

Teachers' Competencies in Digital Integration of Learning Contents in Dynamic Classroom Practices: A Review of Teacher Professional Development Needs

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Received: April 2, 2024; received in revised form: May 6, 2024; accepted: May 7, 2024

Abstract:

Introduction: Integrating digital tools and resources into classroom instruction has become increasingly essential in modern education. As technology advances, teachers face the challenge of effectively integrating digital learning content into dynamic classroom practices. This paper explores the competencies teachers require for this task, aiming to contribute to understanding teacher professional development needs in digital integration.

Purpose: This study aims to investigate the competencies required by teachers for the successful integration of digital tools and resources into classroom practices.

Methods: A comprehensive literature review was conducted using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) diagram flow to address this aim. A total of 84 articles published from 2000 to 2024 were systematically reviewed, focusing on publications in English that addressed the professional development of teachers, technology integration into classroom practices, and digital competencies. Articles that did not meet these criteria were excluded from the analysis.

Results: The synthesis of findings from the literature review highlighted the knowledge base of teachers' professional development needs in digital integration. The review identified critical competencies for successful digital integration, including technological proficiency, pedagogical knowledge, and content expertise. Additionally, theoretical frameworks such as Technological Pedagogical Content Knowledge (TPACK) and the SAMR model guided the exploration of teachers' competencies and their implications for instructional practices.

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Discussion: The implications of the study's findings extend to educational policy, teacher training programs, and classroom practices. By identifying critical competencies for successful digital integration, this study provides insights into areas for further research and teacher professional development. Moreover, the discussion delves into how these findings can inform the design of effective teacher training programs and support the development of pedagogical practices that leverage digital tools to enhance student learning outcomes.

Limitations: Despite the thoroughness of the literature review process, it is essential to acknowledge certain limitations. The study focused primarily on articles published in English, potentially excluding relevant research published in other languages. Additionally, while the PRISMA diagram flow facilitated a systematic review, some relevant articles may need to be noticed.

Conclusions: In conclusion, this study contributes to understanding teacher competencies required for effective digital integration of learning contents in dynamic classroom practices. The study identifies critical competencies and highlights areas for further research and teacher professional development by synthesising findings from relevant empirical studies and theoretical contributions. Ultimately, the findings have implications for educational policy, teacher training programs, and instructional practices to enhance student learning outcomes in the digital age.

Key words: teachers' competencies, digital integration, classroom practices, professional development, learning contents.

Introduction

In their study, Maphalala and Ajani (2024) argue that in contemporary educational landscapes, the infusion of digital technologies has revolutionised teaching and learning paradigms, necessitating a paradigm shift in educators' competencies. The dynamic nature of today's classrooms demands that teachers possess a diverse skill set to effectively integrate digital learning content into their instructional practices (Chai et al., 2018). The research underscores the pivotal role of teachers in leveraging digital tools to enhance student engagement, collaboration, and critical thinking skills (Lai & Bower, 2019). However, evidence suggests that many educators face challenges in acquiring and applying the requisite competencies for effective digital integration (Ertmer et al., 2012). This study aims to undertake a comprehensive review of existing literature to elucidate the multifaceted nature of teachers' competencies in the digital integration of learning contents within dynamic classroom settings, specifically focusing on identifying professional development needs in this area. The integration of digital technologies into education has been propelled by technological advancements and a growing recognition of its potential to transform teaching and learning processes (Mishra & Koehler, 2006; Angeli &

Valanides, 2009). As classrooms evolve into digitally rich environments, teachers must adeptly navigate many digital tools and resources to facilitate meaningful learning experiences (Koehler & Mishra, 2009; Chigona et al., 2018). However, the effective integration of technology hinges on technical proficiency, pedagogical innovation, and content knowledge (Hughes et al., 2006). The Technological Pedagogical Content Knowledge (TPACK) framework provides a conceptual lens for understanding the intersection of these domains. It emphasises the importance of teachers' ability to integrate technology seamlessly into instructional practices (Mishra & Koehler, 2006; Finger & Houguet, 2012).

Furthermore, the SAMR (Substitution, Augmentation, Modification, and Redefinition) model offers a hierarchical framework for evaluating the depth of technology integration in classrooms. By moving beyond the mere substitution of traditional tools with digital alternatives, educators can reimagine learning tasks and transform pedagogical practices to achieve higher levels of engagement and innovation (Puentedura, 2006). Theoretical frameworks such as TPACK and SAMR provide valuable insights into the competencies teachers require to navigate the complexities of digital integration in dynamic classroom environments.

Despite the proliferation of digital technologies in education, research indicates that many teachers need help effectively integrating these tools into their instructional practices (Ertmer et al., 2012; Ajani, 2023). Factors contributing to this challenge include inadequate access to technology, limited training opportunities, and a lack of institutional support (Kay, 2006). Additionally, resistance to change and fear of technology may impede teachers' willingness to embrace digital integration (Ertmer et al., 2012). Addressing these barriers requires a concerted effort to provide comprehensive professional development that equips teachers with the necessary competencies to leverage digital tools effectively.

Effective digital integration in education requires teachers to possess various competencies, including technological proficiency, pedagogical flexibility, and a deep understanding of subject matter content (Koehler & Mishra, 2009; Ajani & Govender, 2021). Technological proficiency encompasses selecting, evaluating, and utilising appropriate digital tools to support diverse learning needs and enhance student engagement (Mishra & Koehler, 2006). Pedagogical flexibility entails adapting instructional strategies to leverage digital technologies' affordances while focusing on learning objectives and student outcomes (Hughes et al., 2006). Additionally, teachers must align digital learning activities with curriculum standards and assessment practices to ensure coherence and rigour in instruction (Lai & Bower, 2019).

However, integrating digital technologies into education has profound implications for teaching and learning practices (Gibson & Oberg, 2020). As classrooms evolve into digitally rich environments, educators face the challenge of acquiring and applying the competencies required for effective digital integration. Theoretical frameworks such as TPACK and SAMR offer valuable insights into the multifaceted nature of teachers' competencies in this domain. However, addressing barriers to digital integration and providing comprehensive professional development opportunities are essential steps towards equipping teachers with the skills to navigate dynamic classroom environments effectively (Ajani, 2021). This paper seeks to contribute to the existing body of knowledge by synthesising research on teachers' competencies in digital integration and identifying implications for teacher professional development. Thus, the study is guided by the following objectives:

- To identify the specific competencies required by teachers for effective integration of digital learning contents into dynamic classroom practices, drawing upon existing literature and theoretical frameworks such as TPACK and the SAMR model.
- To examine the professional development needs of teachers in acquiring and applying the identified competencies, considering factors such as access to technology, training opportunities, institutional support, and attitudes towards digital integration.
- To explore the implications of the findings for educational policy, teacher training programs, and classroom practices, focusing on informing strategies to enhance teachers' competencies in digital integration and improve student learning outcomes in the digital age.

1 Literature review

The literature on teachers' competencies in digital integration encompasses diverse perspectives, theoretical frameworks, and empirical studies. At the core of this discourse lies the Technological Pedagogical Content Knowledge (TPACK) framework, which posits that effective technology integration in education requires an intricate interplay of technological knowledge, pedagogical knowledge, and content knowledge (Mishra & Koehler, 2006). Mishra and Koehler (2006) argue that teachers must understand how to use technology and integrate it meaningfully into their teaching practices to enhance student learning outcomes. Moreover, the SAMR (Substitution, Augmentation, Modification, and Redefinition) model provides a hierarchical framework for evaluating how much technology is integrated into instructional practices, guiding educators towards transformative uses of technology that redefine learning tasks (Puentedura, 2006).

Building upon these theoretical foundations, empirical studies have identified a range of competencies essential for effective digital integration in dynamic classroom practices. Technological proficiency emerges as a foundational competency, encompassing teachers' ability to select, evaluate, and utilise appropriate digital tools to support diverse learning needs (Ertmer et al., 2012). Hughes, Thomas, and Scharber (2006) propose the RAT (Replacement, Amplification, Transformation) framework as a lens for assessing technology integration, emphasising the importance of moving beyond simply substituting traditional tools with digital alternatives towards transformative uses that redefine learning experiences.

Pedagogical flexibility is another critical competency highlighted in the literature, emphasising teachers' capacity to adapt instructional strategies to leverage the affordances of digital technologies while maintaining a focus on learning objectives and student outcomes (Hughes et al., 2006). Educators must adopt student-centred approaches that promote active engagement, collaboration, and critical thinking skills (Lai & Bower, 2019). Furthermore, teachers must deeply understand subject matter content to effectively integrate digital learning content into their instructional practices (Koehler & Mishra, 2009). Curriculum alignment is essential to ensure coherence and rigour in instruction, as digital learning activities should be closely aligned with curriculum standards and assessment practices (Lai & Bower, 2019).

Despite the existing literature's theoretical and empirical insights, many teachers still need help acquiring and applying the competencies required for effective digital integration. Kay (2006) identifies various barriers to technology integration in education, including inadequate access to technology, limited training opportunities, and a lack of institutional support. Additionally, resistance to change and fear of technology may impede teachers' willingness to embrace digital integration (Ertmer et al., 2012). Addressing these barriers requires a multifaceted approach that includes comprehensive professional development initiatives, supportive school leadership, and a conducive institutional culture (Ertmer et al., 2012).

Ajani (2022) argues that professional development plays a significant role in supporting teachers' acquisition and application of competencies for digital integration. Research suggests that effective professional development programmes should be ongoing, job-embedded, collaborative, and differentiated to meet the diverse needs of educators (Garet et al., 2001). Furthermore, professional development activities should focus on technical skills and pedagogical strategies, curriculum design, and assessment practices that effectively leverage digital technologies (Ertmer et al., 2012). In addition to formal professional development opportunities, informal learning networks and communities of practice can provide valuable support and resources for teachers

seeking to enhance their competencies in digital integration (Lai & Bower, 2019).

The literature also underscores the importance of policy support and systemic reforms to promote effective digital integration in education. Policymakers are crucial in allocating resources, establishing standards, and creating incentives to support teachers' professional development in digital integration (Kay, 2006). Moreover, educational leaders within schools and districts must prioritise digital integration as a strategic priority and provide ongoing support for teachers' professional growth in this area (Ertmer et al., 2012). By fostering a culture of innovation, collaboration, and continuous improvement, educational institutions can create conducive environments for effective digital integration and enhance student learning outcomes in the digital age (Ajani & Gamede, 2021).

Moreover, research emphasises the need for a holistic approach to professional development that integrates formal and informal learning opportunities (Ajani, 2021, 2023). Formal professional development programmes should be tailored to teachers' needs and delivered through various formats, including workshops, courses, conferences, and online modules (Ertmer et al., 2012). These programmes should provide teachers with hands-on experiences and opportunities for reflection, collaboration, and feedback to support their growth in digital integration competencies (Garet et al., 2001). Furthermore, ongoing support and mentoring from instructional technology specialists or experienced colleagues can complement formal professional development efforts and facilitate the transfer of learning to classroom practices (Chigona et al., 2010; Lai & Bower, 2019).

In addition to individual teacher professional development, systemic reforms are needed to create supportive environments for digital integration in education. This includes investing in infrastructure and resources to ensure equitable access to technology for all students and teachers (Kay, 2006). Furthermore, policies should be enacted to incentivise and recognise innovative practices in digital integration, such as integrating technology into teacher evaluation frameworks or providing financial incentives for professional development (Ertmer et al., 2012). Additionally, educational institutions should foster partnerships with industry, higher education, and community organisations to leverage external expertise and resources in supporting teachers' professional development in digital integration (Kay, 2006).

The literature also highlights the role of educational leadership in driving effective digital integration initiatives (Chigona et al., 2018). School leaders play a critical role in setting a vision for digital learning, allocating resources, and providing ongoing support and encouragement for teachers (Ertmer et al., 2012). Moreover, educational leaders should create opportunities for collaboration and shared leadership among teachers, fostering a culture of innovation and

continuous improvement (Lai & Bower, 2019). School leaders can enhance the sustainability and impact of these initiatives by promoting distributed leadership and empowering teachers to take ownership of digital integration efforts (Garet et al., 2001).

Therefore, the reviewed literature on teachers' competencies in digital integration provides valuable insights into the complex interplay between technology, pedagogy, and content knowledge. While theoretical frameworks such as TPACK and the SAMR model offer conceptual lenses for understanding these competencies, empirical studies highlight the challenges and opportunities associated with their acquisition and application in practice. Addressing barriers to digital integration requires a multifaceted approach that includes comprehensive professional development, supportive policies, and effective educational leadership (Chikasanda et al., 2012). By investing in teachers' professional development and creating supportive environments for digital integration, educational institutions can harness the transformative potential of technology to enhance student learning outcomes in the digital age.

2 Realities of teachers' digital competencies in integrating digital learning content to learners in South African schools

According to Eke (2019), the realities of teachers' digital competencies in integrating digital learning content present a complex landscape. Despite efforts to promote digital integration in education, challenges persist, impacting teachers' ability to effectively harness digital tools for enhancing student learning outcomes. One key challenge stems from disparities in access to technology and infrastructure across different regions and schools in South Africa (Chigona & Chigona, 2010; Ertmer, 2012). Schools in urban areas often have better access to technology resources than those in rural or underserved communities, exacerbating inequalities in educational opportunities (Chigona & Chigona, 2010). Additionally, teachers need more internet connectivity and a reliable electricity supply to integrate digital learning content into their instructional practices (Eshet-Alkalai, 2004; Herselman et al., 2011).

Furthermore, research indicates that many South African teachers need more digital competencies to effectively integrate technology into their teaching practices (Doherty, 2017). A study by Doherty (2017) found that while teachers in South Africa recognise the potential benefits of digital technologies for enhancing teaching and learning, they often need more technical skills and pedagogical knowledge to leverage these tools effectively. Moreover, there is a gap between teachers' digital proficiency and understanding of meaningfully integrating technology into curriculum-aligned instruction (Finger & Houguet, 2012; Doherty, 2017).

Another challenge concerns the availability of quality digital learning content that aligns with the South African curriculum and caters to diverse learning needs. While a wealth of digital resources is available online, many of these materials may need to be culturally relevant or contextualised to the South African educational context. Additionally, the need for guidelines or standards for evaluating and selecting digital learning content further complicates teachers' decision-making processes (Herselman et al., 2011).

Moreover, the realities of teachers' digital competencies in South African schools are shaped by systemic issues within the education system, including limited opportunities for professional development and inadequate support structures for teachers (Chigona & Chigona, 2010; Gamede et al., 2022). Professional development programmes focused on digital integration are often ad-hoc, one-off events that do not provide sustained support or follow-up opportunities for teachers to apply their learning in practice (Chigona & Chigona, 2010). Additionally, the need for incentives or recognition for teachers who innovate and integrate technology into their teaching further disincentivises efforts to enhance digital competencies (Garet et al., 2001; Doherty, 2017).

Despite these challenges, pockets of innovation and promising practices in South African schools demonstrate the potential for effective digital integration. Schools that have prioritised professional development established collaborative learning communities and provided ongoing support for teachers have reported positive outcomes in improved student engagement, motivation, and learning outcomes (Doherty, 2017). Furthermore, initiatives that leverage mobile technologies and low-cost devices have shown promise in bridging the digital divide and extending access to quality educational resources in underserved communities (Chigona & Chigona, 2010).

In conclusion, the realities of teachers' digital competencies in integrating digital learning contents in South African schools reflect a complex interplay of contextual challenges and systemic issues within the education system. Addressing these challenges requires a concerted effort to provide equitable access to technology, enhance teacher training and support structures, and promote the development of culturally relevant and contextually appropriate digital learning content (Gibson & Oberg, 2020). By investing in teachers' digital competencies and creating conducive environments for digital integration, South Africa can harness the transformative potential of technology to enhance educational opportunities and improve learning outcomes for all students.

3 Possible trends for future research

Future research in teachers' competencies in digital integration of learning contents in dynamic classroom practices may focus on several emerging trends. One trend could involve exploring the impact of emerging technologies, such as artificial intelligence and virtual reality, on teacher competencies and classroom practices (Maphalala & Ajani, 2024). As these technologies continue to evolve, understanding how teachers can effectively leverage them to enhance student learning experiences will be crucial (Mistra & Koehler, 2006). Additionally, future research might delve into the role of socio-cultural factors in shaping teachers' competencies, considering the diverse contexts in which digital integration occurs worldwide. Examining how cultural norms, socio-economic backgrounds, and institutional policies influence teachers' adoption of digital tools can provide valuable insights for designing tailored professional development programmes (Tamášova, 2015).

Furthermore, future studies could investigate the effectiveness of innovative pedagogical approaches and instructional strategies for promoting teachers' competencies in digital integration (Kamali-Arslanta & Yalcin, 2023). Exploring models like flipped learning, project-based learning, and inquiry-based instruction within digital classrooms can illuminate effective practices for engaging students and optimising learning outcomes (Noga, 2016). Moreover, research may delve into the intersectionality of teacher competencies with other domains, such as inclusive education and special needs support (Dermirtas & Mumcu, 2021). Understanding how teachers can adapt their digital integration practices to accommodate diverse student populations with varying learning needs is essential for fostering inclusive and equitable learning environments (Govender et al., 2023).

Despite advancements in research on teachers' competencies in digital integration, several literature gaps persist (Gamede et al., 2022). One notable gap is the limited attention given to the longitudinal effects of teacher professional development interventions on digital integration practices. Longitudinal studies tracking teachers' competency growth over time can provide valuable insights into professional development initiatives' sustainability and long-term impact (Eke, 2019). Additionally, more comparative studies are needed to examine digital integration practices across different educational settings and contexts. Such comparative research can illuminate contextual factors that facilitate or hinder effective digital integration and inform evidence-based strategies for supporting teachers' professional growth (Chigona et al., 2018). Finally, there needs to be more research exploring the role of collaborative learning communities and peer support networks in enhancing teachers' competencies in digital integration (Govender et al., 2023). Investigating how collaborative structures and professional learning communities contribute to teachers' ongoing

professional development in digital integration can offer valuable insights for designing effective support systems in educational settings (Tamášova, 2015).

4 Theoretical framework

The theoretical underpinnings of this study draw primarily from the TPACK framework and the SAMR model. TPACK underscores the importance of teachers' understanding of the interplay between technology, pedagogy, and content knowledge in designing meaningful learning experiences (Finger & Houguet, 2012). By integrating technological tools strategically with pedagogical practices and subject matter expertise, teachers can optimise the learning environment for students. The SAMR model complements TPACK by providing a framework for evaluating the depth of technology integration and encouraging educators to move beyond simply using digital tools as substitutes for traditional methods towards transformative practices that redefine The Technological Pedagogical Content Knowledge (TPACK) framework and the SAMR (Substitution, Augmentation, Modification, and Redefinition) model serve as foundational theoretical frameworks for understanding teachers' competencies in digital integration within dynamic classroom practices (Harris et al., 2009). Developed by Mishra and Koehler (2006), TPACK is grounded in recognising that effective technology integration in education requires a nuanced understanding of the intersection between technological, pedagogical, and content knowledge. Technological knowledge refers to understanding how to use digital tools effectively; pedagogical knowledge encompasses teaching strategies and student learning processes; and content knowledge involves expertise in subject matter content (Mishra & Koehler, 2006; Hennessy & Onguko, 2016). TPACK emphasises the integration of these three knowledge domains to design meaningful learning experiences that leverage technology to enhance student learning outcomes.

TPACK provides a comprehensive framework for conceptualising the competencies required by teachers for effective digital integration. By integrating technological, pedagogical, and content knowledge, teachers can create innovative learning experiences that leverage the affordances of digital technologies to support diverse learning needs and foster student engagement and achievement. Moreover, Huges et al. (2006) agree that TPACK highlights the dynamic nature of teaching with technology, emphasising the need for teachers to continuously adapt and refine their practices in response to evolving pedagogical goals, technological advancements, and changes in curricular content (Koehler & Mishra, 2009).

The SAMR model, developed by Puentedura (2006), offers a hierarchical framework for evaluating the depth of technology integration in instructional practices. The model categorises technology use into four levels: substitution,

augmentation, modification, and redefinition. Substitution involves using technology as a direct substitute for traditional tools or processes without significant changes in function. At the same time, augmentation enhances traditional practices through technology, offering improvements in efficiency or effectiveness. Modification involves restructuring tasks or activities to take advantage of technology's affordances. At the same time, redefinition represents the transformation of learning tasks and experiences through innovative technology, leading to new possibilities that were previously inconceivable (Puentedura, 2006).

The SAMR model complements TPACK by providing a framework for evaluating the extent to which technology is integrated into instructional practices and the transformative potential of technology use. While TPACK focuses on integrating technological, pedagogical, and content knowledge, SAMR offers a lens for assessing the impact of technology integration on learning experiences and outcomes. Together, these frameworks provide a comprehensive understanding of teachers' competencies in digital integration, guiding educators towards more effective and meaningful use of technology in their teaching practices (Mishra & Koehler, 2006; Puentedura, 2006).

In the context of this study, TPACK and SAMR offer valuable theoretical lenses for examining teachers' competencies in digital integration within dynamic classroom practices. TPACK underscores the importance of integrating technological, pedagogical, and content knowledge to design and implement compelling digital learning experiences (Kay, 2006). By considering how technology can support and enhance teaching and learning goals, teachers can make informed decisions about selecting, integrating, and evaluating digital learning content in their instructional practices (Mishra & Koehler, 2006).

Similarly, the SAMR model provides a structured framework for evaluating the depth of technology integration and the transformative potential of technology use in classrooms. By assessing the extent to which technology is used to substitute, augment, modify, or redefine learning tasks, educators can identify opportunities for innovation and improvement in their digital integration efforts. Moreover, SAMR encourages educators to move beyond simply using technology as a substitute for traditional tools towards more transformative practices that redefine learning experiences and outcomes (Puentedura, 2006).

In this study, TPACK and SAMR serve as guiding frameworks for examining the competencies required by teachers for effective digital integration of learning contents within dynamic classroom practices. Drawing upon these theoretical perspectives, the study seeks to identify the specific knowledge, skills, and dispositions teachers need to integrate technology meaningfully into their instructional practices. Moreover, TPACK and SAMR provide a basis for evaluating the impact of technology integration on teaching and learning

processes and identifying areas for improvement and further research (Mishra & Koehler, 2006; Puentedura, 2006).

Overall, TPACK and SAMR offer valuable theoretical frameworks for understanding and evaluating teachers' competencies in digital integration within dynamic classroom practices. By integrating technological, pedagogical, and content knowledge and assessing the depth and impact of technology integration, these frameworks guide educators seeking to enhance their digital integration efforts and improve student learning outcomes. In the context of this study, TPACK and SAMR inform the exploration of teacher professional development needs and the identification of strategies to support teachers in integrating digital learning contents effectively into their instructional practices.

5 Method

A systematic approach was employed to comprehensively review existing literature on teachers' competencies in the digital integration of learning contents in dynamic classroom practices. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) model was utilised to structure the review process, ensuring transparency, rigour, and replicability (Moher et al., 2009). The PRISMA model provides a systematic framework for conducting literature reviews, encompassing key stages such as identification, screening, eligibility assessment, data extraction, and synthesis of findings (Moher et al., 2009). By adhering to the PRISMA guidelines, this study aimed to minimise bias and ensure the reliability and validity of the review process. The inclusion criteria for selecting studies were established to ensure relevance and comprehensiveness. Studies were included if they focused on teachers' competencies in the digital integration of learning contents within basic educational settings (Kitchenham et al., 2009). The timeframe for inclusion was set from 2000 to 2024 to capture recent developments and trends in the field. Additionally, studies needed to be published in English and available in peerreviewed journals or reputable conference proceedings to ensure scholarly rigour. Exclusion criteria included studies focusing on higher education contexts, non-English publications, and those needing to address teachers' competencies in digital integration (Knezek & Christensen, 2010).

The search strategy involved systematic searches of electronic databases such as ERIC, PsycINFO, Education Source, and Google Scholar using keywords such as "teacher competencies," "digital integration," "professional development," and "dynamic classroom practices." Boolean operators and truncation were used to refine search terms and maximise the retrieval of relevant studies. Additionally, manual searches of reference lists from identified studies and relevant review articles were conducted to identify additional sources. The initial search yielded many potential studies, which were then screened based on their titles and

abstracts to assess their relevance to the research objectives. Studies that met the inclusion criteria were selected for full-text review, while those that did not were excluded (Higgins & Green, 2006). The full-text review involved a detailed examination of the selected studies to determine their suitability for inclusion based on predefined criteria. Data extraction was conducted systematically to capture relevant information from the selected studies, including study characteristics (e.g., authors, publication year, research design), participants (e.g., teachers and educators), key findings, and implications for teacher professional development (Braun & Clarke, 2006). A standardised data extraction form was developed to ensure consistency and accuracy in data collection across studies. Data were synthesised using thematic analysis to identify common themes, patterns, and trends related to teachers' competencies in digital integration (Braun & Clarke, 2006).

The synthesis of findings involved organising and categorising extracted data into thematic clusters based on key concepts and recurring patterns identified across studies (Higgins & Green, 2011). The thematic analysis allowed for a nuanced understanding of the complexities and nuances of teachers' competencies in digital integration, highlighting both commonalities and variations in practice. Findings were synthesised into coherent narratives, supported by evidence from the selected studies, to provide a comprehensive overview of the current state of knowledge in the field. The PRISMA model provided a structured and transparent framework for conducting the literature review, ensuring methodological rigour and adherence to best practices in systematic review methodology. By following the PRISMA guidelines, this study aimed to minimise bias, enhance transparency, and improve the reliability and validity of the review process. Moreover, the systematic approach facilitated the identification of relevant studies, extracting critical information, and synthesising findings, enabling a comprehensive analysis of teachers' competencies in digital integration within dynamic classroom practices (Braun & Clarke, 2006).

In summary, the methodology employed in this study involved a systematic review of existing literature on teachers' competencies in the digital integration of learning contents in dynamic classroom practices. The PRISMA model guided the review process, ensuring transparency, rigour, and replicability. Through systematic searches, screening, and data extraction, relevant studies were identified, synthesised, and analysed to provide insights into the competencies required by teachers for effective digital integration (Higgins & Green, 2011). Thematic analysis facilitated the identification of key themes and patterns, offering a nuanced understanding of teachers' competencies in digital integration and informing implications for teacher professional development and future research efforts.

6 Results

The systematic review of literature on teachers' competencies in digital integration of learning contents in dynamic classroom practices yielded valuable insights into the current state of knowledge in the field (Braun & Clarke, 2006). Findings revealed a multifaceted landscape characterised by diverse perspectives, challenges, and promising practices related to teachers' competencies in digital integration. Across the selected studies, several key themes emerged, highlighting the importance of technological proficiency, pedagogical flexibility, and content knowledge in effective digital integration (Ertmer et al., 2012).

Technological proficiency emerged as a foundational competency for teachers engaging in digital integration, encompassing the ability to select, evaluate, and utilise appropriate digital tools to support diverse learning needs (Hughes et al., 2006). Studies have highlighted the importance of teachers' confidence and competence in using digital technologies effectively to enhance student engagement, collaboration, and critical thinking skills (Lai & Bower, 2019). Furthermore, findings underscored the need for ongoing professional development to support teachers in acquiring and refining their technological skills in digital integration (Ertmer et al., 2012).

Pedagogical flexibility was identified as another critical competency for teachers in digital integration, emphasising the capacity to adapt instructional strategies to leverage the affordances of digital technologies while maintaining a focus on learning objectives and student outcomes (Hughes et al., 2006). Teachers who demonstrated pedagogical flexibility could better design and implement innovative learning experiences that engaged students and fostered a deeper understanding and application of content knowledge (Koehler & Mishra, 2009). Moreover, studies have highlighted the importance of teacher autonomy and agency in shaping digital integration practices, emphasising the need for supportive school leadership and a conducive institutional culture (Ertmer et al., 2012).

Content knowledge emerged as a foundational component of effective digital integration, emphasising teachers' deep understanding of subject matter content and curriculum standards (Grant & Booth, 2009; Koehler & Mishra, 2009). Teachers with solid content knowledge could better design digital learning activities aligned with curriculum objectives and assessment practices, ensuring coherence and rigour in instruction (Lai & Bower, 2019). Additionally, findings highlighted the importance of interdisciplinary collaboration and integrated learning content across subject areas to promote holistic and integrated learning experiences for students (Ertmer et al., 2012).

Theoretical frameworks like TPACK and SAMR provided valuable lenses for interpreting and contextualising the systematic review's findings (Kitchenham et

al., 2009). TPACK underscored the importance of integrating technological, pedagogical, and content knowledge to design and implement compelling digital learning experiences (Mishra & Koehler, 2006). Findings from the selected studies reflected the interconnected nature of these knowledge domains, highlighting the need for teachers to draw upon multiple forms of expertise to navigate the complexities of digital integration in dynamic classroom practices (Koehler & Mishra, 2009).

Moreover, the SAMR model provided a structured framework for evaluating the depth of technology integration and the transformative potential of technology use in classrooms (Puentedura, 2006). Findings revealed a range of technology integration practices across the SAMR continuum, from simply substituting traditional tools with digital alternatives to more transformative uses that redefine learning tasks and experiences (Puentedura, 2006). Teachers with higher levels of technology integration could leverage digital tools to create innovative learning opportunities beyond traditional instruction boundaries (Hughes et al., 2006).

Overall, the systematic review results underscored the importance of teachers' competencies in digital integration for enhancing student learning outcomes in dynamic classroom practices (Koehler et al., 2014). Findings highlighted the need for comprehensive professional development programs that address the multifaceted nature of digital integration and provide ongoing support for teachers in acquiring and refining their competencies (Ertmer et al., 2012). Moreover, the study identified implications for educational policy, teacher training programs, and classroom practices, emphasising the importance of fostering a culture of innovation, collaboration, and continuous improvement in educational institutions (Lai & Bower, 2019).

Thus, the systematic review results provided valuable insights into teachers' competencies for effective digital integration of learning contents in dynamic classroom practices (Lai & Bower, 2019). Findings underscored the importance of technological proficiency, pedagogical flexibility, and content knowledge in guiding teachers' practices and promoting student engagement and achievement. Theoretical frameworks such as TPACK and SAMR provided valuable lenses for interpreting and contextualising the findings, highlighting the interconnected nature of teachers' competencies in digital integration and the transformative potential of technology use in classrooms. Implications for educational practice and future research efforts were identified, emphasising the need for comprehensive professional development programs, supportive policies, and a conducive institutional culture to promote effective digital integration in education (Maphalala & Ajani, 2024).

7 Discussion

The discussion synthesises the study's findings with the theoretical frameworks of TPACK and SAMR to provide a comprehensive understanding of teachers' competencies in digital integration within dynamic classroom practices (Puentedura, 2006). By integrating these perspectives, we can elucidate the complexities of digital integration and identify implications for educational practice and future research. The study's findings underscore the interconnected nature of teachers' digital integration competencies, as TPACK elucidated. Technological, pedagogical, and content knowledge are interwoven in teachers' practices, influencing their ability to effectively integrate digital learning content into instruction (Mishra & Koehler, 2006). Teachers with solid technological knowledge are better equipped to select and utilise appropriate digital tools to support diverse learning needs. In contrast, those with pedagogical knowledge can design and implement meaningful learning experiences that leverage technology effectively (Koehler & Mishra, 2009). Additionally, content knowledge enables teachers to align digital learning contents with curriculum objectives and assessment practices, ensuring coherence and relevance in instruction (Mishra & Koehler, 2006).

Furthermore, the findings align with the SAMR model, which provides a structured framework for evaluating the depth of technology integration and the transformative potential of technology use in classrooms. Teachers' competencies in digital integration can be mapped onto the SAMR continuum, ranging from simply substituting traditional tools with digital alternatives to more transformative uses that redefine learning tasks and experiences (Puentedura, 2006). Teachers who engage in higher levels of technology integration can leverage digital tools to create innovative learning opportunities that extend beyond the boundaries of traditional instruction (Hughes et al., 2006). The integration of TPACK and SAMR offers valuable insights into the complexities of digital integration and the competencies teachers require to navigate these challenges effectively. By considering the interplay between technological, pedagogical, and content knowledge, teachers can design and implement digital learning experiences that are meaningful, engaging, and impactful (Koehler & Mishra, 2009). Moreover, by evaluating the depth of technology integration through the SAMR lens, educators can identify opportunities for innovation and improvement in their digital integration efforts, moving towards more transformative uses of technology that redefine learning experiences and outcomes (Puentedura, 2006).

The discussion also highlights the implications of the study findings for educational practice and future research efforts. Comprehensive professional development programs that address the multifaceted nature of digital integration and provide ongoing support for teachers are essential for enhancing teachers'

competencies in digital integration (Ertmer et al., 2012). Moreover, supportive policies, leadership, and a conducive institutional culture are critical for fostering a culture of innovation, collaboration, and continuous improvement in educational institutions (Lai & Bower, 2019). In addition, the study findings underscore the importance of interdisciplinary collaboration and integration of digital learning content across subject areas to promote holistic and integrated learning experiences for students (Ertmer et al., 2012). By fostering collaboration among teachers, instructional technology specialists, curriculum developers, and other stakeholders, educational institutions can create a supportive ecosystem for digital integration that enhances student learning outcomes and prepares students for success in the digital age.

Furthermore, the discussion highlights the need for future research to explore innovative approaches to teacher professional development, including online learning communities, peer mentoring, and immersive learning experiences (Ertmer et al., 2012; Koh et al., 2013). Additionally, longitudinal studies are needed to examine the long-term impact of digital integration efforts on teaching practices and student learning outcomes (Lai & Bower, 2019). By addressing these gaps in the literature, future research can contribute to a deeper understanding of teachers' competencies in digital integration and inform strategies to enhance digital integration efforts in educational practice. Overall, the integration of TPACK and SAMR provides a robust theoretical framework for understanding and evaluating teachers' competencies in digital integration within dynamic classroom practices. By synthesising the study's findings with these theoretical perspectives, we can elucidate the complexities of digital integration and identify implications for educational practice and future research efforts (Konig et al., 2020). Through comprehensive professional development, supportive policies, and interdisciplinary collaboration, educational institutions can foster a culture of innovation and continuous improvement that enhances teachers' competencies in digital integration and improves student learning outcomes in the digital age (Makoe, 2021).

8 Implications of the study

The implications of this study extend to various stakeholders in education, including policymakers, educational leaders, teacher educators, and classroom practitioners. Policymakers can use the findings to inform the development of policies and initiatives to support teachers' professional development in digital integration. Educational leaders can incorporate the identified competencies into teacher training programs and school professional learning communities. Teacher educators can use the insights to design and implement practical professional development activities that address the specific needs of teachers in digital integration. Finally, classroom practitioners can reflect on their

competencies and seek continuous improvement opportunities in integrating digital technologies into their instructional practices.

When integrated with the theoretical frameworks of TPACK and SAMR, the study's implications underscore the importance of comprehensive approaches to teacher professional development, supportive policies, and collaborative practices in fostering effective digital integration in education. We can elucidate actionable implications for educational practice and future research by synthesising the study's findings with these theoretical perspectives.

Firstly, the study underscores the need for comprehensive professional development programmes that address the multifaceted nature of digital integration and provide ongoing support for teachers. As highlighted by TPACK, effective digital integration requires a nuanced understanding of the intersection between technological, pedagogical, and content knowledge (Mishra & Koehler, 2006). Professional development initiatives should, therefore, focus on developing teachers' competencies across these knowledge domains, equipping them with the skills and knowledge needed to design and implement meaningful digital learning experiences (Ertmer et al., 2012).

Moreover, the study findings emphasise the importance of supportive policies and leadership in fostering a culture of innovation and continuous improvement in educational institutions. Educational policies should incentivise and recognise innovative practices in digital integration, providing teachers with the necessary resources and support to experiment with new approaches and technologies (Lai & Bower, 2019). Additionally, school leaders play a critical role in setting a vision for digital learning, allocating resources, and providing ongoing support and encouragement for teachers (Ertmer et al., 2012).

Furthermore, interdisciplinary collaboration and integrating digital learning content across subject areas are essential for promoting holistic and integrated learning experiences for students. TPACK emphasises that effective digital integration requires collaboration among teachers, instructional technology specialists, curriculum developers, and other stakeholders (Koehler & Mishra, 2009). By fostering interdisciplinary collaboration, educational institutions can create a supportive ecosystem for digital integration that enhances student learning outcomes and prepares students for success in the digital age.

Additionally, the study highlights the importance of innovative approaches to teacher professional development, including online learning communities, peer mentoring, and immersive learning experiences. As suggested by TPACK, effective professional development programs should provide teachers with hands-on experiences and opportunities for reflection, collaboration, and feedback (Ertmer et al., 2012). Online learning communities and peer mentoring programs can complement formal professional development efforts, providing

teachers with ongoing support and opportunities for sharing best practices and lessons learned (Lai & Bower, 2019).

Moreover, longitudinal studies are needed to examine the long-term impact of digital integration efforts on teaching practices and student learning outcomes. As suggested by TPACK and SAMR, effective digital integration requires sustained effort and ongoing support for teachers (Mishra & Koehler, 2006; Puentedura, 2006). Longitudinal studies can provide insights into the factors that influence the sustainability and scalability of digital integration initiatives, informing strategies to support teachers in the long term (Ertmer et al., 2012).

In conclusion, the implications of the study, when integrated with the theoretical frameworks of TPACK and SAMR, underscore the importance of comprehensive approaches to teacher professional development, supportive policies, and collaborative practices in fostering effective digital integration in education. By synthesising the study's findings with these theoretical perspectives, we can elucidate actionable implications for educational practice and future research, informing strategies to enhance digital integration efforts and improve student learning outcomes in the digital age.

Conclusions

This study provides valuable insights into the complexities of teachers' competencies in digital integration within dynamic classroom practices. By synthesising the findings with theoretical frameworks such as TPACK and SAMR, we have illuminated the interconnected nature of technological, pedagogical, and content knowledge and their implications for effective digital integration. The study highlights the importance of comprehensive professional development programmes, supportive policies, and collaborative practices in fostering effective educational digital integration. Furthermore, the implications underscore the need for innovative approaches to teacher professional development, interdisciplinary collaboration, and longitudinal research to enhance digital integration efforts and improve student learning outcomes in the digital age. This study contributes to the ongoing discourse on digital integration in education by providing actionable insights for educators, policymakers, and researchers. By addressing the multifaceted nature of digital integration and providing evidence-based recommendations for practice and future research, this study aims to empower educators to harness the transformative potential of technology to enhance teaching and learning experiences. Through continued collaboration and innovation, educational institutions can create a supportive ecosystem for digital integration that prepares students for success in the digital age and fosters lifelong learning and growth.

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