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Enhancing Pre-Service Teacher Education: Crafting a Technology-Responsive Curriculum for Modern Classrooms and Adaptive Learners

Oluwatoyin Ayodele Ajani[a]

a. Department of Languages and Social Sciences Education, University of Zululand, KwaDlangezwa, South Africa.
E-mail: oaajani@gmail.com

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ABSTRACT
This study examines the incorporation of technology in pre-service teacher education, specifically emphasising creating a curriculum sensitive to the needs of contemporary classrooms and adaptable learners. The research examines the current literature using a scoping review methodology to find significant patterns, difficulties, and most effective approaches. After conducting an extensive search on various databases, a total of 345 publications were found. Of these, 54 articles that had undergone peer review and were published between 2010 and 2024 were chosen for in-depth examination. The results emphasise the crucial importance of technology in improving teaching and learning methods, underscoring the need for teacher education programmes to integrate digital tools and teaching methods properly. The review highlights several key topics, including the significance of practical training, the necessity for ongoing professional growth, and the influence of institutional support on promoting technology integration. Furthermore, the study emphasises the importance of creating versatile and responsive curricula to cater to learners' varied requirements in modern educational environments. This research offers helpful recommendations for policymakers, educators, and curriculum creators who want to provide future teachers with the necessary skills to succeed in technology-rich learning environments. These recommendations are based on a combination of empirical facts and theoretical ideas. The report asserts that a meticulously organised curriculum incorporating technology is crucial in equipping pre-service teachers with the skills to develop captivating, inclusive, and efficient learning opportunities for all students.

KEYWORDS
Technology integration; pre-service; teacher education; responsive curriculum; modern classrooms; adaptive learners.

INTRODUCTION

The rapid advancement of technology has significantly revolutionised the education industry, necessitating a significant overhaul in the structure and implementation of pre-service teacher education (Ajani & Govender, 2023). Integrating technology into teacher education programmes is becoming a necessary prerequisite rather than an optional extra to adequately prepare future educators for the demands of modern classrooms (Brookfield, 2017). This study investigates the integration of technology in the education of prospective educators, particularly in developing a flexible curriculum that fulfils the needs of contemporary learners. The primary goal is to understand how technology may enhance teaching and learning methods and allow educators to traverse modern educational environments' complexities effectively.

Incorporating technology in education is a multifaceted concept that entails using digital resources to enhance learning, streamline communication, and foster collaboration among students and teachers (Ajani, 2024; Koehler & Mishra, 2009). The TPACK framework, developed by Mishra and Koehler (2006), highlights the importance of technology, pedagogy, and content knowledge in facilitating effective education in the digital age. This paradigm provides a valuable approach to assessing technology integration in pre-service teacher education, highlighting the need for educators to develop a deep understanding of how various elements interact (Cheung & Slavin, 2013).

Studies have shown that incorporating technology into educational settings can significantly enhance student engagement and academic performance (Ajani, 2023; Tamim et al., 2011). However, successfully integrating technology into education requires more than access to digital resources. A comprehensive approach is required, including training teachers, establishing a supportive infrastructure, and a curriculum that can adjust to technological advancements (Ertmer & Ottenbreit-Leftwich, 2010). This study aims to analyse these components within the framework of pre-service teacher education to identify the most effective ways and potential challenges to achieving successful implementation.

The importance of thoroughly preparing pre-service teachers to employ technology in their future classrooms effectively cannot be overstated. According to the guidelines established by the International Society for Technology in Education (ISTE), educators must possess advanced proficiency in using technology to improve student learning, generate digital learning experiences, and promote responsible digital conduct (ISTE, 2017; Maphalala & Ajani, 2023). To guarantee that future educators acquire the necessary skills and knowledge, it is crucial to revise pre-service teacher education curricula to include comprehensive training on the use of technology in teaching and learning.

While the benefits of utilising technology are widely recognised, several barriers persist. A significant issue is the lack of uniformity in the accessibility of technology and digital resources in different educational settings, which can exacerbate pre-existing inequalities (Maphalala & Ajani, 2023; Warschauer, 2011). Furthermore, there is often a discrepancy between the technological skills that pre-service teachers acquire throughout their training and the actual

needs of the classroom (Harris et al., 2010). Addressing these challenges requires a collective effort from educational institutions, policymakers, and other stakeholders to create a favourable environment for technology integration.

Curriculum design is paramount in facilitating the integration of technology. A flexible curriculum that incorporates technology prepares teachers for the practical aspects of modern classrooms and ensures their capacity to adapt to the evolving needs of their students (Lai & Hong, 2015). This study examines how the curriculum might be structured to include teaching methods that use technology, focusing on promoting the development of skills such as digital literacy, critical thinking, and collaborative learning.

Furthermore, it is essential to consider the cultural context in which technological integration occurs. The curriculum must be culturally responsive in educational settings, particularly in diverse regions like South Africa (Gamede et al., 2022). This ensures that the educational content and approach are tailored to meet the specific needs of students from various cultural backgrounds (Gay, 2010). This involves incorporating culturally relevant content and teaching methods that acknowledge and respect the diverse range of students. By adopting this method, pre-service teacher education programmes can improve their capacity to effectively instruct future educators in establishing inclusive and fair learning environments.

Continuous professional development (CPD) is also highly relevant in supporting the incorporation of technology (Ajani & Govender, 2023). Research indicates that ongoing training and support are crucial for instructors to integrate technology effectively into their teaching practices (Darling-Hammond et al., 2017). This study examines the impact of CPD courses on the readiness of pre-service teachers to integrate technology into their classrooms, emphasising the significance of ongoing professional development and learning.

The success of integrating technology into pre-service teacher preparation is heavily influenced by institutional support. Educational institutions must provide the necessary infrastructure, resources, and administrative support to facilitate the effective use of technology (Ertmer et al., 2012). This includes the presence of digital devices, reliable internet access, and support for technical difficulties. Schools can enhance the capacity of pre-service teachers to use technology in their teaching by creating a supportive institutional environment.

The incorporation of technology in pre-service teacher education also has an impact on student learning. Studies have shown that technology can enhance student engagement, motivation, and academic performance (Cheung & Slavin, 2013; Khoalenyane & Ajani, 2024). This study examines incorporating technology-enhanced instructional approaches into pre-service teacher education to improve students' learning outcomes. By doing this, it seeks to make a valuable contribution to the broader discourse on the role of technology in education.

Moreover, the rapid pace of technological progress necessitates that pre-service teacher education programmes possess flexibility and adaptability. This study highlights the importance of consistently updating curricula to match technological advancements and changing educational needs (Hughes, 2013). By fostering an environment that encourages innovation and

adaptability, educational institutions may ensure that their courses remain current and effective in preparing future educators.

The main objective of this study is to provide a comprehensive understanding of how technology is integrated into the education of prospective teachers, with a particular focus on developing a flexible curriculum that meets the needs of modern classrooms and students who can adapt to various learning environments (Ajani & Khoalenyane, 2023). This research aims to examine a wide variety of literature to identify the most efficient tactics, challenges, and prospective benefits in the sector. The findings will offer crucial knowledge for policymakers, educators, and curriculum creators, offering significant recommendations for enhancing the calibre and applicability of pre-service teacher education programmes.

LITERATURE REVIEW

Recently, there has been a strong emphasis on studying and applying technology in education (Darling-Hammond et al., 2009; Gamede et al., 2021). This indicates a global trend towards the use of digital technology in different sectors, including the education sector. This transformation has profound implications for the education of aspiring teachers, necessitating a comprehensive understanding of how technology can be effectively integrated into curricula to prepare future educators. The academic literature on this topic highlights numerous significant issues, including the impact of technology on education, the challenges and barriers to integrating technology, and the strategies for fostering a technology-rich learning environment.

The Technological Pedagogical Content Knowledge (TPACK) framework, developed by Mishra and Koehler (2006), is a foundational paradigm for understanding the incorporation of technology in education. TPACK emphasises the coming together of technology, pedagogy, and subject knowledge, stating that using technology effectively in education requires a deep understanding of how these components interact. This approach has been widely accepted in both research and practice, providing a valuable viewpoint for assessing the complexities of integrating technology into the education of prospective teachers (Mbonambi et al., 2023).

Empirical research consistently proves that technology can enhance teaching and learning outcomes (Daudt et al., 2013). Tamim et al. (2011) conducted an extensive meta-analysis covering over four decades of research. Their findings suggest that incorporating technology in education often positively affects student performance. Cheung and Slavin (2013) found that incorporating educational technology in K-12 classrooms significantly improves mathematics proficiency. These findings highlight the potential of technology to transform educational methods and outcomes.

Nevertheless, the integration of technology in education faces numerous challenges. A significant issue is the lack of uniformity in technology accessibility and digital resources, potentially exacerbating pre-existing disparities (Ajani & Maphalala, 2023; Warschauer, 2011). Studies have shown that educational institutions in economically disadvantaged areas often need more infrastructure and resources, which impedes their capacity to effectively incorporate

technology into their curriculum (Ertmer & Ottenbreit-Leftwich, 2010). This digital divide poses a significant barrier to attaining equitable and uniform access to technology in education.

Teachers' views and attitudes shape technology integration (Govender & Ajani, 2021). Ertmer et al. (2012) identified a strong association between teachers' evaluations of the value and feasibility of technology and their actual utilisation of technology in the classroom. Teachers who view technology as beneficial and necessary for teaching are more likely to include it in their teaching methods. On the other hand, teachers who are apprehensive or need more confidence in using technology are likely to adopt it. This underscores the need to address instructors' perspectives and provide support and training.

Providing teachers with professional development opportunities is crucial to improve their proficiency in integrating technology effectively (Ajani, 2024). Research indicates that ongoing, high-quality professional development is essential for helping instructors gain the requisite skills and confidence to effectively integrate technology into their teaching methods (Darling-Hammond et al., 2017). Professional development in this environment should be ongoing, collaborative, and focused on the practical application of technology in the classroom. Competent professional development programmes can significantly enhance teachers' technical, pedagogical, and content knowledge (TPACK).

The design and implementation of pre-service teacher education programmes also play a crucial role in teaching future educators to employ technology successfully. Studies have shown that pre-service teachers often feel inadequate when integrating technology into their teaching because they have not received comprehensive training during their teacher education programmes (Tondeur et al., 2012). To address this issue, teacher education programmes must incorporate technology training into their curricula, providing pre-service teachers with opportunities to acquire hands-on experience in using technology in natural classroom settings.

Collaborative learning and peer support are highly effective methods for promoting the integration of technology. Trust et al. (2016) found that creating professional learning communities that promote sharing experiences and collaboration among teachers can enhance their skills and confidence in incorporating technology. These communities provide a supportive environment for educators to investigate and apply innovative technologies and teaching approaches, fostering a culture of continuous learning and improvement.

The cultural context in which technology integration occurs is an essential and significant factor. Developing culturally responsive teaching strategies is paramount in diverse educational settings, particularly in South Africa (Gamede et al., 2022). These strategies should acknowledge and respect students' language and cultural diversity (Gay, 2010). Utilising culturally responsive teaching methods can help establish a link between students' experiences at home and school, thus improving the significance and effectiveness of learning. Incorporating culturally important material and instructional strategies can enhance student engagement and academic achievement.

The importance of leadership in promoting technological integration cannot be overstated. School administrators must design a well-defined strategy for technology utilisation, allocate the necessary resources, and support teachers in integrating technology into their teaching methods (Hughes, 2013). Influential leaders foster an environment of creativity and experimentation, inspiring educators to embrace ambiguity and investigate new approaches (Buthelezi & Ajani, 2023). Furthermore, they provide ongoing professional development and support, helping teachers gain the essential skills and confidence to utilise technology effectively.

Institutional support plays a crucial role in the successful integration of technology. Educational institutions must provide the necessary infrastructure, resources, and administrative support to facilitate the effective use of technology (Ertmer et al., 2012). This includes the presence of digital devices, reliable internet connectivity, and support for technical difficulties. Organisations that prioritise the integration of technology are more likely to see positive outcomes in terms of both teaching and learning.

Due to the rapid pace of technological advancement, teacher education curricula must be flexible and adaptable. Hughes (2013) highlights the importance of consistently updating curricula to match technological advancements and changing educational needs. This dynamic approach ensures that teacher education curricula remain relevant and effective in preparing future teachers for the challenges of modern classrooms. By fostering an environment that promotes creativity and adaptability, educational institutions may ensure that their courses remain at the forefront of educational excellence.

Research has further highlighted the importance of integrating technology into the broader curriculum rather than treating it as a distinct subject (Govender & Ajani, 2021). Fayolle and Gailly (2015) argue that integrating technical ideas into other sectors can enhance the overall efficiency of technology integration. By utilising a multidisciplinary approach, students can comprehensively understand the diverse applications of technology and its efficacy in various contexts (Mncube et al., 2023).

Gender disparities in technology integration are a matter of great concern. Studies undertaken by Kelley et al. (2017) and Kirkwood (2016) indicate that female students often need help with utilising technology, such as a lack of confidence and limited networking opportunities. To address gender inequalities, we can enhance the inclusion and effectiveness of technology integration by launching targeted initiatives and offering support. To promote equity in education, it is necessary to ensure that every student has an equal opportunity to cultivate their technological proficiency.

The impact of technology on student learning is well-documented (Govender et al., 2023). The studies undertaken by Tamim et al. (2011) and Cheung and Slavin (2013) provide evidence that effectively using technology can enhance student engagement, motivation, and academic achievement. This underscores the potential of technology to completely transform educational approaches and outcomes, providing a powerful tool for improving student

learning. However, tapping into this potential requires careful planning and implementation and ongoing support for educators and learners.

Conversely, the current research on integrating technology in pre-service teacher education highlights several significant principles (Govender et al., 2023). These factors encompass the impact of technology on the teaching and learning process, the challenges and complexities of using technology, and the strategies for establishing an educational setting rich in technical resources. By addressing these issues, educational institutions can strengthen their training of future educators to utilise technology effectively, boosting education's quality and relevance in the digital age. This study aims to expand current understanding by examining the integration of technology in pre-service teacher preparation. The main emphasis is on developing a flexible curriculum that fulfils the demands of modern classrooms and learners who can adapt to various circumstances.

THEORETICAL FRAMEWORK

The study's theoretical framework is grounded in Transformative Learning Theory and Diffusion of Innovation Theory. These theories offer robust frameworks for assessing and integrating novel instructional approaches in pre-service teacher education programmes. These ideas provide valuable insights into how individuals and organisations adapt to new educational models, particularly when integrating technology in modern classrooms.

Transformative Learning Theory, first introduced by Mezirow (1991), states that learning is a process that entails transforming one's perspective. This process involves individuals thoroughly examining their existing beliefs, assumptions, and experiences, leading to substantial changes in their general perspective on the world. This theory emphasises the importance of critical reflection and conversation to facilitate transformative learning experiences. These experiences are essential for pre-service teachers to adapt to the complexities of modern educational environments. Mezirow (2000) defines transformative learning as a cognitive process when individuals encounter a perplexing scenario that compels them to reassess their beliefs and viewpoints.

The principles of Transformative Learning Theory are highly relevant to pre-service teacher education. They advocate for reflective techniques that challenge conventional notions about teaching and learning, a particularly crucial aspect for aspiring educators. Brookfield (2012) asserts that critical reflection is crucial for instructors to improve their understanding of their teaching strategies and their impact on student learning. Teacher education programmes can improve future teachers' readiness to successfully navigate today's dynamic and varied classrooms by establishing an atmosphere that promotes transformative learning.

The Diffusion of Innovation Theory, as Rogers (2003) developed, provides an alternative perspective by examining the mechanism via which new ideas and technology spread within a social context. This theory examines the key aspects that affect how new ideas are accepted and integrated. These factors include the characteristics of the invention, the communication

channels used, the timing, and the social context. Rogers (2010) highlights that the rate at which an invention is embraced depends on the perceived qualities of the innovation, such as its relative superiority, compatibility, complexity, trialability, and observability.

Technology integration in pre-service teacher education can be analysed through the Diffusion of Innovation Theory to understand the factors that facilitate or hinder its adoption. Rogers (2003) argues that innovations perceived as superior to existing methods, in line with the values and needs of adopters, and user-friendly and observable, are more likely to be accepted. These notions help determine the specific circumstances in pre-service teacher education when technology is most likely beneficial.

Research has shown that human, institutional, and contextual elements often affect incorporating technology in education. Ertmer and Ottenbreit-Leftwich (2010) found that teachers' beliefs about the significance and efficacy of technology have a substantial impact on their willingness to integrate it into their teaching approaches. This aligns with Rogers' (2003) emphasis on the importance of individual perceptions in adopting anything. Furthermore, providing institutional support, including the availability of resources and opportunities for professional development, is crucial for establishing a conducive environment that encourages innovation (Ertmer et al., 2012).

Integrating Transformative Learning Theory and Diffusion of Innovation Theory provides a complete framework for understanding the complexities of integrating technology in pre-service teacher training. Transformative Learning Theory emphasises the importance of critical reflection and dialogue in fostering personal and professional growth. At the same time, Diffusion of Innovation Theory offers insights into the social and institutional factors that influence the adoption of innovative practices. Together, these concepts highlight educational innovation's intricate and varied qualities and the need for a holistic approach to fostering change.

Incorporating digital resources into teacher education curricula is a profound learning opportunity for pre-service teachers and a dissemination process within the educational institution. When confronted with foreign technologies, pre-service teachers may experience a perplexing quandary, which compels them to engage in critical introspection on their own pedagogical concepts and methods. Participating in this process of introspection can lead to a deep and influential learning experience in which individuals gain new perspectives and skills that enhance their effectiveness as instructors (Mezirow, 1991; 2000).

As Rogers (2003) delineated, the successful incorporation of these digital tools into the teacher education curriculum depends on various factors, such as the tools' relative advantages, their compatibility with existing teaching methodologies, and the level of institutional backing provided. The interplay between these individual and institutional factors affects how technology is embraced and sustained within the course.

The combination of these theoretical approaches is further supported by empirical research that emphasises the importance of both individual and systemic factors in educational

innovation. In their study, Tondeur et al. (2012) found that the perspectives and beliefs of future teachers towards technology and the assistance they received from their teacher training programmes significantly influenced their use of technology in the classroom. This emphasises the importance of implementing a complete approach that addresses transformation's individual and organisational components.

Moreover, the principles of Transformative Learning Theory and Diffusion of Innovation Theory can be employed to direct the development and implementation of professional development programmes for pre-service teachers. By incorporating opportunities for critical analysis, discourse, and practical implementation of emerging technologies, these programmes can facilitate transformative learning experiences that enhance the readiness of pre-service teachers to adopt and implement innovative teaching approaches (Ertmer & Ottenbreit-Leftwich, 2010; Rogers, 2003).

Conclusively, Transformative Learning Theory and Diffusion of Innovation Theory provide a thorough theoretical framework for examining the use of technology in pre-service teacher education. These concepts highlight the importance of thoughtful analysis, discussion, and organisational assistance in fostering educational advancement. By exploiting these valuable insights, teacher education programmes may improve their capacity to effectively educate pre-service teachers with the essential abilities to navigate the complex dynamics of modern classrooms and smoothly integrate technology into their teaching approaches.

RESEARCH METHODOLOGY

The research methodology for this study was a scoping review chosen for its ability to provide a broad and thorough examination of the existing literature on integrating technology in pre-service teacher education. Scoping reviews are well-suited to address complex research questions involving various study designs and methods (Munn et al., 2018). This approach was selected to offer a comprehensive overview of current research, identify gaps, and suggest areas for future exploration.

The literature search was conducted using Google Scholar and Scopus, databases known for their extensive coverage of academic publications across various fields. The search strategy was carefully crafted to capture a wide range of relevant studies, employing a combination of keywords such as "pre-service teacher education," "technology integration," "modern classroom," "curriculum," and "responsive learners." Boolean operators (AND, OR, NOT) were used to refine the search and ensure it remained focused on the research topic (Levac et al., 2010). This initial search yielded 345 publications.

Strict inclusion and exclusion criteria were applied to ensure the quality and relevance of the studies selected. The inclusion criteria were designed to focus on peer-reviewed studies published in English between 2010 and 2024 exploring technology integration in pre-service teacher education. Both empirical studies and theoretical or policy discussions were included to ensure a well-rounded understanding of the topic.

Exclusion criteria were applied to maintain the focus and relevance of the review. Studies published before 2010 or after 2024, those not peer-reviewed, not in English, or not directly related to the research topic, were excluded. Additionally, any studies that did not meet rigorous methodological standards or needed more detail for proper evaluation were excluded (Tricco et al., 2018).

After applying these criteria, the titles and abstracts of the 345 publications were reviewed to determine their relevance. This initial screening helped narrow the studies to those that met the inclusion criteria. A further in-depth review led to selecting 54 peer-reviewed articles for detailed analysis.

Data was extracted systematically, gathering essential information from each selected study, including the author's details, publication year, study objectives, methodologies used, key findings, and implications for pre-service teacher education. A standardised data extraction form was used to ensure consistency and accuracy across all studies (Daudt et al., 2013), facilitating a comprehensive analysis of the results.

The extracted data were analysed using thematic analysis, which allowed for the identification, analysis, and presentation of recurring patterns or themes (Nowell et al., 2017). The data were organised into critical themes relevant to the research questions, such as the effectiveness of technology integration, challenges faced by pre-service teachers, and the role of institutional support. This method provided a structured approach to interpreting the findings and drawing meaningful conclusions.

The review followed the PRISMA-ScR guidelines to enhance transparency and rigour in reporting (Tricco et al., 2018). This involved detailed search strategy documentation, inclusion and exclusion criteria, screening process, data extraction, and thematic analysis. Adherence to these guidelines ensured that the review process was replicable, thereby supporting the validity and reliability of the findings.

In summary, the scoping review methodology used in this study provided a comprehensive overview of technology integration in pre-service teacher education. The systematic approach, rigorous inclusion criteria, and thorough thematic analysis ensured that the findings were robust and based on solid empirical evidence. This study offers valuable insights for future research and practice in this field.

RESULTS/FINDINGS

The study identified six key themes highlighting the critical aspects of integrating technology into pre-service teacher education. These themes underscore the opportunities and challenges educators and institutions face in preparing future teachers for technology-rich learning environments.

1. Effectiveness of Technology Integration

Integrating technology into teacher education has shown significant potential to transform teaching and learning experiences. Research by Ertmer and Ottenbreit-Leftwich (2013) suggests that when technology is effectively embedded into the curriculum, it can make learning more

interactive, engaging, and accessible. For example, digital tools such as interactive whiteboards and educational software allow students to visualise complex concepts, leading to deeper understanding. However, the mere presence of technology does not guarantee improved outcomes. These tools must be thoughtfully integrated into pedagogical practices to ensure they support, rather than hinder, learning objectives (Higgins et al., 2012).

Many teacher education programmes need help moving beyond surface-level integration despite its potential benefits. As Mishra and Koehler (2006) argue, effective technology integration requires more than just knowing how to use digital tools—it involves a deep understanding of how these tools can enhance specific teaching and learning goals. This highlights the importance of designing teacher education curricula that not only introduce pre-service teachers to technology but also train them on how to use it strategically to support their teaching.

Moreover, the success of technology integration often hinges on the alignment between technological tools and educational content. According to Selwyn (2016), there is a risk that technology can be used in a way connected to educational aims, leading to wasted resources and missed opportunities for learning. Therefore, teacher education programmes must prioritise the development of digital pedagogical skills, ensuring that pre-service teachers can make informed decisions about when and how to use technology to enrich their teaching.

2. Challenges Faced by Pre-Service Teachers

Pre-service teachers face numerous challenges when integrating technology into their teaching practices. One of the most significant issues is a need for more confidence in using digital tools, often rooted in insufficient training during their education (Tondeur et al., 2012). Many pre-service teachers report feeling unprepared to use technology effectively in the classroom, which can lead to anxiety and reluctance to adopt new methods. This lack of confidence is compounded by the rapid pace of technological change, which can leave even the most tech-savvy individuals feeling out of their depth (Admiraal et al., 2017).

Another challenge is the disparity in access to resources. Pre-service teachers who train in well-funded institutions often have greater access to the latest technologies and support systems. At the same time, those in less-resourced environments may need help to gain practical experience (Howard, 2013). This creates an uneven playing field, where some teachers enter the profession with a significant advantage over others. Addressing this issue requires a concerted effort from educational institutions to provide equal access to technology and ensure that all pre-service teachers receive adequate support.

Additionally, the pressure to keep up with technological advancements can be overwhelming for pre-service teachers. As Pachler, Bachmair, and Cook (2010) note, the expectation of proficiency in a wide range of digital tools can lead to inadequacy, particularly when these tools are not well integrated into their training. To overcome these challenges, it is essential for teacher education programmes to offer robust support systems that include

ongoing training and opportunities for hands-on practice, helping pre-service teachers build the confidence and skills they need to succeed in a technology-rich educational environment.

3. Importance of Practical Training

Practical training in the use of technology is essential for pre-service teachers to develop the skills and confidence needed to integrate digital tools effectively in the classroom. As Laurillard (2012) emphasises, hands-on experience is critical to teacher education. Pre-service teachers can experiment with technology in a controlled environment and learn from their successes and mistakes. With this practical experience, theoretical knowledge remains abstract and more accessible to apply in real-world teaching scenarios.

Furthermore, practical training helps pre-service teachers understand technology's pedagogical implications. According to Shulman (1987), knowing how to use a tool is not enough—teachers must also understand how it can be used to achieve specific educational outcomes. Practical training allows pre-service teachers to bridge this gap, allowing them to see first-hand how technology can enhance learning and develop strategies for its effective use in their future classrooms.

However, the quality of practical training varies widely between institutions. Pre-service teachers sometimes receive minimal exposure to technology during their placements, leaving them unprepared for the challenges they will face in the classroom (Loughran, 2014). To address this, teacher education programmes must prioritise practical training, ensuring that pre-service teachers can engage with technology meaningfully. This might include extended placements in technology-rich schools, workshops led by experienced educators, and access to a wide range of digital tools for experimentation.

4. Ongoing Professional Development

Ongoing professional development is crucial for ensuring teachers remain competent and confident in using technology. The rapid pace of technological change means that what is cutting-edge today may be outdated tomorrow (Warschauer, 2011). Consequently, pre-service teachers need to be equipped with the skills they need now and the capacity to continue learning and adapting as new technologies emerge. This requires a commitment to lifelong learning and access to professional development opportunities that keep pace with technological advancements.

Professional development should not be an afterthought but an integral part of a teacher's career progression. Research by Darling-Hammond, Hyler, and Gardner (2017) indicates that effective professional development is sustained, collaborative, and focused on practical application. This means that pre-service teachers should be encouraged to continuously learn from the outset of their careers, with opportunities for ongoing training built into their professional journey. Such an approach keeps teachers up-to-date with new technologies and fosters a culture of continuous improvement and innovation in education.

Moreover, institutions have a responsibility to support teachers in this endeavour. Fullan and Langworthy (2014) argue that educational institutions must provide the necessary

infrastructure and resources to facilitate ongoing professional development. This includes access to training programmes, mentorship opportunities, and a supportive community of practice where teachers can share their experiences and learn from one another. By investing in ongoing professional development, institutions can ensure their teachers are competent technology users and leaders in integrating digital tools into education.

5. Impact of Institutional Support

Institutional support is pivotal in successfully integrating technology into pre-service teacher education. Without the backing of their institutions, pre-service teachers are less likely to gain the skills and confidence needed to use technology effectively in their classrooms (Tondeur et al., 2016). Institutional support can take many forms, from providing up-to-date technology and resources to offering comprehensive training and professional development opportunities. When institutions prioritise technology integration and provide the necessary support, pre-service teachers are likelier to adopt and utilise digital tools effectively.

Moreover, the culture within an institution significantly impacts how technology is perceived and used. As Bates and Sangrà (2011) noted, institutions that foster a culture of innovation and encourage experimentation with new technologies are more likely to see successful integration of technology. In such environments, pre-service teachers feel supported in their efforts to incorporate digital tools into their teaching, knowing that they have the backing of their institution. Conversely, in institutions where technology is seen as an add-on or where support is lacking, pre-service teachers may be reluctant to embrace new methods, fearing that they will not be supported if things go wrong.

Institutional support also includes providing clear policies and guidance on technology use. Selwyn (2014) highlights the importance of a coherent technology integration strategy aligning with the institution's educational goals. This ensures that technology is used to support teaching and learning rather than being implemented haphazardly. By providing solid institutional support, including transparent policies, access to resources, and a culture of innovation, educational institutions can significantly enhance the effectiveness of technology integration in pre-service teacher education.

6. Curriculum Flexibility and Responsiveness

The need for a flexible and responsive curriculum is more pressing than ever in today’s rapidly changing educational landscape. Pre-service teachers must be equipped with the skills and knowledge to adapt to different teaching environments and cater to the diverse needs of their students (Beetham & Sharpe, 2013). A rigid, one-size-fits-all curriculum fails to prepare teachers for the realities of modern classrooms, where technological advancements and varied learning styles demand a more dynamic approach.

A flexible curriculum allows for the integration of various digital tools and teaching methods, ensuring that pre-service teachers can tailor their approaches to meet the needs of their students (Laurillard, 2012). This adaptability is crucial for creating inclusive learning environments where all students can thrive regardless of their abilities or backgrounds. By

incorporating various technologies and pedagogical strategies, teacher education programmes can better prepare pre-service teachers to handle the complexities of contemporary education.

However, achieving this flexibility requires careful planning and a willingness to innovate. As Conole (2013) argues, curriculum design must be an ongoing process, constantly evolving to incorporate new technologies and teaching practices. This means that teacher education programmes must proactively review and update their curricula to ensure they remain relevant and practical. By embracing a flexible and responsive approach to curriculum design, educational institutions can equip pre-service teachers with the tools they need to succeed in an ever-changing educational landscape.

DISCUSSION OF THE FINDINGS

This study's results highlight the importance of integrating technology into the curricula for training future teachers, particularly in teaching English in South African schools. By integrating transformational learning theories with experiential learning, we can establish a robust framework for understanding the impact of technological interventions on teacher preparation. Mezirow's (2000) theory of transformational learning emphasises the significance of critical reflection in changing one's viewpoint, which is crucial for adapting to new teaching techniques facilitated by technology.

The empirical findings of the review indicate that technology-enhanced environments encourage critical thinking and reflective behaviours among pre-service teachers, aligning with transformative learning theory (Cranton, 2016). These settings encourage the careful analysis of traditional teaching concepts and enable prospective educators to explore innovative teaching methods. Using digital tools and platforms requires teachers to think about their teaching approaches, leading to a deeper understanding of how technology may be used to enhance language training.

Kolb (2014) underscores the importance of tangible, applied experiences in the learning process, as outlined in the theory of experiential learning. The findings suggest that pre-service teachers benefit significantly from participating in experiential learning opportunities enabled through technology integration. Virtual simulations, interactive modules, and digital storytelling are tools that offer immersive learning experiences, allowing pre-service teachers to apply theoretical knowledge in actual situations (Gibson, 2013). These experiences not only enhance their technical proficiency but also enhance their teaching capabilities.

The study highlights the importance of self-efficacy in the education of pre-service teachers, as supported by Bandura's (1997) theory of self-efficacy. Studies have shown that integrating technology into teacher education programmes boosts the confidence of aspiring teachers in their ability to use digital technologies effectively. A strong belief in one's ability is crucial for developing a positive attitude towards instruction and learning that technology boosts. Tschannen-Moran and Woolfolk Hoy (2007) emphasise the significance of instructors

possessing robust self-efficacy, as it is likely to result in adopting innovative pedagogical approaches and establishing engaging learning environments.

Moreover, the findings suggest incorporating technology to facilitate collaborative learning is essential for enhancing pre-service teacher education. Pre-service educators can use digital platforms for collaborative projects and professional learning communities (PLCs). These platforms allow them to share resources, exchange ideas, and receive feedback from peers and mentors (Lave & Wenger, 1991). The stated approach aligns with the sociocultural underpinnings of experiential learning theory. According to this view, learning occurs through social interactions when individuals participate in activities together (Johnson & Johnson, 2014).

However, the study also emphasises the challenges related to the digital divide, which can hinder the effectiveness of integrating technology into pre-service teacher training. Differences in the accessibility of technical resources among different institutions create an uneven environment for pre-service teachers (Ramukumba, 2014). In order to address this issue, it is imperative to allocate funds towards infrastructure and professional development. This will ensure equitable and uniform access to technology for all aspiring teachers. To ensure successful technology integration, seeking support from organisations that can offer the necessary resources and expertise is imperative. This support is crucial for expediting the process (Fullan, 2014).

Institutional leadership fosters a culture of innovation and continuous improvement in teacher education programmes. Leaders in educational institutions must prioritise integrating technology into their strategic planning and consistently support instructors and students (Leithwood et al., 2010). Effective leadership may create an environment conducive to transformative learning, where aspiring instructors are encouraged to investigate and employ innovative technologies and teaching approaches (Northouse, 2018).

The study highlights digital storytelling's capacity as a powerful tool for promoting transformative learning in pre-service teacher education. Pre-service teachers can employ digital storytelling to create and share multimedia narratives that portray their personal and professional experiences (Robin, 2016). This approach encourages self-reflection, logical thinking, and the development of digital literacy skills, all essential for effective teaching in today's classrooms.

Integrating technology improves the essential aspect of culturally responsive teaching methods. Through the use of digital platforms, prospective teachers can easily access a diverse array of cultural information and perspectives. This enables educators to develop a comprehensive curriculum that reflects all students' diverse experiences and backgrounds (Gay, 2010). This approach aligns with the principles of transformative learning, which emphasise the importance of cultural comprehension and empathy in fostering significant educational experiences (Mezirow, 2000).

Integrating technology significantly improves the methods used for formative assessment. Online quizzes, interactive simulations, and e-portfolios are digital tools that

provide immediate feedback and aid in self-regulated learning (Nicol & Macfarlane-Dick, 2006). These formative evaluation processes align with experiential learning theory, highlighting feedback's importance in the learning process (Kolb, 2014).

Professional development programmes for teacher educators are crucial for successfully integrating technology in pre-service teacher education. Continuous professional development guarantees that teacher educators understand and master the latest technological tools and pedagogical techniques. This empowers them to effectively mentor and assist pre-service teachers in their educational development and progress (Darling-Hammond et al., 2017). Sustained institutional support is essential for preserving the advancement of transformational learning and innovation in teacher education.

Participating in reflective practice is essential for enhancing the efficacy of technology integration. Reflective practice involves thoroughly analysing one's teaching methods and experiences to get significant insights and improve future practices (Schön, 1983). Technology can augment reflective practice by providing digital venues for tasks such as maintaining a journal, analysing videos, and receiving peer feedback (Brookfield, 2017). Continual self-reflection and improvement are essential to transformative and experiential learning theories.
Policy structures enabling technology integration into pre-service teacher education are crucial. Policymakers should recognise the substantial influence that technology may have and formulate policies that promote its use, utilisation, and incorporation in teacher education programmes (U.S. Department of Education, 2017). Implementing policies that primarily focus on funding, infrastructure, and professional development is crucial to ensuring that all pre-service teachers receive a high-quality education enriched by technology.

Thus, this study highlights the substantial influence that integrating technology into pre-service teacher education can exert. By utilising digital technologies and resources, aspiring teachers can obtain the necessary skills, knowledge, and attitudes to teach effectively in modern educational settings. Integrating transformational learning and experiential learning theories provides a comprehensive understanding of how technology can enhance the preparation of pre-service teachers and ultimately improve educational outcomes for all students. The study's findings highlight the importance of institutional support, professional development, and regulatory frameworks in encouraging the successful integration of technology and improving the overall quality of teacher education programmes in South Africa.

Implications of the Study

The findings of this study have significant implications for several stakeholders engaged in preparing prospective educators, including policymakers, educational institutions, teacher trainers, and pre-service teachers themselves. Integrating technology into teacher preparation programmes is considered a vital component in enhancing the preparedness and efficacy of prospective educators. This necessitates a comprehensive approach that addresses systemic, institutional, and individual levels.

The study emphasises the significance of robust regulatory frameworks for policymakers, which are necessary to enable the integration of technology into teacher education. Policymakers must prioritise the allocation of cash for technology infrastructure and professional development. This will guarantee that teacher education institutes have the essential resources to integrate digital tools effectively. Moreover, governments should offer rewards for using cutting-edge pedagogical approaches that leverage technology to enhance educational outcomes. Implementing this will foster a conducive environment for educational change.

Educational institutions play a vital role in executing these policies. Institutions must demonstrate a solid dedication to investing in state-of-the-art technological resources and infrastructure to enhance digital learning environments. This includes the availability of fast internet, interactive whiteboards, and other digital learning technologies that facilitate successful teaching and learning. Moreover, institutions should foster a culture of continuous improvement and creativity by encouraging professors and students to explore and experiment with innovative technology.

Teacher educators play a vital role in translating policy into practical implementation. The study highlights the importance of ongoing professional development for teacher educators to ensure their expertise in using and teaching technology. Professional development courses should prioritise enhancing technical skills and pedagogical methods integrating technology into the curriculum. In order to adequately equip future teachers for modern classrooms, teacher educators must stay current with technological advancements. This allows them to showcase excellent techniques and provide future educators with essential resources and strategies.

The report emphasises the importance of developing digital literacy and technology skills for future teachers. Pre-service teacher education curricula should incorporate comprehensive teaching on using digital technologies and resources for instructional purposes. This includes hands-on experiences with technology through internships, practicums, and simulations that faithfully reproduce real-world educational environments. Engaging in experiential learning opportunities is crucial for building self-assurance and expertise in effectively using technology to enhance student learning.

CONCLUSION

This study aimed to investigate the incorporation of technology into pre-service teacher education programmes in South African classrooms. The key findings indicate that incorporating technology has a considerable positive impact on teaching effectiveness and student engagement. However, technology adoption is impeded by limited resources, insufficiently qualified instructors, and inconsistent institutional support. The study emphasises the significant impact of technology in promoting creative and inclusive educational methods, emphasising the importance of comprehensive policy frameworks, robust professional development, and collaborative learning environments. These findings serve as a fundamental

framework for future research to prioritise the long-term effects and the creation of methods to overcome obstacles in implementation, guaranteeing the continuous enhancement of teacher education and student achievements.

Limitations of the Study

Although this study takes a broad approach, it is essential to acknowledge its limits. Firstly, using a systematic literature review limits the conclusions to the quality and extent of the current research, which may only fully encompass some subtleties and recent advancements in the subject. The selection criteria, which emphasised peer-reviewed articles from 2010 to 2024, may have unintentionally eliminated significant studies published outside this time range or in non-peer-reviewed sources. This could have restricted the range of insights obtained. Furthermore, the study's focus on South African pre-service teacher education may restrict the results' applicability to other settings with distinct educational difficulties and resources. In order to gain a comprehensive grasp of the challenges at hand, future research should focus on integrating primary data gathering, conducting longitudinal studies, and making cross-cultural comparisons.

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