proficiency.

The qualitative analysis revealed several key themes that influence the implementation of TPACK among teachers in Tripoli. One of the most frequently cited barriers was resource constraints. Teachers identified limited access to technology, including outdated hardware, unreliable internet connections, and insufficient software, as major obstacles to adopting technology in their classrooms. Schools in underfunded areas, particularly those with fewer financial resources, struggled to provide the necessary infrastructure for effective technology integration. These limitations hindered teachers' ability to design and deliver technology-enhanced lessons, as many digital tools required stable internet and updated devices. Teachers also expressed frustration with the lack of maintenance and repair services for existing technology, which often fell outside the school's budget. To address these challenges, the study suggests that investment in technological infrastructure, both hardware and software, is essential for the successful implementation of TPACK.

Another key theme was the importance of professional development in supporting TPACK adoption. Teachers who participated in well-designed, context-specific training programs were better able to integrate technology into their teaching practices. However, the inconsistency in the quality and availability of these programs was a concern. Many teachers expressed the need for training that was tailored to their specific content areas and the challenges they faced in their classrooms. The study emphasizes the need for ongoing professional development that covers both the technical skills required to use digital tools and the pedagogical strategies for integrating technology effectively. Structured, contextualized, and collaborative training programs are recommended to help teachers develop the necessary skills and confidence to implement TPACK.

The final theme involved cultural perceptions of technology and change. Resistance to adopting technology, particularly among senior teachers, was identified as a barrier. Many experienced educators expressed reluctance to incorporate technology, often due to a belief in the effectiveness of traditional teaching methods. Younger teachers appeared more open to adopting new technologies, highlighting a generational shift toward digital tools. To overcome these cultural barriers, the study recommends involving senior teachers in the change process and emphasizing the benefits of technology integration.

CONCLUSION AND RECOMMENDATIONS

This study provides valuable insights into the factors influencing the implementation of the TPACK (Technological Pedagogical Content Knowledge) framework among primary school teachers in Tripoli, Libya. The quantitative findings highlighted the critical role of organizational support, self-efficacy, and technological support in determining the success of technology integration in teaching practices. Teachers who had access to adequate resources, training, and peer support were more likely to develop high levels of TPACK proficiency and incorporate technology effectively into their lessons. In contrast, the qualitative findings shed light on the challenges faced by teachers, particularly the constraints related to resources and the insufficiency of training. However, positive experiences with collaborative learning and organizational support suggested that these barriers could be overcome. The study presents a comprehensive understanding of both the enabling factors and the obstacles that shape TPACK implementation, offering a foundation for recommendations to enhance its adoption in Tripoli.

One of the key findings of this study was the significant role that organizational support plays in TPACK adoption. Schools that provided adequate technological resources, such as computers, tablets, projectors, and reliable internet access, enabled teachers to integrate technology more easily into their teaching practices. Additionally, effective leadership that encouraged the use of technology and supported teachers through training and resources was associated with higher levels of TPACK proficiency. This finding underscores the importance of institutional commitment to providing both material and professional support for technology adoption. The study also showed that teachers who participated in regular professional development programs focused on technology integration performed significantly better in TPACK knowledge than those who lacked access to such programs. This highlights the need for schools to invest in ongoing, structured professional development opportunities that equip teachers with the skills they need to incorporate technology effectively into their classrooms.

Furthermore, the study revealed the mediating role of self-efficacy in the successful implementation of TPACK. Teachers who had higher levels of self-efficacy were more confident in using technology in their teaching and displayed a greater willingness to experiment with digital tools. These teachers tended to use technology to enhance student engagement by incorporating multimedia resources and interactive educational tools. Self-efficacy also influenced how teachers adapted technology to fit their pedagogical strategies, ultimately improving their overall TPACK proficiency. On the other hand, teachers with lower self-efficacy were more reluctant to adopt technology and often limited their use to basic, familiar applications. These findings reinforce the importance of teacher confidence in the successful integration of technology in the classroom, aligning with Bandura's (1997) work on self-efficacy and its influence on behavior.

The role of perceived usefulness and ease of use also emerged as a key factor in the study. Teachers who perceived digital tools as user-friendly and relevant to their pedagogical goals were more likely to adopt and use these tools in their teaching. This highlights the importance of designing educational technology that is intuitive and easy to integrate into existing teaching practices. When technology is easy to use and aligns with the pedagogical needs of teachers, its adoption becomes more feasible. Therefore, professional development programs should not only focus on developing technical skills but also on fostering an understanding of how technology can enhance teaching and learning. The ease of integration into existing teaching methods is crucial for ensuring that technology does not become an additional burden but a tool that supports pedagogical goals. In addition to these enabling factors, the qualitative analysis revealed several challenges that hindered TPACK implementation. One of the most frequently mentioned barriers was the limited access to technological resources. Teachers in schools with inadequate infrastructure, particularly in underserved areas, faced significant difficulties in integrating technology into their lessons. Limited access to functioning hardware, unreliable internet connections, and outdated software made it challenging for teachers to fully embrace the

TPACK framework. Teachers also noted that the maintenance and repair of technology often fell outside of the school's budget, which further exacerbated the problem. This finding suggests that investment in technological infrastructure is essential to overcoming the barriers posed by resource constraints. Schools must prioritize upgrading their hardware, software, and internet access to provide teachers with the tools they need to integrate technology effectively into their teaching practices.

Another significant barrier was the lack of sufficient and relevant training. Although some teachers had access to professional development programs, many expressed dissatisfaction with the quality and relevance of the training. Teachers reported that the training sessions were often too general, not tailored to their specific content areas or teaching contexts, and not aligned with the practical challenges they faced in the classroom. Moreover, the timing and duration of these training sessions often conflicted with teachers' busy schedules, making it difficult for them to attend. These findings suggest that professional development programs must be more context-specific, addressing the actual needs of teachers and focusing on the practical application of the TPACK framework in the classroom. Training should also be flexible, allowing teachers to participate at times that are convenient and feasible for them.

Despite these challenges, the qualitative analysis also highlighted positive experiences where collaboration and organizational support helped teachers overcome obstacles to technology integration. Teachers in schools with strong peer support networks and collaborative cultures reported more success in integrating technology into their classrooms. In these schools, teachers could share knowledge, discuss challenges, and learn from one another's experiences. Collaborative learning environments were particularly effective in building teacher confidence and competence in using technology. This finding underscores the importance of fostering a culture of collaboration among teachers, where they can support one another and share best practices for using technology in the classroom. Peer-to-peer support can play a crucial role in overcoming resistance to change and promoting the successful implementation of the TPACK framework.

To enhance the adoption of the TPACK framework among primary school teachers in Tripoli, several recommendations emerge from this study. First, tailored professional development programs should be designed to address the specific needs of teachers, with a focus on practical applications of the TPACK framework. These programs should emphasize hands-on learning experiences, ongoing support, and collaboration to help teachers build their confidence and competence in integrating technology into their classrooms. Furthermore, investment in technological infrastructure is crucial to overcoming the significant resource constraints that many schools face. Schools should prioritize improving hardware, software, and internet access to ensure that teachers have the tools they need to integrate technology seamlessly into their teaching practices.

Additionally, promoting collaboration among teachers is essential for the successful implementation of the TPACK framework. Schools should encourage collaborative learning approaches and provide opportunities for teachers to share knowledge and experiences. Addressing resistance to change, particularly among senior teachers, is another critical factor. Policymakers and administrators should involve senior teachers in the change process and demonstrate the benefits of technology integration through workshops, mentorship programs, and success stories. Finally, educational policies should align with the realities faced by teachers in the field, offering clear guidelines, support mechanisms, and funding to make technology adoption feasible and practical. By implementing these recommendations, educational stakeholders in Tripoli can create a supportive environment for the effective integration of technology, ensuring that the TPACK framework can be successfully adopted and sustained in primary schools.

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