Adult learning theory tenets: A panacea to ICT skills gaps among educators in South Africa

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Abstract

The integration of information communication technology (ICT) in education is vital for achieving educational objectives, and South Africa has undertaken diverse efforts and initiatives to promote this integration in schools. Despite policy support and financial backing, there persists a gap in educators' ICT skills uptake. This paper adopted conceptual analysis to make sense of the principles of adult learning theory (ALT) as a veritable tool for improving ICT skills uptake among educators. The paper outlines the Department of Basic Education's efforts in promoting ICT integration in schools and discusses the associated challenges. Overall, the article advances ALT tenets in planning and implementing ICT-focused, school-based teacher professional development (SBTPD) in schools. These tenets include the need-to-know principle, self-concept or self-directedness principle, learners' experiences principle, readiness-to-learn principle, orientation-to-learning principles, and intrinsic-motivation principle as effective correlates of ICT-oriented SBTPD training. Based on the explication, the paper recommends reforming existing teacher professional development policies, promoting a decentralised approach to ICT training, and conducting comprehensive ICT needs assessments to design effective ICT-oriented needs-based SBTPD training.

Keywords: adult learning theory, ICT, digital pedagogy, classroom ICT integration

Introduction

Technology has ushered in an era of unprecedented transformation, redefining human existence with swiftness unparalleled by any previous invention (Neuhofer et al., 2021). Unlike earlier industrial revolutions, the rapid pace of technological advancement demands a more agile response from the education sector, outstripping the measured evolution seen in society and educational institutions (Mulyani et al., 2021). The advent of the Third Industrial Revolution (3IR) in the 1970s to the late 20th century paved the way for the current Fourth Industrial Revolution (4IR) era. However, numerous African education systems continue to grapple with the effective assimilation of 3IR and its attendant benefits (Formunyam, 2020). It is common knowledge that the unfolding of the 4IR encompasses transformative and disruptive effects across all sectors, including reshaping the very nature of teaching and learning.

The United Nations Educational, Scientific, and Cultural Organization (UNESCO) has proactively pursued its 4IR agenda, anchoring it on three essential pillars to harness the full potential of this developmental surge in the education sector. UNESCO actively guides nations in developing curricula and teaching methodologies that foster critical 21st-century skills such as creativity, critical thinking, problem solving, and digital literacy (González-Salamanca et al., 2020). Moreover, UNESCO empowers learners of all ages, instilling in them the confidence and autonomy to drive their learning experiences through initiatives like the Global Education Monitoring Report's Youth and Skills Campaign (Ossiannilsson, 2021). Lastly, UNESCO places a premium on connecting learners in an age dominated by digital interconnectedness. Initiatives like the UNESCO Connecting Classrooms Programme link classrooms across geographical and cultural boundaries (Mhlanga, 2021). Notably, with respect to information communication technology (ICT) integration within education, stark disparities in perceptions and attitudes among educators exist across different nations. Developed economies often exhibit higher success rates in adopting ICT due to well-established infrastructure and robust international cooperation (Garrity, 2017; Korovkin, 2019). Conversely, developing economies face multifaceted challenges including infrastructural deficits, social and urban–rural divides, and a disparity in ICT knowledge among educators all influencing their disposition towards ICT adoption (Alakrash & Razak, 2022).

In South Africa, integrating ICT is a pivotal strategy to enhance educational outcomes and bridge the digital divide between the Global North and South. Although the South African government has invested significantly in procuring ICT equipment and providing educator training, substantial challenges remain to surmount. These challenges include enhancing infrastructure and skilled workforce, and addressing the high costs associated with ICT resources (Dlamini & Mbatha, 2018; Munje & Jita, 2020).

Previous studies have explored the intricacies of ICT penetration in the educational space in South Africa. For instance, Mwapwele et al. (2019) explored the adoption of ICTs by rural teachers in South African schools within the framework of the national broadband policy,

South Africa Connect. Drawing on baseline data from the ICT4E[1] project across seven provinces, their investigation employed the Technology Readiness Index as its guiding theoretical lens. Their findings revealed a potential conflict arising from school policies that prohibited personal digital device use by students, indicating a potential misaligning with the objectives of the South Africa Connect policy, and which constitutes a barrier to ICT-oriented instructional delivery by teachers.

Further, Manda and Ben Dhaou (2019) investigated the challenges and opportunities encountered by developing nations, with a specific emphasis on South Africa, in adopting digital transformation strategies to promote inclusive growth during the era of the 4IR. They employed an interpretive case study approach, relying on document analysis and literature review as primary data collection methods. Through a secondary, data-based case study centred on South Africa, their study underscored the crucial need for tailored, context-specific strategies to effectively meet the demands of the digitally driven 4IR for educators. Similarly, in another study, Atsu et al. (2021) investigated the challenges multigrade teachers faced in South African primary schools when implementing ICT. The study employed three theoretical lenses to interpret the results, emphasising the generative theory of rurality, Rogers' diffusion of innovation theory, and Bourdieu's concepts of habitus, field, and capital. Their findings revealed that these challenges are multifaceted and can be understood within the ecological systems framework, which operates on various levels. The study's conclusion underscored the necessity of a holistic approach that takes cognisance of individual school contexts before addressing the challenges associated with ICT implementation in multigrade settings.

Even though those studies illuminated the challenges associated with ICT integration in schools, none explicitly addressed the significance of teaching and learning strategies in training teachers in ICT-oriented instructional delivery. To fill that gap, this study advances adult learning theory (ALT) instrumentation in deploying ICT training for educators in South Africa. Specifically, the study aimed to address this gap by advocating for incorporating ALT principles in the planning and execution of ICT-focused, school-based teacher professional development (SBTPD) programmes. Consequently, the paper proposes reforming existing teacher professional development policies, a decentralised approach to ICT training, and a comprehensive assessments of ICT needs to facilitate the design of tailored, effective SBTPD programmes that address the specific requirements of educators in South Africa.

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1   The Information and Communication Technology for Education (ICT4E) initiative aimed to train educators in rural areas of seven provinces in South Africa to effectively utilise ICT tools. This project received funding from the Department of Rural Development and Land Reform and received backing from the University of the Free State (UFS). The UFS provided training for both teachers and youth enrolled in the National Rural Youth Service Corps program at 24 schools across seven provinces in South Africa.

Methodology

This study is a conceptual paper that relied on conceptual analysis as its methodology. Conceptual analysis mean clarifying and critically examining the meaning and implications of concepts, theories, and frameworks in any field of inquiry (Castro et al., 2016; Foronda et al., 2016). We considered conceptual analysis suitable for this study because it allowed us to explore the nuances and applications of ALT as a framework for addressing ICT skills gap among educators in South Africa. ALT holds a set of principles that emphasise the roles of learners' prior experiences, self-directedness, motivation, and readiness to learn, in facilitating effective and meaningful learning (Knowles et al., 2015). Hence, we adopted ALT principles as the data source from which we derived insights and recommendations for designing and implementing school-based ICT-oriented training for educators in South Africa.

To strengthen and validate our conceptual analysis, we extensively reviewed relevant literature on ALT, ICT integration in education, and teacher professional development (Castro et al., 2016). This comprehensive review provided the necessary context for understanding the interplay between ALT principles and the specific challenges faced by educators in South Africa concerning ICT proficiency. Furthermore, case studies and exemplar practices from other contexts were examined to draw parallels and analogies that could strengthen the application of ALT in the South African educational landscape. By employing conceptual analysis in conjunction with an in-depth literature review and cross-contextual case studies, we provide a robust and well-grounded theoretical framework for deploying ICT-oriented training based on ALT principles. This approach not only bridges the theoretical and practical domains but also offers a nuanced understanding of how ALT could serve as a remedy for ICT skills gaps among educators in South Africa.

Literature review

Educators' ICT proficiency in 3IR and 4IR

Digital nativity (the ability to operate essential computer equipment such as phones and laptops), especially among teachers, is often seen as digital proficiency. Notably, many teachers who are digital natives lack the requisite digital proficiency to adopt ICT for teaching (Zhao & Zhao, 2021). In other words, ICT proficiency emphasises the need for a nuanced understanding of digital skills by educators, and their roles in adopting it during the teaching–learning process. Unfortunately, not all teachers can demonstrate the requisite digital pedagogical proficiency in the classroom (Chigona, 2018). For instance, the 3IR encompasses an influx of computers and the internet into the various spheres of national life. Unfortunately, many teachers are merely familiar with using essential ICT gadgets for personal use but need help to integrate digital pedagogy in the classroom.

While many educators grapple with adopting ICT in teaching practice, the 4IR stares us in the face. Although our current understanding of 4IR is limited, it is becoming a widely discussed

topic across different sectors of the economy. 4IR involves the fusion of many technologies capable of collapsing physical, digital, and biological boundaries (Mirbabaie et al., 2022). It is also fast attracting increased attention from policymakers, business practitioners, and academics (Oke & Fernandes, 2020). The pressing question is: "With educators still striving to master digital integration effectively, what lies ahead for schools in the 4IR?" Educators hold a crucial role in the education system as the gatekeepers of school knowledge and curriculum implementers. Hence, the success or failure of ICT integration largely hinges on their disposition, readiness, and engagement. To achieve the objectives of well-designed policy reform on ICT curriculum, practical in-service training for teachers (who act as the final arbiters of such curriculum) becomes imperative. Regardless of how commendable a policy may be, its ultimate success rests on the mantra of "train the trainer." In other words, providing comprehensive training to educators is paramount for effectively integrating ICT into the education system.

Several factors are associated with digital pedagogical skill incompetence among educators in South Africa (Abrahams & Burke, 2021). These factors include teachers' attitudes and dispositions towards ICT, availability or non-availability of ICT infrastructures, educators' socioeconomic status, rural–urban school location dichotomy, who is responsible for training costs, and school-related factors, among others (Alakrash & Razak, 2022; Bladergroen & Chigona, 2018; Pashapa & Rivett, 2017). Similarly, Nyahodza & Higgs (2017) noted slow internet connection, security concerns, shortcomings in information literacy, problems of access and accessibility, and reluctance to engage with unfamiliar technology as some of the challenges hindering ICT integration in South African schools. And some of these factors became pronounced during the Covid-19 pandemic lockdown when schools migrated to an online instructional delivery mode. Most educators who were not ICT proficient struggled to migrate to online teaching; some self-learned, and others relied on one-on-one training from colleagues (Sasere & Makhasane, 2020). For that period, policy on transition to online instructional delivery can be considered appropriate, however, most trainers and educators lacked the requisite skills for implementation.

ICT-oriented SBTPD framework: The way to go

Traditionally, teacher professional development has always assumed a one-size-fits-all centralised approach with its attendant deficiencies (Praveen, 2018). And, these deficiencies would be replicated in digital pedagogical orientation for teachers if such training was not school-based. The SBTPD framework is an ideal way to deploy digital integration training to teachers because it allows teachers to undergo training in a familiar and comfortable environment with the interplay of their school's peculiarities. In such a programme, teachers can learn about digital tools and how to use them to enhance teaching and learning. Further, these programmes allow teachers to share best practices and ideas with fellow teachers. Digital pedagogical training programmes can help build teachers' confidence in adopting digital technologies, leading to a more effective and engaging teaching and learning experience. Notably, such training often involves covering the selection and appropriate utilisation of digital resources, designing engaging and effective digital lessons, and assessing

student learning using digital tools. Drawing from the above, government policies on ICT integration in schools should engender school-based training that encapsulates school contexts and peculiarities to achieve effective classroom digital integration.

Advancing ICT integration in South African education: Policy initiatives and challenges

The South African government has made a series of efforts to integrate ICT across various sectors, particularly education. Policies like the 2004 White Paper on e-Education (Department of Education, 2004) and the 2013 South Africa Connect broadband policy (Department of Communications and Digital Technologies [DCDT], 2013) were pivotal in enhancing learning practices and nurturing skills development through ICT (Abrahams & Burke, 2021). However, persistent challenges of infrastructure limitations and gaps in teacher training have meant significant setbacks for attaining their objectives (Ilic, 2021; Rey-Moreno & Pather, 2020). The White Paper for Post-School Education and Training (Department of Higher Education and Training, 2013) addressed critical learning approaches, particularly emphasising the needs of disadvantaged groups. But intervention equally suffered the same fate as previous initiatives (Baatjes, 2018; Mayombe, 2017). In another development, the United Nations proposed a provisional workplace e-learning acceptance framework that aligned with the 4IR agenda, which ultimately catalysed the creation of the South Africa Professional Development Framework for Digital Learning in 2017 (Lotriet & Twinomurinzi, 2021; van der Merwe & Armitage, 2019).

Subsequently, the National Digital and Future Skills Strategy set out to equip the population, particularly the youth, with imperative digital skills for the 4IR (DCDT, 2020). Nevertheless, implementation of these initiatives and interventions encounter various challenges including financial limitations and persistent digital disparities (Abrahams & Burke, 2021; DCDT, 2020). Notably, the integration of ICT in South African schools, particularly in rural settings, faces hurdles such as inadequate infrastructure and financial constraints (Kafu-Quvane, 2021; Padayachee, 2017). The issue of teacher training remains of particular concern because it profoundly influences their proficiency in leveraging technology for effective teaching (Munje & Jita, 2020). This study, therefore, advocates the application of ALT tenets as an instrumental framework for robust ICT-oriented SBTPD, thereby making a meaningful contribution to the realisation of the National Digital and Future Skills Strategy for South Africa 2021–2025. (Abrahams & Burke, 2021)

The roles of ICT experts in teacher digital orientation

The use of digital technology in education is becoming more and more commonplace (Kessler, 2018). Therefore, teachers must receive proper pedagogical training to effectively integrate these tools into their classrooms (Voogt & McKenney, 2017). However, designing and delivering such training can be daunting, hence, involving a consultant becomes highly beneficial (Hedberg, 2011). Consultants can help design a comprehensive training programme that covers all the essential aspects of using digital technology in the classroom.

They can also provide professional guidance on how school-based facilitators can effectively deliver subsequent training to their colleagues.

Furthermore, consultants offer valuable insights and feedback based on their experience using digital technology in education (Wilczynski et al., 2017). Monteiro et al. (2019) exemplified the necessity of consultancy in ICT training for teachers in their conference paper titled "Curricular Integration of Computational Thinking, Programming, and Robotics in Basic Education: A Proposal for Teacher Training." The objectives were to provide a training framework for curricular technology units in teacher training courses at the tertiary level and for in-service training. Furthermore, they aimed to outline the ideal profile for childhood educators and primary school teachers, who serve as mediators in integrating programming and robotics education within their specific educational environments. The rationale behind this approach was that ICT experts are best suited to map out a practical framework for teacher ICT training. Overall, having a consultant involved in the digital pedagogical training process can guarantee the highest quality and ensure that teachers are well prepared to integrate digital pedagogy into their teaching practice.

The theoretical underpinning: Leveraging ALT for effective ICT-centric teacher development

This section advances the principles of ALT as a panacea to ICT skills gaps among educators in South African Schools. Most ICT training initiatives for teachers adopt a pedagogical approach more suitable for children and adolescents. Training consultants often deliver lectures using the top-down approach with little or no teacher contribution. On the contrary, the adult learning approach to teacher ICT training emphasises the role of the learner in the learning process. Hence, the adult learning approach, or andragogy, is more appropriate for adult learners (in this case, the educators). Most in-service teachers are familiar with the usage of ICT; they have prior experience, and their learning can only be meaningful when it resonates with their previous knowledge and roles as teachers.

An adult learner is seen as an active participant in the learning process, while the trainer assumes the role of a facilitator who provides guidance and support. The principles of andragogy state that adults learn best when they are involved in the learning process and have a personal stake in the outcome. The tenets of ALT posit that adults learn best when actively involved in the learning process, and when the content is relevant to their needs. To effectively train teachers in the use of ICT in the classroom, adopting an adult learning approach is essential. This implies that the training must be interactive and hands-on, focusing on practical applications of ICT in the classroom. The content must also be relevant to the needs of the teachers, considering their experience and expertise. Only by adopting an adult learning approach will the training be genuinely effective in helping teachers integrate ICT into their teaching practice. The next section will examine the tenets of ALT, and how they can inform ICT-oriented SBTPD from the planning to the feedback stages.

Our thesis in this article is anchored on Malcolm Knowles's (1973) perspective of ALT. Malcolm Knowles is considered the father of andragogy, and the principles have since been widely adopted by trainers and educators working with adult learners (Rachal, 2002). His works sparked a reawakening in Europe, and popularised andragogy in the United States (Elias, 1979; Usher et al., 1997). Notably, Knowles's work drew on that of Dusan Savicevic- a professor in the then Yugoslavia in South-Eastern Europe in 1966 (Knowles, 1984; Rachal, 2002). Knowles defined andragogy as the "art and science of helping the adult to learn" (1984, p. 12). Andragogy is a construct derived from the Greek words "*andr,*" meaning man and "*agogus,*" meaning leader of, hence, andragogy could be called leading men (Knowles, 1973, p. 51).

In 1973, Knowles authored *The Adult Learner: A Neglected Species*. The book's core, and the emphasis of his subsequent work, was that adult learning differs from children's learning. The basis of Knowles' methodology for adult learning rested on two main ideas: first, that adults have a wealth of experience and knowledge to bring to the learning process, and second, that learners should be at the centre of that process rather than instructors (Conaway & Zorn-Arnold, 2015; Knowles, 1984). Knowles's theory of adult education has six assumptions: the need to know, self-concept, experience, readiness to learn, orientation to learning, and intrinsic motivation. These form the core adult learning principles of ALT. The following sections explicate the nuances of ALT principles and the deployment of school-based ICT-oriented training for educators in South African schools.

The need-to-know principle as a correlate of ICT training for teachers

This principle posits that adults must understand the reason for learning before effective learning can occur (Knowles et al., 2014). In other words, they need to see the relevance of their learning to be motivated to learn it. This principle is fundamental in ICT training for teachers. In today's rapidly changing world, it is more important than ever for teachers to be able to use technology in their classrooms. However, many teachers are resistant to the adoption of technology because they do not see the relevance of it, or because they do not feel confident in their ability to use it. The best way to overcome this resistance and get teachers to use new technology is to orientate them on how ICT can improve their teaching. Once they see the relevance and value of the technology, they will be more motivated to learn how to use it. This is where the need-to-know principle comes in. By showing teachers the relevance of new technology and explaining how it can improve their teaching, facilitators can help them overcome their resistance and get them excited about using new technology in their classrooms. Given the enormous amount of information available on ICT, teaching without a focus can be overwhelming, hence, focusing on the most relevant and necessary information makes ICT training more effective. Aljohani and Alajlan (2021) found, in their study that sought to explore the degree of conformity with andragogy principles in an advanced diploma programme in Saudi Arabia, that the participants (who were adults) reported that they were fully aware of their need to know before participating in the programme.

Self-concept or self-directedness principle as correlate of ICT training for teachers

This principle holds that adult learners perceive themselves as responsible for their decisions, actions, and lives. This includes participation in in-service training. They are ready to learn when such training gives room for self-directing (Ferreira & Maclean, 2018) because then, their self-concept has shifted from dependent to self-directing. Conflict often ensues when training content is at odds with their deep-seated self-concept. Given this, facilitators need to create an atmosphere that accommodates the willingness of adults to direct their learning.

In the context of ICT-oriented teacher professional development, it is crucial to acknowledge that teachers have varying levels of experience in ICT proficiency, making it essential to tailor the training to meet their individual needs. In applying the self-concept or self-directedness principle to teachers' ICT training, planners should ensure that the training directly relates to their teaching practice. This approach increases the likelihood of teachers' engagement with the material and absorption of information because the training becomes practical and directly applicable to their roles. Hence, there is a need to have an ICT professional capable of giving lectures and demonstrations tailored to individual teacher's needs. This exercise can be daunting, but it can also be simplified by carrying out a needs-based assessment of teachers before the training, and then grouping them based on their needs during the training (Knowles, 1975). This differential training approach would prevent the deficiencies associated with traditional one-size-fits-all teacher professional development.

Learners' experiences principle as correlate of ICT training for teachers

Andragogy varies from pedagogy in several aspects (Knowles, 1975). Notably, it does not assume that adults lack prior experience or knowledge. Instead, andragogy relies on the learner's experiences as the basis for new learning because their accumulated knowledge significantly contributes to the process. Hence, andragogy respects experience as an essential element in the learning process (Conaway & Zorn-Arnold, 2015). ICT training for teachers transcends getting them to memorise a set of concepts. It involves training the teachers to acquire knowledge and skills they can actively apply in their workplace. One way of doing this is by considering the teacher's previous experience.

The trainer, therefore, should try to understand the teacher's existing knowledge and skills and then build on that. For example, if the teachers are familiar with basic ICT concepts, the trainer can focus on more advanced topics. Learners who bring their previous experience to bear are more likely to engage with the material and learn more effectively. To this end, the trainer should try to understand the teacher's existing knowledge and skills and then build on those. According to Aslan and Zhu (2016), individuals with previous exposure to ICT tend to possess greater confidence in their computer abilities, maintain a positive outlook towards ICT, and experience less apprehension about using computers.

Consistent with the principle of adult prior experience in learning, Galustyan et al. (2019) conducted an initial study to identify the level of ICT competency in experimental and

control groups at the beginning of an ICT course for teachers. They discovered an array of ICT competencies among the teachers in analytical, search, design, and creative components. They then explained how these different components are involved in utilising websites for educational purposes. The analytical aspect involves evaluating the suitability of specific websites for educational activities. The search component entails selecting appropriate materials to implement educational tasks and necessitates proficiency in using various search systems and databases. The design element requires the skill to create educational electronic content and assess its practical efficacy. Lastly, the creative component involves utilising digital educational resources created by peers and generating original content for educational purposes. The study showed that ascertaining teachers' prior knowledge before ICT training yielded positive results.

Readiness-to-learn principle as correlate of ICT training for teachers

The readiness-to-learn assumption of andragogy holds that, as an individual matures, the biological development and academic pressures of learning decrease. In contrast, the individual's social roles necessitate the pressure to learn. In practical terms, adult learners tend to be naturally ready to acquire new knowledge so long as it enables them to discharge their social roles effectively. The same holds for ICT-oriented teacher professional development. In their article, Ghavifekr and Rosdy (2015) pointed out that teachers' readiness and skills in using ICT play a crucial role in integrating ICT into education. On the other hand, with the risk of becoming irrelevant in the face of the ongoing technological disruption that permeates society, teachers are motivated to acquire skills that enable them to become relevant in the 21st-century classroom. However, when teachers are unaware of the importance of digital pedagogical skills, the onus lies on the facilitators to motivate teachers to be digitally pedagogical compliant.

Orientation-to-learning principle as correlate of ICT training for teachers

Adolescent orientation to learning is broad because the curriculum content at their level prepares them for their future. At this stage, learning is both teacher-centred and subject-centred. The adolescent curricula are not self-determined; instead, they are structured to give them a broad background across various fields from which they can choose in the future. On the other hand, instead of focusing primarily on future content, adult curriculum content needs to focus on problem-solving skills that they can apply to their current developmental tasks. This is because, when adults have to make a lifestyle change that requires them to return to school, they want to learn applicable content immediately. This immediate need for applicable content makes adults very clear about what they need to know to address their current situation.

Similarly, ICT training for teachers should equip teachers with digital pedagogical and problem-solving skill sets that can be applied now to solve their instructional challenges. The content should be relevant and applicable to today's teaching practice. In their study, Aljohani and Alajlan (2021) found a significant positive difference in participants' job

performance when their training curriculum adopted andragogy. This implies that adults transfer their newly acquired knowledge and skills to solve immediate job problems.

Intrinsic-motivation principle as correlate of ICT training for teachers

Unlike extrinsically motivated children, via punishment and reward stimuli (Crow, 2021), adults are intrinsically motivated to learn—not necessarily because they want to obtain a degree but to satisfy personal growth and development needs (Díez-Palomar et al., 2021). In-service training for adults brings a sense of pride and accomplishment—in this case, the ability to apply digital pedagogical skills in the classroom. Teachers who ignore the use of ICT equipment such as projector, internet service, and desktop or laptop computer made available in their classroom due to a lack of the requisite skill set often feel incompetent, which can be embarrassing. On the other hand, teachers' confidence increases when they can integrate available ICT equipment for instructional delivery.

Despite the potential of ALT in fostering ICT proficiency among teachers, the framework, like other frameworks, is not insulated from limitations or challenges. Implementing ICT-oriented SBTPD within the framework of ALT could be hampered by challenges such as the frequency of professional development programmes for teachers, incongruency between training contents and teachers' needs, insufficient ICT resources and infrastructure, as well as concerns over safety and protection of ICT equipment in schools (Ajani, 2021; Castro-Guzmán, 2021; Çelen & Seferoglu, 2020; Munje & Jita, 2020). To overcome these challenges, experts recommend exposing teachers to frequent ICT-oriented SBTPD that focuses on addressing their diverse classroom needs (Warner et al., 2021). Furthermore, the structuring of professional development programmes should adhere to criteria including needs-based content, active learning, duration, joint participation, compliance with individual needs, colleague collaboration, and expert support. Likewise, the South African Department of Basic Education (DBE) should consider individual school contexts when allocating ICT resources, and reinforce monitoring and evaluation mechanisms to identify contextual challenges and provide assistance where necessary. Finally, the DBE should provide practical professional development training for school-based facilitators, who are predominantly teachers drawn from each school, and furnish schools with the necessary ICT resources and infrastructure to ensure the successful implementation of ICT in education programmes.

Conclusion and recommendations

This article explores ALT tenets as a formidable framework for deploying ICT training for teachers in South African schools. Foregrounding the study was the exigency of an ICT skill set for teachers in the 3IR and 4IR. An attempt was made to review the South African government's efforts to integrate digital pedagogy in the classroom. The government also brought to bear the educators' ICT proficiency level during the 3IR and towards the 4IR. Our study further explored digital pedagogy orientation approaches for both pre-service and in-service teachers. Central to the article is the argument in favour of an andragogy-informed ICT-oriented SBTPD, and the involvement of an ICT consultant in the development and

implementation of such training. Finally, the article advances the principles of ALT as a solution to ICT pedagogy skills gaps among teachers in South Africa.

Given the above, we recommend the following:

- The DBE should review existing policy guiding the deployment of ICT training for teachers to include a decentralised approach where the teachers and the trainers can appropriate contextual advantages. If single-school training is not possible, schools within the same quintile should form a cluster with a sustainable arrangement.
- Initial and continuous ICT needs assessment exercises for teachers are essential. With these exercises, programme organisers are better informed as to which area to concentrate their efforts on and, if there were need for differential training, it would be identified prior to training.
- Drawing from the principles of ALT, it becomes evident that adults learn differently from children. Therefore, ICT training for teachers should thoroughly consider andragogy principles throughout the planning and implementation stages. This approach aims to avoid repeating the outcomes of previous top-down traditional teacher professional development programmes that trained teachers like children.
- The Department of Higher Education and Training should review the pre-service teacher curriculum to include a well-designed and robust digital pedagogy module. This would forestall the circle of graduating teachers in need of digital pedagogy skills into the school system.

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