International Journal of Management, Knowledge and Learning | ISSN 2232-5697

Exploring Post-COVID-19 Teacher Experiences: Advancing Technology-Driven Professional Development for Contemporary Education

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Purpose: The purpose of this study is to examine the post-COVID-19 experiences of teachers regarding technology-driven professional development activities. It aims to explore the challenges, opportunities, and best practices for equipping teachers with the digital competencies necessary to navigate online and blended learning environments effectively. The study seeks to provide actionable insights for enhancing teacher professional development in the evolving digital education landscape.

Study Design/Methodology/Approach: This study employs a systematic literature review (SLR) to synthesise existing research on technology-focused professional development activities for teachers after the COVID-19 pandemic. It critically analyses literature on teachers' challenges, the strategies employed to address them, and the outcomes of professional development initiatives to enhance their digital skills.

Findings: The study highlights the heightened demand for technology-driven professional development, driven by the increased reliance on digital teaching tools. Key challenges identified include limited access to technological resources, time constraints, and resistance to change. However, the study also identifies effective strategies for overcoming these barriers, such as personalised learning pathways, peer collaboration, and ongoing support systems. These approaches empower teachers to integrate technology into their pedagogy, improving learner engagement and learning outcomes.

Originality/Value: This research provides valuable insights into the critical role of technology-driven professional development in the post-COVID-19 educational landscape. It emphasises the necessity of cultivating a technologically proficient teacher workforce and offers practical recommendations for policymakers, educational institutions, and educators. By addressing the intersection of teacher professional development and technology integration, this study contributes to the ongoing discourse on preparing educators for the digital age and enhancing the effectiveness of teaching practices in a technology-driven educational ecosystem.

Introduction

The COVID-19 pandemic, which disrupted education systems worldwide, has brought to the forefront the importance of technology-driven professional development for teachers (Anderson, 2020). With schools forced to adapt rapidly to remote and hybrid learning environments, teachers faced unprecedented challenges in delivering quality instruction (Maphalala et al., 2021). In response to these challenges, teachers and educational institutions had to embrace technology in ways they had never imagined. This paradigm shift has highlighted the critical need for ongoing and effective professional development to ensure teachers have the skills and knowledge necessary to thrive in this new educational landscape. Thus, the COVID-19 pandemic forced the closure of schools and the sudden shift to online learning, revealing the digital divide among learners and teachers (UNESCO, 2020). Many teachers had to prepare for remote teaching, needing more digital literacy and instructional technology skills (Hodges et al., 2020). This crisis exposed vulnerabilities in our education systems and underscored the urgency of providing teachers with opportunities for technology-

driven professional development (Dhawan, 2020). Effective professional development is essential for teachers to adapt to evolving teaching methodologies and technologies (Inan & Lowther, 2010; Govender & Ajani, 2021). With the rise of online educational tools, virtual learning environments, and digital resources, teachers must engage in continuous learning to remain effective (Bannister, 2019). Hence, technology-driven professional development can empower teachers to harness digital tools for enhanced instruction, learner engagement, and improved learning outcomes (Darling-Hammond et al., 2017).

The contemporary digital era has ushered in a transformative phase in global education, where Information and Communication Technology (ICT) and electronic learning (e-learning) have emerged as pivotal instruments in reshaping educational systems (Selwyn, 2021). These technological tools have significantly augmented the Teaching and Learning (TAL) processes, with e-learning serving as a principal catalyst for the electronic dissemination of knowledge, extending educational content delivery beyond the confines of traditional classrooms. According to Butgereit (2020), E-learning encompasses using diverse electronic mediums to acquire, generate, and disseminate knowledge, facilitating the teaching and learning journey. Al-Busaidi (2013) and Kibinkiri (2014) characterise e-learning as applying computer technologies to facilitate effective pedagogy, operational in offline and online modes, encompassing internet and intranet utilisation. Kent, Laslo, and Rafaeli (2016) further assert that e-learning entails computer-assisted learning strategies that enhance pedagogical methodologies and enrich the learning experiences for both teachers and learners. The seamless integration of technology, including e-learning, into the educational landscape represents an innovative paradigm that increasingly pervades various phases of the education system (Ohei & Brin, 2019).

Poon (2013) underscores that integrating online learning with traditional physical classrooms, a pedagogical approach termed blended learning, harnesses a diverse set of ICT tools. Atef and Medhatl (2015) also expound upon blended learning, highlighting its remarkable efficacy in imparting new knowledge and skills while nurturing a proactive learning attitude among learners, surpassing conventional teacher-centric approaches. The infusion of various technologies into education has ignited fresh motivation for learning, signifying a notable enhancement in learners' academic performance within institutions fully embracing ICT and e-learning (Han & Shin, 2016). Prudent utilisation of ICT and e-learning can expand educational access, mitigate infrastructure costs associated with constructing extensive physical classrooms, and elevate the overall quality of education (Linna, 2013). In the contemporary landscape, ICT and e-learning have become indispensable tools for teaching and learning, rendering physical interactions between teachers and learners increasingly dispensable in many advanced nations (Murshitha & Wickramarachchi, 2016). This underscores how these technologies afford teachers and learners the convenience of accessing online educational resources and classes.

Additionally, according to Van den Bossche et al. (2020), several factors affect teachers' technology adoption, including perceived usefulness, ease of use, attitude, and job relevance. Teachers are integral to promoting and facilitating technology adoption among learners for academic purposes, and they play a pivotal role in accepting and utilising various ICT and e-learning tools (Trucano et al., 2012). Consequently, teachers are responsible for advancing teaching and learning within modern education systems. By furnishing teachers with requisite training and support, E-learning tools engender a sense of quality enhancement within the Teaching and Learning (TAL) process (Poon, 2013). In broader terms, incorporating technology in education enhances the teaching process and serves as a lever for augmenting teaching and learning, thereby bestowing a competitive edge (Muthupoltotage, 2021).

Nevertheless, it is disconcerting that there is a pronounced dearth of ICT and e-learning adoption among teachers in certain African schools, warranting urgent attention (Naresh & Reddy, 2015; Ajani, 2023). In the South African context, despite the availability of resources, various technologies engineered to enhance TAL still need to be fully harnessed within most educational institutions (Darling-Hammond & Hyler, 2020; Boyle et al., 2023). Numerous South African schools strive to integrate ICT and e-learning tools to catalyse transformation and foster quality education (Kanyemba, 2022; Ntsobi & Costa, 2022; Adebisi et al., 2023). Consequently, the rapid technological evolution has posed a challenge to the teaching profession, necessitating a recalibration of pedagogical approaches to accommodate the transformative changes ushered in by technology in the TAL domain (Ohei & Brink, 2019). This technological paradigm encompasses a spectrum of ICT tools, encompassing computers, mobile phones, and tablets, facilitating online access to learning content, group discussions, forums, and interactions via diverse e-learning platforms (Rossouw & Garbutt, 2022). Integrating ICT and e-learning into Teacher Professional Development (TPD) is becoming increasingly prevalent across South African schools to enhance educational quality and the blended teaching and learning experience (Kibinkiri, 2014; Mashoko & Vaal, 2023).

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Despite the growing emphasis on technology-driven professional development, the implementation of ICT in education remains inconsistent, particularly in under-resourced schools and universities (Ajani & Govender, 2023). For instance, while some well-funded institutions have successfully integrated blended learning models, many rural and township schools still struggle with limited digital infrastructure and inadequate teacher training (Ntsobi

& Costa, 2022). Practical examples highlight the stark contrast in ICT adoption: in some South African schools, teachers have innovatively used mobile phone applications like WhatsApp to facilitate learning, whereas others lack even the basic connectivity required for virtual lessons (Mashoko & Vaal, 2023). Furthermore, research by Kanyemba (2022) indicates that the lack of sustained teacher support and training has hindered the long-term success of e-learning initiatives in many institutions. Without structured and continuous professional development opportunities, teachers may struggle to integrate digital tools effectively into their pedagogy, ultimately limiting the potential benefits of technology-enhanced learning (Boyle et al., 2023). By critically reflecting on these practical realities, this study underscores the need for targeted policies and investment in digital teacher training programmes to bridge the technological divide and enhance teachers' confidence and proficiency in using ICT for instruction.

This study embarks on an exploration of the post-COVID-19 experiences of teachers as they navigate technology-driven professional development activities. This research provides valuable insights into how educational institutions can better support teachers in the digital era by investigating the challenges, achievements, and best practices associated with adopting technology for professional growth. The findings of this study will contribute to a deeper comprehension of the evolving landscape of teacher professional development in a post-pandemic world. In the forthcoming sections, we will delve into the extant literature surrounding technology-driven professional development for teachers, elucidating its significance and efficacy in enhancing teaching practices and educational outcomes in the contemporary digital age.

Literature Review

The Impact of COVID-19 on Teacher Professional Development

The emergence of the Coronavirus (COVID-19) in Wuhan, China, in December 2019 and its subsequent global spread, including South Africa, prompted President Cyril Ramaphosa to declare a nationwide lockdown on 27 March 2020 as part of a comprehensive strategy to mitigate the virus's transmission (Simon & Hans, 2020). This sudden lockdown halted all academic activities, disrupting the 2020 academic calendar (Gamede et al., 2022). Teacher Professional Development (TPD) is pivotal in building teachers' capacity (Ajani, 2019). The dynamic nature of education demands teachers who can professionally facilitate learning experiences and positively influence learners through effective pedagogical methods. The pandemic necessitated a shift towards e-learning and online teaching in many educational institutions worldwide to salvage the academic year (Jaime, 2020). Face-to-face TPD activities became unfeasible, highlighting the imperative of exploring alternative approaches, such as ICT/E-learning, to engage teachers in enriching professional development activities that enhance the teaching and learning process (Simon & Hans, 2020).

ICT and E-Learning as a Solution for Teacher Capacity Building

Adopting ICT/E-learning for TPD allowed for capacity building among South African teachers during the COVID-19 pandemic, offering accessibility from diverse locations at their convenience (Jaime, 2020). The shift to online learning has made ICT-driven professional development an essential tool for teachers to adapt to the demands of digital education. Integrating technology in teaching requires teachers to develop competencies in digital pedagogy, instructional technology, and learner engagement through virtual platforms (Ugwuonah, 2023). ICT-based learning allows teachers to engage with educational content asynchronously, enabling flexibility and self-paced learning (Kanyemba, 2023). Additionally, it allows teachers to explore different online learning methodologies and interactive learning

tools to enhance student participation (Ohei & Brink, 2020). The research underscores the potential of ICT/E-learning in improving teacher professional development by broadening access to educational resources, enhancing collaboration, and fostering innovation in teaching methodologies (Trucano et al., 2012; Gachago et al., 2015; Anderson, 2020; Boyle et al., 2023).

Challenges in ICT and E-Learning Adoption

Despite the undeniable benefits of ICT/E-learning in teacher development, the adoption rate among South African teachers remains low (Trucano et al., 2010; Mashoko & Vaal, 2023). Studies indicate that several barriers hinder the effective implementation of digital learning initiatives, including inadequate digital infrastructure, limited internet access, and a lack of digital literacy among teachers (Poon, 2013; Adebisi et al., 2023). The Department of Basic Education has reported that many ICT devices remain underutilised in some schools due to teachers' unfamiliarity with advanced technological tools (Department of Basic Education, 2016; Mojapelo & Durodolu, 2023). Consequently, ICT integration in teacher development will remain challenging without targeted training programmes and ongoing support. Moreover, the lack of alignment between existing ICT policies and actual implementation on the ground contributes to the slow adoption of digital tools in teaching and learning (Linna, 2013).

Blended Learning and Digital Transformation in Teacher Development

Blended learning, which combines online learning with face-to-face instruction, has been recognised as a viable approach for integrating ICT in teacher training (Ohei & Brink, 2019). This model has been shown to improve teaching effectiveness by allowing teachers to engage with content both online and in physical classroom settings (Van den Bossche et al., 2020). Additionally, blended learning promotes digital literacy among teachers and enables them to incorporate technology-driven strategies in their teaching practices (Butgereit, 2020; Kanyemba, 2022). Research suggests that teacher training programmes should prioritise blended learning approaches to enhance digital competence and improve engagement in virtual learning environments (Anderson, 2020). However, despite its potential, implementing blended learning requires adequate funding, technological infrastructure, and institutional support, which remain significant challenges in many South African educational institutions (Department of Basic Education, 2016).

The Role of ICT Policies in Enhancing Digital Inclusion

South Africa's commitment to leveraging ICT for education is evident in its policies, such as the National Integrated ICT Policy White Paper (Department of Telecommunications and Postal Services, 2016) and the National Development Plan 2030 (National Planning Commission, 2012). These policies highlight the importance of digital education in addressing educational disparities and fostering socio-economic development. However, while these policies establish a framework for ICT integration, implementing ICT-PD initiatives remains inconsistent (Gachago et al., 2015). There is a pressing need for policies that promote ICT integration and ensure that teachers receive adequate training and resources to use digital tools effectively (Chigona & Chigona, 2010). Teacher professional development initiatives should align with national ICT strategies to bridge the digital divide and ensure equitable access to technology-driven learning opportunities.

Bridging the Digital Divide through ICT-PD

The digital divide remains a significant challenge in South Africa, particularly in underprivileged communities (Department of Basic Education, 2016). ICT-driven professional development can play a crucial role in mitigating educational inequalities by equipping teachers

with the skills and resources needed to support learners in digital learning environments (Muthupoltotage, 2021). Research suggests that targeted ICT-PD programmes, particularly in rural areas, can enhance teachers' ability to deliver high-quality online instruction and support learners in developing essential digital skills (Harris, 2016; Inah & Lowther, 2020). By prioritising digital literacy training, the education sector can create more inclusive learning environments where teachers and learners can benefit from digital education.

Investing in ICT-PD for Sustainable Teacher Development

The COVID-19 pandemic has underscored the need for sustainable investments in ICT-PD to support teachers adapting to digital learning (Khan, 2018; Ajani, 2023). Investing in teacher training programmes focused on digital pedagogy, online classroom management, and interactive learning tools can ensure long-term improvements in teaching practices (Anderson, 2020). Additionally, institutions must adopt a multi-stakeholder approach involving government agencies, private sector partners, and non-governmental organisations to facilitate teachers' access to ICT resources (Gachago et al., 2015). By strengthening teacher development initiatives, South Africa can improve educational outcomes and prepare teachers for the evolving digital landscape.

Conversely, the integration of ICT and e-learning in teacher professional development presents a unique opportunity to transform the education system in South Africa. However, limited access to digital tools, inadequate training, and infrastructural deficiencies hinder progress. Addressing these issues requires a collaborative effort from policymakers, educational institutions, and stakeholders to ensure teachers receive the support they need to navigate digital education effectively. By investing in ICT-driven professional development, South Africa can bridge the digital divide, enhance teaching practices, and improve learning outcomes in the post-pandemic era.

Theoretical Framework

This study employs the Unified Theory of Acceptance and Use of Technology (UTAUT) and Diffusion of Innovation Theory (DOI) to understand the use of ICT/E-learning for TPD in South Africa. These theories will provide a clear understanding and conceptual models for this study.

The Unified Theory of Acceptance and Use of Technology (UTAUT)

The Unified Theory of Acceptance and Use of Technology (UTAUT), introduced by Venkatesh, Morris, Michael, and Davis in 2003, amalgamates constructs and moderators from eight technology acceptance and utilisation theories. This comprehensive theoretical framework was formulated to investigate the most effective strategies for promoting technology adoption and influencing user behaviour, particularly in the context of Teacher Professional Development (TPD). UTAUT stands out among technology acceptance theories due to its exceptional descriptive capacity and ability to offer deeper insights into technology acceptance and utilisation. UTAUT's richness and high descriptive capability make it particularly pertinent in ICT/e-learning adoption within TPD and classroom settings compared to alternative acceptance models. Venkatesh et al. (2003) assert that UTAUT can elucidate up to 70% of the variance in the intention to use technology, underlining its robust explanatory power. Comprising eight distinct theories, the UTAUT model emerges as a comprehensive and indispensable framework for comprehending information technology utilisation in teaching and learning contexts (Venkatesh & Speier, 1999).

One of UTAUT's remarkable strengths lies in its applicability to users irrespective of gender, levels of information technology proficiency, cultural backgrounds, and the diverse array of

available technologies, demonstrating its versatility and reliability. UTAUT encompasses four primary constructs employed in this study to explore teachers' adoption of ICT/e-learning for professional development. These constructs include Performance Expectancy (PE), Effort Expectancy (EE), Social Influence (SI), and Facilitating Condition (FC). Performance Expectancy pertains to users' belief that employing a particular system to perform their job functions will enhance their overall performance. At the same time, Effort Expectancy evaluates the perceived ease of using a system. Social influence captures users' perception that influential individuals expect them to use the new system. Meanwhile, the Facilitating Condition assesses the degree to which users believe their organisation provides the necessary technological infrastructure and support for technology adoption. UTAUT's richness, reliability, and applicability substantiate the rationale for embracing ICT/e-learning in TPD to enhance classroom instructional practices.

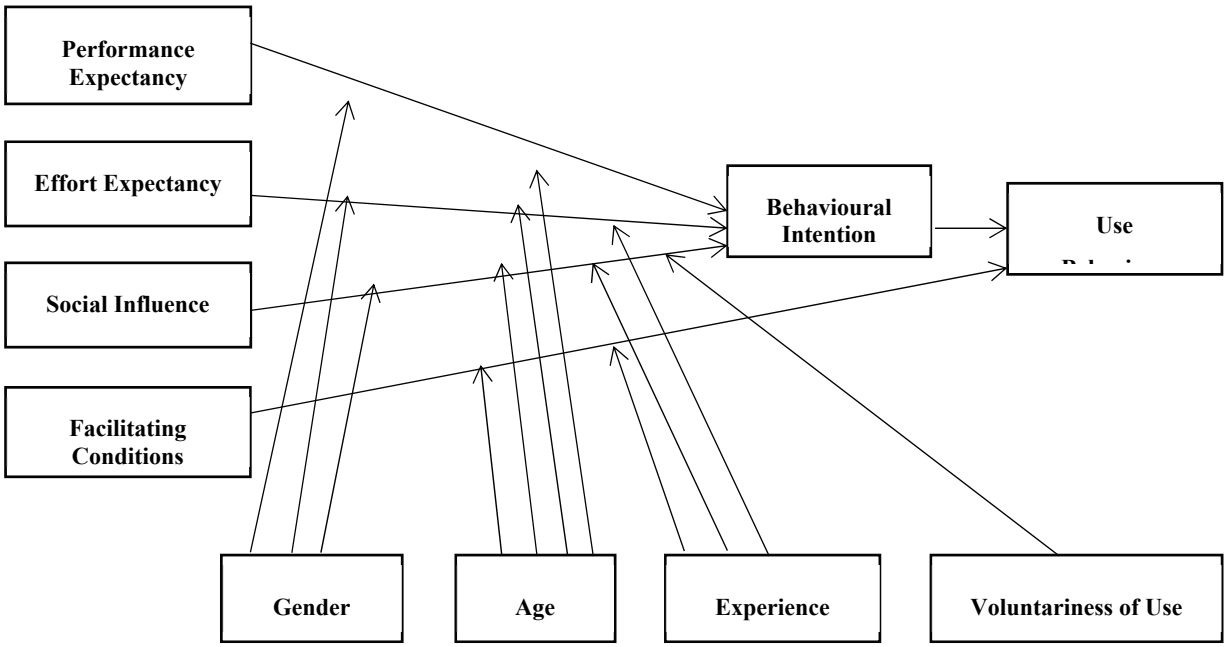

Fig.1: UTAUT Model (Venkatesh et al. 2003).

In this study, the utilisation of the Unified Theory of Acceptance and Use of Technology (UTAUT) is underpinned by the aim to investigate the adoption of ICT/e-learning in Teacher Professional Development (TPD) and the various determinants influencing the behavioural intention to employ these technologies for teaching and learning purposes within the South African educational context (Venkatesh & Davis, 2000). To operationalise the UTAUT constructs, the study aligns them with the use of ICT/e-learning in TPD:

Performance Expectancy: In this context, it signifies "the extent to which a teacher believes that the utilisation of ICT/e-learning will augment the quality of their teaching and learning processes."

Effort Expectancy: This construct represents "the degree to which a teacher perceives that utilising ICT/e-learning will be straightforward and uncomplicated in the context of their teaching responsibilities."

Social influence is "a teacher's perception of the influence exerted by their peers, regarding the necessity of incorporating ICT/e-learning into their teaching practices."

***Facilitating Conditions*:** This framework reflects "the extent to which a teacher is confident that the essential organisational and technical infrastructure exists to support the effective implementation of ICT/e-learning for teaching and learning."

The Diffusion of Innovation (DOI) Theory

The Diffusion of Innovation (DOI) theory, initially developed by Rogers (1962), is a conceptual framework that elucidates how the acceptance and adoption of new ideas or innovations occur within a social system. In the context of this theory, "innovation" encompasses technological advancements and novel ideas or practices. The theory underscores the process through which innovative concepts or products gain momentum and disseminate across a population, ultimately leading to the adoption of new behaviours or practices by individuals, such as teachers. This adoption signifies a departure from previous behaviours and is integral to the diffusion process. To catalyse this diffusion, teachers must perceive the idea or product as innovative, thus recognising its potential to bring positive change within their educational contexts. Innovation's successful adoption and diffusion hinge on various characteristics, including relative advantage, compatibility, observability, trialability, and complexity. The perceived benefits and the ease of integration into existing practices significantly influence the rate of innovation adoption. However, the suitability of the innovation for the specific context also plays a crucial role. The diffusion process can vary widely in terms of duration, with some innovations gaining rapid acceptance while others require years to permeate the target population.

Furthermore, Al-Busaidi (2013) introduces four additional factors that can influence innovation diffusion: the nature of the innovation itself, the effectiveness of communication regarding the innovation, the timing, and the characteristics of the social system into which the innovation is introduced. Within the DOI theory, adopters of innovation are classified into five categories: innovators, early adopters, early majority, late majority, and laggards, each exhibiting distinct characteristics and timelines for adoption. This classification aids in understanding the diversity of responses to innovation within a given population.

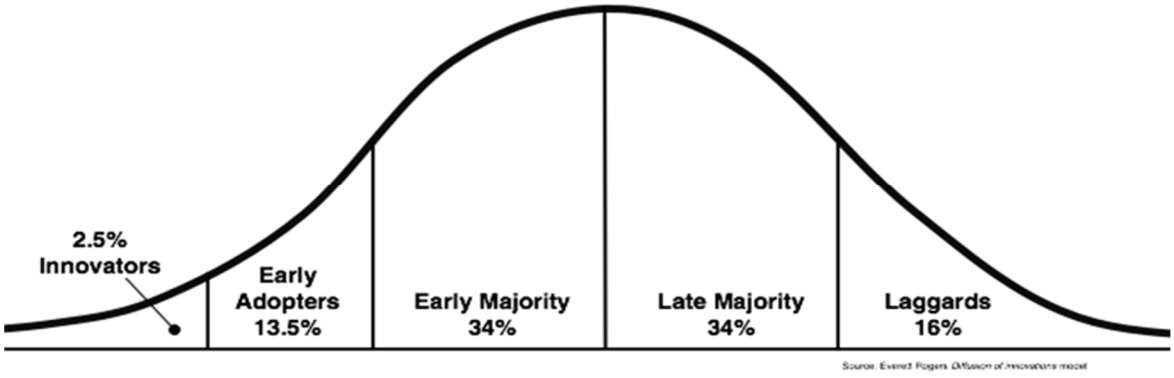

Fig. 2. Predictors of technology users (Source: http://blog.leanmonitor.com/early-adopters-allies-launching-product/)

The adoption and diffusion of technology within educational contexts are multifaceted processes that demand careful consideration of individual and organisational factors. The Diffusion of Innovation Theory (DOI), initially formulated by Rogers (1962), offers a valuable framework for comprehending these processes. DOI recognises that technology adoption occurs in stages, from early innovators and adopters to the late majority and laggards. In the context of this study, DOI assists in understanding the adoption of ICT-driven professional development as an innovation among South African teachers. By categorising teachers along the adoption curve, researchers can assess the readiness of the education system to embrace

technology-driven professional development initiatives. This approach allows for identifying teachers at different stages of adoption, potential change agents, and developing targeted strategies to expedite the diffusion of ICT-driven professional development practices.

In conjunction with DOI, the Unified Theory of Acceptance and Use of Technology (UTAUT) is a foundational framework for exploring the factors influencing teachers' acceptance and adoption of information and communication technology (ICT) for professional development. Developed by Venkatesh et al. (2003), UTAUT consolidates key constructs from various technology acceptance models, providing a comprehensive understanding of user behaviour. When applied to this study, UTAUT facilitates the analysis of teachers' willingness to embrace technology-driven approaches to professional growth. Critical factors considered within UTAUT include performance expectancy, effort expectancy, social influence, and facilitating conditions. By leveraging UTAUT, researchers gain insights into the determinants of teachers' acceptance of ICT-driven professional development initiatives, shedding light on the drivers and barriers within the South African educational context. The amalgamation of UTAUT and DOI establishes a robust theoretical foundation for examining teachers' post-COVID-19 experiences related to technology-driven professional development. UTAUT elucidates individual-level factors that shape teachers' acceptance, while DOI provides a macro-level perspective on the innovation's diffusion process within the educational ecosystem. Together, these theories empower researchers to assess the current educational landscape, identify adoption challenges, and devise targeted interventions to facilitate the effective integration of ICT-driven professional development activities. These efforts can potentially enhance teaching practices and learner outcomes within South Africa's evolving educational environment.

Methods

The research methodology adopted for this systematic literature review (SLR) involved a thorough and structured approach to systematically gather, evaluate, and synthesise relevant research on the post-COVID-19 experiences of teachers in technology-driven professional development activities (Rossouw & Garbutt, 2023). The systematic review adhered to established guidelines and protocols to ensure the validity and reliability of the findings (Rohmah et al., 2023). In the initial phase, a clearly defined research question and specific inclusion and exclusion criteria were established to guide the selection of relevant literature (Van Staden, 2023). A comprehensive search of electronic databases, academic journals, and other scholarly sources was conducted to identify pertinent studies (Maliphol & Walter, 2023). Keywords and search terms related to technology-driven professional development, teachers, post-COVID-19, challenges, opportunities, and best practices were strategically employed to retrieve a broad set of articles (Kanyemba, 2022). The search process was systematic, transparent, and reproducible, minimising the risk of bias in study selection.

Once potential articles were identified, a rigorous screening process followed. Initially, titles and abstracts were reviewed to assess their relevance to the research question and alignment with the inclusion criteria. Subsequently, full-text articles of selected studies were examined to ensure they met the predefined criteria (Ugwuonah, 2023). The selected articles were then critically appraised to evaluate their methodological quality and relevance to the research objectives (Rohmah et al., 2023). Data extraction was carefully carried out, capturing key information from each study, such as research design, findings, and implications (Van Staden, 2023). The synthesised findings from the selected articles were analysed thematically to identify common themes, challenges, opportunities, and best practices in technology-driven professional development for teachers in the post-COVID-19 era (Selwyn, 2021).

The rigorous, systematic approach to conducting this SLR ensured that the research process was transparent, replicable, and comprehensive (Rossouw & Garbutt, 2023). By adhering to

established guidelines and protocols, the study aimed to provide a reliable, evidence-based synthesis of the current literature on the subject, offering insight into the evolving landscape of technology-driven professional development for teachers in a post-pandemic world.

Results

The results of this study highlight the critical role of ICT-driven teacher professional development in enhancing instructional practices while identifying key challenges and strategies for effective integration within the South African education system. Thematic analysis of the systematic literature review generated the following themes as findings for the study.

Theme 1: Concept of Teacher Professional Development

Teacher professional development is a dynamic and evolving concept essential for enhancing educational practices (Ajani & Govender, 2021). Professional development equips teachers with the necessary knowledge, skills, and instructional strategies to improve teaching and learning outcomes (Darling-Hammond & Hyler, 2020). The findings indicate that professional development encompasses various initiatives, including workshops, mentorship, coaching, and training in digital pedagogy. These activities are structured to support teachers in adapting to changing educational environments and integrating innovative teaching approaches into their classrooms (Department of Basic Education, 2016). Additionally, teacher professional development is not uniform; it is highly contextualised and tailored to teachers' specific needs and learning environments (Ajani, 2023). The findings highlight that teachers benefit more from personalised and continuous professional development rather than one-off training sessions. Effective programmes incorporate reflective practice, collaborative learning, and peer support, reinforcing that teacher development is an ongoing journey (Fullan, 2021).

Moreover, professional development directly impacts learner achievement and broader education systems (Muthupoltotage, 2021). Findings suggest that well-structured professional development enhances teachers' capacity to deliver high-quality instruction and respond effectively to diverse learner needs. The data underscores the need for sustained investment in teacher development, mainly through ICT-driven approaches, to support evolving educational landscapes and ensure teachers remain lifelong learners.

Theme 2: Effective ICT-Driven Teacher Professional Development

ICT-driven professional development has emerged as a transformative approach, reshaping how teachers acquire new skills and adapt to digital teaching methods (Darling-Hammond & Hyler, 2020). The findings indicate that integrating ICT into teacher professional development fosters innovative teaching strategies, digital literacy, and learner engagement. In a post-COVID-19 context, ICT-driven development enables teachers to navigate remote and blended learning environments (Means & Neisler, 2020). The study highlights that effective ICT-driven professional development is structured around interactive and participatory learning. Teachers benefit most from hands-on experiences, engaging with digital tools, e-learning platforms, and virtual learning communities (Fullan, 2021). Findings suggest that peer collaboration, mentorship, and real-time instructional support further enhance the effectiveness of ICT-based training. When teachers are actively involved in designing and implementing digital learning strategies, they develop confidence and competence in using technology for teaching.

Furthermore, the findings emphasise the importance of aligning ICT-driven teacher development with practical classroom applications (Mtebe & Raisamo, 2014). While digital training programmes exist, teachers often struggle to translate these skills into effective classroom practices. The study suggests that professional development initiatives must be

directly linked to instructional design, assessment strategies, and subject-specific content delivery to ensure long-term impact.

Theme 3: ICT and E-Learning in Teacher Professional Development

E-learning has been identified as a key professional development facilitator, providing teachers with flexible and accessible learning opportunities (Darling-Hammond, 2020). The findings reveal that e-learning enables teachers to engage in self-paced learning, access diverse digital resources, and interact with global professional networks. This shift represents a departure from traditional teacher-centred training towards more inclusive and collaborative learning experiences. The study further highlights that South African teachers, particularly in rural settings, face challenges in integrating ICT into their professional development (Ajani, 2019). While many are familiar with essential digital tools, such as email and presentation software, they require targeted training to utilise e-learning for instructional delivery effectively. Findings indicate that teachers in well-resourced urban settings are more likely to engage in ICT-based professional development than their rural counterparts due to disparities in digital infrastructure and internet connectivity (Department of Basic Education, 2016).

Additionally, findings suggest that teacher professional development should enhance teachers' confidence in using ICT for learning and teaching (Van den Bossche et al., 2021). When teachers are well-trained in ICT applications, they are more inclined to integrate these tools into their classrooms, promoting active and technology-enhanced learning.

Theme 4: Challenges of ICT and E-Learning in Teacher Professional Development

Despite the numerous advantages of ICT-driven teacher professional development, findings indicate several challenges that hinder its widespread adoption (DBE, 2016). A significant concern is the lack of access to digital tools, particularly in under-resourced schools and rural areas (Mtebe & Raisamo, 2014; UNESCO, 2020). Many teachers struggle with inadequate internet connectivity, outdated digital devices, and limited institutional support, preventing them from fully utilising ICT in their professional growth. Additionally, findings reveal that teachers often lack the necessary digital literacy skills to engage effectively with online learning platforms (Gamede et al., 2022). Professional development initiatives frequently focus on technical training without addressing the pedagogical implications of ICT integration. This results in a knowledge gap where teachers are proficient in using digital tools but struggle to apply them in classroom settings (Ajani & Govender, 2023).

Moreover, findings suggest that time constraints pose a significant barrier to ICT adoption in professional development. Many teachers juggle multiple responsibilities, leaving them with limited time to engage in continuous learning and digital training. The study highlights the need for structured and flexible ICT-based professional development models that accommodate teachers' schedules and learning preferences (Inan & Lowther, 2020).

Theme 5: Strategies to Enhance the Adoption of ICT in Teacher Professional Development

Findings suggest several strategies to improve ICT adoption in teacher professional development to overcome the barriers identified. One key recommendation is to provide teachers with personal laptops and internet access to facilitate digital learning (UNESCO, 2020). Ensuring that educators have access to digital resources will enhance their ability to engage with e-learning platforms and integrate technology into their teaching practices.

The study also highlights the importance of ongoing training in digital literacy and pedagogy (Khan, 2018). Teachers benefit most from professional development initiatives that offer sustained engagement rather than one-off training sessions. Findings suggest mentorship

programmes, where experienced teachers support their peers, can significantly improve ICT adoption in professional learning (Govender et al., 2023).

Furthermore, findings recommend that teacher training institutions and policymakers develop structured ICT-driven professional development frameworks that align with national education policies. Providing targeted support, including financial incentives and training resources, will encourage teachers to embrace ICT as a vital component of their professional growth (Butgereit, 2020).

Discussion

The findings reinforce the significance of teacher professional development in improving instructional practices and learner outcomes (Ajani & Govender, 2021). The study highlights that ICT-driven development is no longer optional but essential in equipping teachers with the skills necessary to navigate modern digital learning environments (Darling-Hammond & Hyler, 2020). The integration of ICT into teacher professional development aligns with global education trends and South Africa's commitment to digital transformation in education. However, the study also underscores significant challenges that hinder the effectiveness of ICT-based professional development. The digital divide remains a critical issue, with rural and underprivileged teachers facing substantial barriers to accessing digital learning resources (Department of Basic Education, 2016). The findings suggest that targeted government policies and institutional investments are necessary to bridge these gaps and ensure equitable access to ICT-driven training.

Furthermore, the discussion highlights the importance of designing professional development initiatives that are practical, interactive, and directly applicable to classroom teaching (Fullan, 2021). Practical teacher training goes beyond technical skills; it must incorporate pedagogical strategies that enable teachers to use technology to enhance learning outcomes (Mtebe & Raisamo, 2014). The study also connects the findings to social justice pedagogy, emphasising equitable access to education and professional development (Van den Bossche et al., 2021). ICT-driven teacher development must be inclusive, ensuring that all teachers, regardless of location or socio-economic background, have equal opportunities to enhance their skills. The findings suggest a more collaborative and policy-driven approach is required to promote sustainable and impactful professional learning experiences.

Conclusively, this study highlights the transformative potential of ICT in teacher professional development while acknowledging the structural and practical challenges that must be addressed. To ensure teachers remain effective in digital learning environments, institutions and policymakers must prioritise strategic interventions, capacity-building initiatives, and resource allocation to support continuous professional development.

Conclusion

The advent of the COVID-19 pandemic has significantly disrupted the landscape of education and teacher professional development in South Africa and across the globe. In response to this disruption, integrating Information and Communication Technology (ICT) and e-learning has emerged as a vital strategy to ensure the continuous capacity building of teachers. This approach addresses the challenges posed by the pandemic and offers opportunities to enhance instructional delivery and learning experiences for teachers and learners. By harnessing the power of ICT and e-learning in teacher professional development (TPD), teachers can engage in teaching and learning activities without the constraints of physical contact, thus fostering the continuity of education. Moreover, using ICT and e-learning platforms in TPD creates a flexible and accessible environment for teachers, enabling them to participate in professional development activities at their convenience and preferred locations. This approach facilitates

interactive, collaborative, experiential learning experiences, seamlessly connecting teachers with mentors and peers.

Furthermore, it opens avenues for innovative assessment methods and practices while equipping teachers with the requisite skills and knowledge to effectively integrate ICT and e-learning into their pedagogical practices. Nevertheless, it is crucial to acknowledge and address the challenges that may impede the adoption of ICT-driven TPD. These challenges include the digital divide, limited access to functional ICT resources in schools, and the need for comprehensive capacity-building initiatives for teachers. To harness the full potential of ICT and e-learning in South Africa's education system, it is imperative to prioritise teacher training in ICT usage, ensure equitable access to technology resources in educational institutions, and establish a framework for ongoing and systematic TPD in this domain.

In conclusion, this study underscores the transformative potential of Information and Communication Technology (ICT) and e-learning in the realm of teacher professional development (TPD) within the context of South Africa, especially in the wake of the COVID-19 pandemic. While the pandemic brought about unprecedented disruptions to education, it also accelerated the recognition of ICT and e-learning as indispensable tools for teachers and learners. This research has highlighted the numerous benefits of leveraging these technologies in TPD, including enhanced instructional delivery, flexible learning opportunities, interactive engagement, and innovative assessment methods. However, addressing the challenges hindering the widespread adoption of ICT in TPD, such as the digital divide and the need for comprehensive teacher training, is imperative. By strategically addressing these obstacles and promoting a culture of ICT-driven TPD, South Africa can advance its education system, empower its teachers, and ultimately equip its learners with the skills and knowledge needed to thrive in the digital age.

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