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Factors influencing the integration of ICT in teaching and learning

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Abstract

The extant literature highlights that a combination of attitudes towards technology, technological competencies, and access to technology tools significantly impact the integration of technology within the classroom teaching and learning environment by educators and school management. This study investigated the influence of these factors in predicting successful technology integration in teaching and learning within the private school context in South Africa. It included respondents from primary and secondary schools. The research adopted a quantitative cross-sectional survey strategy and collected data from educators and school management using a questionnaire. The study found positive educator attitudes towards using ICT tools in classroom teaching and learning. In addition, educators have a high skill level in using ICT tools for teaching. It also found high exposure levels to technology tools for classroom use. Although it was found that the management staff are largely undecided on technology integration, favourable perceptions were expressed towards factors related to the application process, familiarity and confidence, adaptation, and creativity in the use of technology in education. Educators' ICT skills significantly influenced technology integration in teaching and learning. However, no statistical evidence suggests that access to technology and educator attitudes can significantly influence technology integration in teaching and learning. The study offers several recommendations for enhancing technology integration in the classroom.

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1. Introduction and Background

The impact of the ever-increasing reliance on Information and Communication Technologies (ICTs) across various sectors of our society is evident. As a result, it is deemed unavoidable for ICTs to be embedded in school curricula. Assimilating technology in teaching and learning has become an essential goal for various governments across the globe. In South Africa, the seminal Draft White Paper on e-Education explicates the government's strategy to implement e-education or e-learning in South African schools. The Department of Education previously highlighted that the developments in ICTs "create access to learning opportunities, redress inequalities, improve the quality of learning and teaching, and deliver lifelong learning" (SA DOE, 2003). Promoting ICT implementation in education is based on the prospective benefits of ICTs in supporting the learning process (Dawes, 2001; Jadhav, Gaikwad &Patil, 2022). The use of technology in schools has been regarded as an opportunity to increase access to educational content and assist students in developing the skills required to be competent in the digital era. Research indicates that integrating ICT in schools will positively influence educators and learners (Meladi & Awolusi, 2019). Scholars highlight that technology use in an educational setting offers various benefits (Farjon, Smits & Voogt, 2019; Kim & Hannafin, 2011; Sasota, Cristobal, Sario, Biyo & Magadia, 2021; Jadhav, Gaikwad &Patil, 2022). From a pedagogy perspective, technological innovations can change how students learn and educators teach (Dzansi & Amedzo, 2014).

Integrating technologies into education has become a priority for the government of South Africa (Hart & Laher, 2015). However, despite the various efforts towards integrating technology in education over the years, there were still inconsistent views and a lack of consensus on the actual contribution of ICTs towards enhancing education in South Africa (Mdlongwa, 2012). While some argue that ICTs have the potential to enhance education, others point to the persistent underperformance in subjects like science and mathematics. Simply introducing technology into the classroom is

not enough to improve educational outcomes. Instead, it is important to carefully consider how these tools are used and integrated into the curriculum. Additionally, ongoing training and support for teachers is crucial to ensure they have the skills and knowledge to incorporate technology into their teaching practices effectively. Even though policies are in place at national and school levels, they do not necessarily translate to the reality of what happens in the classroom (Howie & Blignaut, 2009). It is also noted that schools may have various reasons for integrating ICT into classroom teaching and learning (Hew & Tan, 2016). Ultimately, a more holistic approach is needed that considers the availability of technology and its practical use in promoting learning and development.

The integration of ICT to improve teaching and learning has received scholarly and practitioner attention. The extant literature highlights various factors that influence technology integration in educational settings. This study explored the use of ICTs in the classroom environment. The study focused on the influence of attitudes, competencies, and access to technological tools on ICT use in schools. It aimed to understand the factors contributing to effective ICT integration within the classroom in South African private schools at the primary and secondary levels. Data was collected from school management and educators. Both these groups were deemed significant in influencing the integration of ICT in schools since management makes resources available and drives policy implementation. In contrast, on the other hand, educators are at the coalface of teaching and learning. Thus, the perspectives of both these groups were deemed appropriate for inclusion in this study.

2. Literature Overview

2.1. Private Schooling in South Africa

Private school enrollment in African nations like Malawi and Tanzania has increased significantly over the years (Hofmeyr & McCay, 2010; Lewin & Sayed, 2005). This can be attributed to various reasons, such as diversification, stakeholders seeking alternative options to the state's educational offering, local and

international competitive demand for portable qualifications, and an increased need for economic activity. Similarly, the South African private school sector has noted a considerable increase in the number of private schools in operation and increased enrolments of learners (Hofmeyr, McCarthy, Oliphant, Schirmer & Bernstein, 2013). For instance, there were 518 private schools at the dawn of democracy 1994, which increased to 1,399 in 2010 (Hofmeyr et al., 2013). It is reported that in 2019, the private education sector had 402,141 learners, 34,164 educators and 1,966 schools (SA Market Insights, 2020). Thus, the sector is important in the country's education delivery.

2.2 Education for an Increasingly Digital Future

We are navigating the Fourth Industrial Revolution (4IR) (Schwab, 2015), an era representing a reality where people experience more integration across the digital and physical domains of their daily lives. The 4IR is predominantly driven by artificial intelligence, robotics and innovative technologies (Jung, 2020). Other scholars argue that we are beyond the 4IR and are transitioning towards the Fifth Industrial Revolution (5IR) where humans work together with machines (Kassim, 2023). Regardless, the speed at which technological breakthroughs impact society is exponential and hard to ignore. The impact of this digital revolution is that it brings various opportunities and benefits for businesses, government, and citizens (Gwala &Mawela, 2024). However, it may also bring a variety of challenges. Thus, the education sector should prepare learners for an increasingly digital future and a knowledge society underpinned by ICTs (Shah, 2022). Significant changes impacting government initiatives such as education reforms and private business are expected with the advent of the 4IR. Learning in the context of the 4IR is challenging, and there is a requirement to prepare learners for navigating this digital era.

Machin, McNally, and Silva (2007) highlight that policymakers believe ICTs can positively impact education. Technology integration in schools may help address educational challenges such as high dropout rates and low literacy rates that plague some developing nations (Ifinedo, Rikala & Hämäläinen, 2020). This is pertinent in the context of the 4IR. Incorporating technology into

education has shown potential and opportunities for growth in societies. In their study, Aktaruzzaman, Shamim and Clement (2011) established that using ICT in education has dramatically improved the learning process as learners can relate, making it increasingly learner-oriented. Niederhauser, Howard, Voogt, Agyei, Laferriere, Tondeur and Cox (2018) indicate that technology integration is a complex issue; however, when technology initiatives are executed successfully in schools, they may have a beneficial impact.

2.3 Influence of ICT on Teaching and Learning

The integration of ICT into schools' curricula is believed to improve and enhance the way learning content is delivered in the classroom setting (Farjon et al., 2019; Ngao, Sang & Kihwele, 2022). Using technologies in the classroom can encourage and enhance learners' interest, engagement, and motivation (Adukaite, Van Zyl & Cantoni, 2016). According to Smaldino, Lowther, Russell, and Mims (2008), integrating ICT in the classroom is not only an exercise of deploying hardware and expecting it to enhance the learning process – it is more than that. It uses technology to facilitate classroom learning and teaching, i.e. learning through or using technology (Wilson-Strydom, Thomson & Hodgkinson-Williams, 2005). It is meant to offer the educator a learner-centric approach to teaching (Ertmer & Ottenbreit-Leftwich, 2013). It should also be noted that the pervasiveness and popularity of ICT in the digital era make it an effective tool for educators' classroom management (Aldosari & Mekheimer, 2013). The digital age drives a more competitive society and requires people to constantly learn to acquire, disseminate and apply knowledge to improve their lives (Hernandez, 2017). Places of learning, such as schools, are areas where technology can play a critical role in student learning, and the educator's role needs to evolve to accommodate this new change (Fandiño Parra, 2012). However, Farjon et al. (2019) highlight that using technology in classrooms does not necessarily mean that schools effectively integrate ICTs into their teaching practices.

2.4 Factors Influencing ICT Integration in Schools

According to Kozma (2003), the context for ICT integration into any curricula needs to consider three key environmental aspects, namely: micro level (classroom context), meso level (school context) and macro level (national, state, district context). The micro level represents the immediate classroom environment, which may include a variety of elements affecting or influencing the classroom environment including individual factors influencing the educator and learner, such as their attitudes, beliefs, traits and characteristics (Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur & Sendurur, 2012; Mac Callum & Jeffrey, 2014; Peralta & Costata, 2007; Schiller, 2003) educator-student interactions, skills (Diller & Moule, 2005; Voogt & Pelgrum, 2003) and access to ICT tools within the classroom environment. The meso level refers to factors that are external to the classroom but directly influence the classroom. These can be directly translated to school-level elements, including school policies (Law, Pelgrum & Plomp, 2008), school leadership and management (Stuart, Mills & Remus, 2009), as well as support from the school (Ertmer et al., 2012; Eteokleous, 2008; Hew & Brush, 2007; Khan, Hossain, Hasan & Clement, 2012). Training and professional development opportunities are also cited (Buabeng-Andoh, 2012; Du Plessis & Webb, 2012). The macro level refers to those factors that directly affect the classroom but may affect the meso level, which may indirectly affect the micro or classroom level in some way. These include national education policies, national ICT policies, socioeconomic elements and cultural norms (Kozma, 2008; Reynolds, Treharne & Tripp, 2003).

This study focused on the micro level since this is at the coalface of teaching and learning. At the micro level, literature proposed that will (positive attitudes), competencies (skills) and access to technological tools are elements that contribute to the effective integration of ICT in classroom teaching and learning (Knezek & Christensen, 2001, 2016). Literature has also found that an educator's attitude towards the use of technological tools influences whether the educator will accept, adopt, and consistently integrate the technological tools into teaching and learning practices (Admiraal, Louws, Lockhorst, Paas, Buynsters,

Cviko & Kester, 2017; Meelissen, 2008). Peralta and Costata (2007) further suggest that a positive attitude towards an educator's ability to use ICT creates a greater chance of successfully integrating ICT in the classroom. Competence (skill) level, the ability to use or perform a specific task, is usually measured through the educator's self-review or self-assessment. This characteristic is positively related to the educators' inclination to use technological tools (Sang, Valcke, Van Braak & Tondeur, 2010), and being confident and less anxious about using the tool. Furthermore, researchers suggest that access to technological tools in developing countries is still a significant concern. Both access to and the amount of time exposed to the tool influence an educator's use. The lack of access to technological tools tends to negatively influence the attitudes and competencies of educators towards ICT tools (Farjon et al., 2019). The study by Graham, Stols and Kapp (2020) found that educators may have sufficient ICT resources coupled with technical support and ICT knowledge. However, this does not necessarily translate into using ICTs in the classroom. This study, therefore, investigated how the combination of will, skill and access to technology influence ICT integration within a classroom learning environment in the South African private school context and focused on two essential stakeholder groups in schools, namely: management and educators to understand their perceptions on integrating ICT's into teaching and learning practices.

3. Theoretical Foundation and Hypotheses

3.1 Technology adoption and the Will Skills Tool model

Various theoretical models of ICT adoption and integration have been used to understand ICT integration in a classroom environment. These include the Theory of Reasoned Action (TRA) (Ghavifekr, Razak, Ghani, Ran, Meixi & Tengyue, 2014), the Theory of Planned Behaviour (TPB) (Miller, Naidoo, Van Belle & Chigona, 2006), the Unified Theory of Acceptance and Use of Technology (UTAUT) (Attuquayefio & Addo, 2014), Technology Acceptance Model (TAM) (Ghavifekr, Kunjappan, Ramasamy & Anthony, 2016) and Will Skill Tool (WST) model (Agyei & Voogt, 2011) which are commonly used models to understand ICT

integration in schools. Since this study is within an educational context, the study relied on the Will Skills Tool Model as a lens to understand the factors influencing technology adoption in education.

WST considers three constructs (will, skill and tool) to predict ICT integration in a classroom environment. Will is defined as an internal human desire that results in an intentional choice, while skill is acquired cognitive competency that progresses with training and/or practice (Velazquez, 2007). However, Knezek, Christensen, Miyashita and Ropp (2000) and Meelissen (2008) offer additional conceptual definitions of the constructs used in the WST model. Meelissen (2008) defined 'will' as the positive attitude towards using technology in teaching and learning. Based on this definition, will is operationally measured using attitudinal and motivational factors towards technology use, such as enjoyment in using technology, perceived productivity of technology, and fear of using technology, among other determinants.

Skill is defined as the ability to use and experience technology in a classroom environment and the confidence (self-efficacy) and enthusiasm of an individual to use technology for teaching and learning (Christensen & Knezek, 2014; Knezek et al, 2000). Skill is often gained through training and experience in the use of technology. On the other hand, a tool is defined in terms of availability, accessibility and extent of use of technology in classroom practice (Knezek & Christensen, 2016; Knezek et al, 2000). The three constructs of the WST model are all equally important for integrating technology in teaching and learning. Thus, it is not enough to adequately train educators without sufficient investments in acquiring technological tools for educators to use for teaching and learning. Similarly, providing educators with technological tools without adequate training and practice is insignificant to technological integration in the classroom.

The last element of the WST model deals with technology integration. This is understood as integrating technological elements, e.g., hardware and software, together with learning content for a particular subject area to enhance learning while achieving learning outcomes set out by the curriculum (Knezek et

al, 2000). The technology integration process spans various stages and involves the acceptance, adoption, utilisation and creative use of ICT in classroom teaching and learning (Morales, Knezek, Christensen & Avila, 2005). Effective technology integration in the classroom requires more than providing educators with technological tools. It also involves adequate training and practice to ensure educators have the skills to use these tools effectively. The WSI model recognises this by highlighting the importance of professional development for educators. This includes training on integrating technology into their teaching practices and using various technological tools for teaching and learning. Without this training, providing technological tools is insignificant to technological integration in the classroom. Technology integration involves various stages, including acceptance, adoption, utilisation and creative use of ICT in classroom teaching and learning. Educators must be able to accept technology in their classrooms, adopt it as a regular part of their teaching practices, utilise it effectively for teaching and learning purposes, and creatively incorporate it into their lessons. By following these stages and providing adequate training for educators, schools can successfully integrate technology into their classrooms and enhance their students' learning experiences.

3.2 Hypotheses

The research model adopted for the study is outlined in Figure 1:

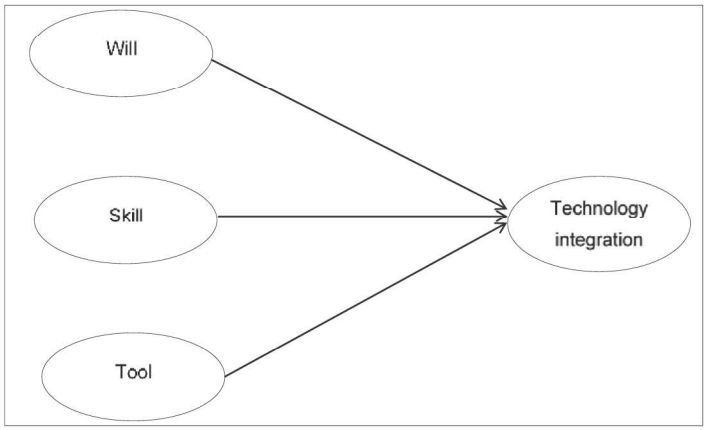

Figure 1: Research Model and Hypotheses

The study investigated the influence of attitudes, competencies and access to technology tools on ICT integration in private South African schools. Therefore, it focused on staff members' will or attitudes towards the use of technology, skill (technology competency), access to technology and technology integration in teaching and learning in a classroom environment. The following hypotheses were proposed to achieve the objectives of the study:

H1: Increasing the will or attitude of educators and management staff towards using technology for teaching and learning leads to higher levels of technology integration in a classroom environment (Knezek et al., 2000; Meelissen, 2008; Velazquez, 2007).

H2: Increasing the skill or competency of educators and management staff towards the use of technology for teaching and learning leads to higher levels of technology integration in a classroom environment (Christensen & Knezek, 2014; Knezek et al., 2000; Velazquez, 2007).

H3: Enhancing educators and management staff's access to technology tools for teaching and learning leads to higher levels of ICT integration in a classroom environment (Knezek et al., 2000; Knezek & Christensen, 2015; Velazquez, 2007; Morales et al., 2005).

4. Methods

A positivist philosophical paradigm underpinned the study, which was exploratory and quantitative. It adopted a cross-sectional survey research design to explore the influence of ICT in the classroom teaching and learning environment. The study focused on two significant stakeholder groups in private schools: management-level staff and educators, to understand both groups' perceptions on integrating ICT into teaching and learning practices.

4.1 Research sample, data collection and analysis

The questionnaire was based on the WST model. The questionnaire comprised five sections covering demographic information (including the respondent's role in the school (educator or manager) and the type of school (primary or high school)), questions related to attitudes, skills, access to technology and perceived influence of ICT integration in classroom learning

and teaching. The study and the questionnaire were submitted to the ethics committee of the researchers' institution, and permission to conduct the study was sought from the relevant school management. Other ethical considerations that were adhered to included informed consent, anonymity, confidentiality, privacy, and voluntary participation. The research was conducted responsibly, considering the respondents' safety. Only adults (educators and management) participated in the study.

The population of interest in this study was educators and management staff of South African private schools. We purposively identified three private schools (referred to as schools A, B and C for anonymity) that are based in the Gauteng province, where the researchers reside, to participate in the research study. The schools were requested to send emails to their staff inviting them to participate. The invitation included a cover letter outlining the study's objectives and indicated voluntary participation. It also covered consent, anonymity, and confidentiality issues and indicated that ethical issues would be strictly observed. One of the researchers also held an information session at each school to answer any questions regarding the study. A total of 150 people were invited to participate. This included educators and management staff at School A (40 respondents invited), School B (70 respondents invited) and School C (40 respondents invited). In the end, 107 people responded, indicating an overall response rate of 71.3%. The paper-based questionnaires were completed during data collection sessions and submitted to one of the researchers. The perceptions of participants are measured on a 5-point Likert scale. The scale ranges from Strongly Disagree to Strongly Agree.

The data on the perceived effectiveness of ICT in a classroom environment was coded numerically and then captured in Excel before it was transferred to the Statistical Package for Social Scientists (SPSS) application software for analysis. The data was primarily tested for normality using Kolmorov Shapiro Wilk test. Descriptive statistics such as mean, median, mode and frequencies were also reviewed. The degree of variation in respondents' perceptions on ICT's influence on classroom teaching and learning was measured using standard deviation, coefficient of variation and skewness. It is also noted that, as the study is exploratory, and

there was a relatively small sample size (107), we opted for mainly non-parametric tests.

Additionally, Cronbach's alpha was used to measure the instrument's reliability and internal consistency of the measuring scale. Cronbach's alpha, a widely used measure of internal consistency, assumes equal indicator loadings and yields a score ranging from 0 to 1. While a minimum threshold of 0.7 is generally recommended for Cronbach's alpha, a value of 0.6 is considered acceptable for exploratory studies such as this one (Hair et al., 2019). This study had an overall Cronbach's alpha of 0.636 (see Table 1). Validity was improved by ensuring that the language used in the questionnaire was simple to understand. In addition, the questionnaire was developed based on existing questionnaires sourced from the literature and the WST model. The instrument was piloted with researchers and colleagues in the domain before deployment. The influence of ICT integration on classroom teaching and learning was discussed in terms of linear regression. A p-value of the coefficients was used to measure the significance of the influence of the independent variable.

Table 1: Overall reliability using Cronbach's alpha

Construct	**No. of items**	**Cronbach's alpha (%)**
Attitudes towards computers (WILL)	7	76.6
Technology in education competency (SKILL)	8	81.9
Access to technology tools (TOOLS)	3	70.4
Technology integration	11	64.5
Overall	29	63.6

Four constructs or scales were used in this study, and these included attitudes towards computers (WILL), technology in education competency (SKILL), access to technology tools (TOOLS) and technology integration. Hair et al. (2019) recommended that Cronbach's Alpha values of at least 60% are acceptable, which means that the instrument can give consistent results. WILL initially had 15 items, SKILL had nine items, TOOLS had three items, and Technology integration had 13 Items.

However, after analysing the reliability using Cronbach's alpha and removing items with poor internal consistency, 29 items remained as per Table 1 above.

5. Results

The following section reflects on the results of the study.

5.1 Overview of respondents

The study had a total of 107 respondents.

Out of 107 study respondents, 48(44.9%) were from school A, 31.8% were from school B, and 23.4% were from school C. Of the respondents, 78(72.9%) were in private primary schools, while the remaining 27.1% were in private high (secondary) schools.

Additionally, out of 107 respondents, 88(82.2%) were educators, while 17.8% were in management positions in their respective schools. The majority, 42(39.3%) of the respondents confirmed that they have been working in the education sector for between 6 and 10 years, while 29.9% confirmed that they have been working there for more than 10 years. In addition, 23.4% declared that they have been working in the education sector for between 2 and 5 years, while 7.5% confirmed that they have been in the education sector for a maximum of 2 years.

One person did not indicate the subject that they teach. Thus, out of 106 respondents who completed a question on the main subject that they teach, 39 (36.8%) were teaching languages, 33 (31.1%) Mathematics/Natural Sciences, 16(15.1%) Social Sciences and 10(9.4%) respondents were teaching Technology. However, 8(7.5%) confirmed they were teaching other subjects not mentioned above.

5.2 Attitudes Towards Technology (WILL)

The perceptions of respondents on attitudes towards technology (WILL), technology in education competency (SKILL) and technology integration were evaluated on a 5-point Likert scale (1 = adverse and 5 = highly favourable). The overall perceived attitude towards technology was highly satisfactory (*M* = 4.4, *SD*

= 0.632), suggesting high positive attitudes towards technology for classroom teaching and learning in South African private schools.

The t-test results indicate no significant differences ($p > 0.05$) in attitudes towards technology between educators and management personnel in private schools in South Africa. Both educators (M = 4.4; SD = 0.623) and management personnel (M = 4.5; SD = *0.716*) expressed highly positive attitudes towards using technology.

Table 2: Attitudes towards computers across positions

Attribute	Overall		Educators		Management		P-value
	Mean	SD	Mean	SD	Mean	SD	
B2	4.4	0.609	4.4	0.558	4.3	0.820	0.682
B3	4.6	0.549	4.6	0.537	4.5	0.612	0.621
B4	4.3	0.739	4.3	0.736	4.4	0.769	0.599
B5	4.4	0.662	4.3	0.684	4.6	0.507	0.056
B6	4.5	0.587	4.5	0.566	4.4	0.692	0.794
B7	4.5	0.572	4.5	0.587	4.6	0.496	0.319
B8	4.4	0.670	4.4	0.695	4.6	0.507	0.110
Overall WILL	4.4	0.632	4.4	0.623	4.5	0.716	0.413

*p <0.05; **p< 0.01

The *t*-test results indicated no significant differences ($p > 0.05$) in attitudes towards technology usage between primary and high schools in private schools in South Africa. Both primary schools (M = 4.4; SD = 0.633) and high schools (M = 4.5; SD = 0.644) expressed highly positive attitudes towards technology.

Table 3: Attitudes towards computers across school levels

Attribute	Overall		Primary school		High school		P-value
	Mean	SD	Mean	SD	Mean	SD	
B2	4.4	0.609	4.3	0.621	4.5	0.574	0.304
B3	4.6	0.549	4.6	0.549	4.7	0.553	0.448
B4	4.3	0.739	4.3	0.737	4.5	0.738	0.213
B5	4.4	0.662	4.3	0.634	4.4	0.736	0.378
B6	4.5	0.587	4.4	0.595	4.5	0.574	0.791
B7	4.5	0.572	4.5	0.575	4.5	0.574	0.947
B8	4.4	0.670	4.4	0.702	4.5	0.574	0.947
Overall WILL	4.4	0.632	4.4	0.633	4.5	0.644	0.997

*p <0.05; **p< 0.01

5.3 Technology Competency (SKILL)

The overall perceived competency in using technology in education was high (M = 4.0, SD = 0.957), demonstrating favourable competencies in using technology in teaching and learning in South African private schools. The t-test results indicated significant differences ($p < 0.05$) in several technological variables between educators and management. There were significant differences ($p < 0.05$) between the above-mentioned groups in the competent use of word processors and graphics to develop lesson plans (C16), competent use of electronic grade book (C19), competent constructing and implementing project-based learning lessons (C20), competence in recognising when a student with special needs may

benefit significantly by the use of adaptive technology (C22), competence in teaching South African Grade R to Grade 12 students age-appropriate information technology skills and knowledge (C23) and competence in working with students in various information technology environments (C24). In all the above significant cases, educators expressed favourable perceptions of the competent use of technology in education, while management personnel were largely undecided.

Table 4: Competency on the use of technology in education across positions

Attribute	Overall		Educators		Management		P-value
	Mean	SD	Mean	SD	Mean	SD	
C16	4.2	0.750	4.3	0.624	3.7	1.057	0.027*
C18	4.5	0.691	4.5	0.546	4.2	1.119	0.168
C19	4.1	0.899	4.3	0.764	3.4	1.121	0.003**
C20	4.0	0.981	4.2	0.824	3.4	1.387	0.039*
C21	4.0	0.884	4.1	0.823	3.6	1.065	0.076
C22	3.9	0.976	4.0	0.851	3.2	1.214	0.008**
C23	3.5	1.184	3.7	1.067	2.8	1.463	0.027*
C24	3.6	1.037	3.7	0.956	3.0	1.177	0.013*
Overall SKILL	4.0	0.957	4.1	0.812	3.4	1.200	0.003**

*p <0.05; **p< 0.01

The t-test for the overall perceived competency on the use of technology in education across school level results indicated no significant differences ($p > 0.05$) in competency on the use of technology between primary and high schools in private schools in South Africa. Both primary schools ($M = 4.0$; $SD = 0.897$) and high schools ($M = 4.0$; $SD = 0.0.912$) expressed highly acceptable competency levels in the use of technology in education.

Table 5: Competency on the use of technology in education across the school level

Attribute	Overall		Primary school		High school		P-value
	Mean	SD	Mean	SD	Mean	SD	
C16	4.2	0.750	4.2	0.710	4.2	0.861	0.823
C18	4.5	0.691	4.5	0.734	4.5	0.572	0.847
C19	4.1	0.899	4.2	0.973	4.1	0.673	0.705
C20	4.0	0.981	4.0	0.939	4.0	1.102	0.912
C21	4.0	0.884	4.0	0.868	4.1	0.939	0.608
C22	3.9	0.976	3.8	0.976	4.1	0.961	0.178
C23	3.5	1.184	3.5	1.224	3.6	1.088	0.916
C24	3.6	1.037	3.6	1.075	3.6	0.942	0.838
Overall SKILL	4.0	0.957	4.0	0.897	4.0	0.912	0.946

5.4 Technology Access (TOOLS)

The association between access to technology tools and position (i.e. educator or management) and the association between access to technology and school level were determined using the chi-squared test. The following hypothesis was formulated to measure the association between access to technology tools and position:

H_{a0}: There is no association between access to technology tools and position within a private school in South Africa.

H_{a1}: There is an association between access to technology tools and position within a private school in South Africa.

Before hypothesis testing, cross-tabulation was done to demonstrate the relationship between access to technology tools and position. It was observed that many more educators and management personnel confirmed that they have access to computers (in the office/computer laboratory), access to computers (in the staff shared room/library), as well as access to internet connectivity (at school/office).

Table 6: Cross tabulation demonstrating the relationship between access to technology tools and position

Attribute		**Position**		**Total**
		Educator	**Management**	
Access to computers (office/computer laboratory), D1	Yes	86	18	104
	No	2	1	3
	Total	88	19	107
Access to computers (staff shared room/library), D2	Yes	87	18	105
	No	1	1	2
	Total	88	19	107
Access to Internet connectivity (at school/office), D3	Yes	84	17	101
	No	4	2	6
	Total	88	19	107

The chi-squared test was used to determine the association between access to technology tools and position within private schools in South Africa. Given that the cell count exceeded 20%, chi-square assumptions were violated; hence, the likelihood ratio was used instead. It was observed that the p-values for access to computers (office/computer laboratory), access to computers (staff shared room/library), as well as access to internet connectivity (at school/office) were greater than 0.05 ($p > 0.05$). The null hypothesis is not rejected. Hence, it can be concluded that there is no association between access to technology tools and position within a private school in South Africa.

Table 7: Testing the association between access to technology tools and position

Attribute		**Value**	**df**	Asymp. P-value
Access to computers (office/computer laboratory), D1	Pearson Chi-Square	0.513	1	0.474
	Likelihood Ratio	0.434	1	0.510
Access to computers (staff shared room/library), D2	Pearson Chi-Square	1.451	1	0.228
	Likelihood Ratio	1.103	1	0.294
Access to Internet connectivity (at school/office), D3	Pearson Chi-Square	1.056	1	0.304
	Likelihood Ratio	0.899	1	0.343

The association between access to technology tools and position within private schools in South Africa was also measured using Cramer's V. Based on the results, there was a positive but weak association between access to computers (in the office/computer laboratory), and position as well as access to internet connectivity (at school/office) and position that was observed. The above relationships recorded low coefficients of 0.069 and 0.099, respectively, which were insignificant. However, a positive but modest association existed between computer access (in the staff common room/library) and position. The above relationship recorded a low coefficient of 0.116, which was insignificant.

Table 8: Measuring the size of the association between access to technology tools and position

Attribute		**Value**	**P-value**
Access to computers (office/computer laboratory), D1	Cramer's V	0.069	0.474
Access to computers (staff common room/library), D2	Cramer's V	0.116	0.228

Attribute		**Value**	**P-value**
Access to Internet connectivity (at school/office), D3	Cramer's V	0.099	0.304

The second hypothesis was formulated as follows:

H_{b0}: There is no association between access to technology tools and school level within a private school in South Africa.

H_{b1}: There is an association between access to technology tools and school level within a private school in South Africa.

It is noted that more primary and high school educators confirmed that they have access to technological tools at the office, school computer laboratory, staff common room, and internet connectivity at school or the office.

Table 9: Cross tabulation demonstrating the relationship between access to technology tools and school level

Attribute		**School level**		**Total**
		Primary	**High school**	
Access to computers (office/computer laboratory), D1	Yes	75	29	104
	No	3	0	3
	Total	**78**	**29**	**107**
Access to computers (staff common room/library), D2	Yes	76	29	105
	No	2	0	2
	Total	**78**	29	107
Access to Internet connectivity (at school/office), D3	Yes	72	29	101
	No	6	0	6
	Total	**78**	**29**	**107**

Given that the cell count was greater than 20%, chi-square assumptions were violated, and the likelihood ratio was also used to validate the association between access to technology tools and school level. The observed p-value was more than 0.05 ($p > 0.05$). Therefore, it can be concluded that there is no association between access to computers (office/computer laboratory) and school level. Again, there was no significant association ($p > 0.05$) between access to internet connectivity (at school/office).

Table 10: Testing the association between access to technology tools and school-level

Attribute		**Value**	**df**	**P-value**
Access to computers (office/computer laboratory), D1	Pearson Chi-Square	1.148	1	0.284
	Likelihood Ratio	1.929	1	0.165
Access to computers (staff common room/library), D2	Pearson Chi-Square	0.758	1	0.384
	Likelihood Ratio	1.279	1	0.258
Access to Internet connectivity (at school/office), D3	Pearson Chi-Square	2.363	1	0.124
	Likelihood Ratio	3.924	1	0.068

Furthermore, there is no significant association ($p > 0.05$) between school level and access to computers (staff common room/library) in private schools in South Africa. Cramer's V, measuring the association between access to technology tools and school level, showed a positive but weak association between access to computers (staff common room/library) and school level. The above relationship recorded a low coefficient of 0.084, which was insignificant. However, there were positive but modest associations between access to computers (office/computer laboratory) and school level, with a coefficient of association of 0.104. The association between access to internet connectivity (at school/office) and school level was also modest, with a coefficient of 0.149. Both associations mentioned above were not significant ($p > 0.05$).

Table 11: Measuring the size of the association between access to technology tools and school level

Attribute		Value	P-value
Access to computers (office/computer laboratory), D1	Cramer's V	0.104	0.284
Access to computers (staff common room/library), D2	Cramer's V	0.084	0.384
Access to Internet connectivity (at school/office), D3	Cramer's V	0.149	0.124

5.5 Technology Integration

A modest level of technology integration (M = 3.3; SD = 0.353) in education was demonstrated. Awareness (M = 1.5; SD = 0.550) and the learning process (M = 1.9; SD = 0.876), one of the variables used to measure technology integration, demonstrated moderate levels. However, high and favourable levels were demonstrated for the application process (M = 4.0; SD = 0.911), familiarity confidence (M = 4.4; SD = 0.698) and adaptation (M = 4.5; SD = 0.595), and creativity (M = 4.5; SD = 0.547) in the use of technology in education.

Table 12: Technology integration in education across positions

Attribute	Overall		Educators		Management		P-value
	Mean	SD	Mean	SD	Mean	SD	
Awareness	1.5	0.550	1.5	0.549	1.6	0.567	0.583
Learning Process	1.9	0.876	1.8	0.777	2.2	1.197	0.048*
Application Process	4.0	0.911	3.9	0.942	4.3	0.694	0.104
Familiarity Confidence	4.4	0.698	4.4	0.645	4.3	0.919	0.468
Adaptation	4.5	0.595	4.5	0.594	4.5	0.612	0.718
Creativity	4.5	0.547	4.5	0.565	4.6	0.459	0.474
Overall Integration	3.3	0.353	3.3	0.332	3.5	0.420	0.05*

The t-test results indicated significant differences ($p < 0.05$) in the learning process to use technology in education between educators and management personnel in private schools in South Africa. Again, there were significant differences ($p < 0.05$) in the overall technology integration between educators and management personnel in private schools. Managers were largely undecided, while educators expressed favourable opinions on integrating technology in learning and teaching. The t-test results indicated no significant differences ($p > 0.05$) in the overall technology integration between primary and high school educators in private schools in South Africa. Primary school ($M = 1.4$; $SD = 0.553$) and high school ($M = 1.4$; $SD = 0.540$) educators expressed adverse opinions on awareness of technology and its use in teaching and learning. However, the two groups were undecided on the learning processes associated with technology in teaching and learning. However, primary and high school educators expressed positive opinions on the application process, familiarity, confidence, adaptation and creativity in using technology in the classroom.

Table 13: Technology integration in education across the school level

Attribute	Overall		Primary school		High school		P-value
	Mean	SD	Mean	SD	Mean	SD	
Awareness	1.5	0.550	1.4	0.553	1.4	0.540	0.284
Learning Process	1.9	0.876	1.9	0.879	1.8	0.880	0.644
Application Process	4.0	0.911	4.0	0.902	4.0	0.950	0.805
Familiarity Confidence	4.4	0.698	4.3	0.778	4.5	0.389	0.182
Adaptation	4.5	0.595	4.5	0.567	4.4	0.673	0.728
Creativity	4.5	0.547	4.6	0.519	4.4	0.596	0.062
Overall Integration	3.3	0.353	3.5	0.337	3.3	0.400	0.584

5.6 Determination of associations between WILL, SKILL and integration

In this study, the Spearman Rho was used to determine the association between the abovementioned variables, in that WILL, SKILL and Integration were ordinal variables. WILL and SKILL demonstrated an insignificant weak and negative association (r =-0.009; $p > 0.05$) at a 0.05 significance level. Again, WILL and integration demonstrated a modest and positive association, insignificant (r = 0.125; $p > 0.05$) at a 0.05 significance level. A weak and negative association was found between SKILL and Integration. The abovementioned association was also insignificant (r = -0.088; $p > 0.05$) at a 0.05 significance level.

Table 14: Correlation between WILL, SKILL and Technology Integration using Spearman Rho

		SKILL	**TOOLS**	**WILL**	**Integration**
SKILL	Correlation Coefficient	1.000	.023	-.009	-.088
	Sig.	.	.815	.925	.369
	N	107	107	107	107
TOOLS	Correlation Coefficient	.023	1.000	-.044	.157
	Sig.	.815	.	.653	.105
	N	107	107	107	107
WILL	Correlation Coefficient	-.009	-.044	1.000	.125
	Sig.	.925	.653	.	.199
	N	107	107	107	107
Integration	Correlation Coefficient	-.088	.157	.125	1.000

	Sig.	.369	.105	.199	.
	N	107	107	107	107

5.7 A predictive model of technology integration using the will–skill–tool concept

A regression analysis model explored how well will, skill and technology tools predict technology integration. In this model, technology integration was the dependent variable while will, skill and tools were the independent variables. It was observed that the *p*-value of the skill coefficient was less than 0.05 ($p < 0.05$). This means that technology in education competency or SKILL significantly influences technology integration in teaching and learning in private schools in South Africa. However, no statistical evidence (at 0.05 level of significance) suggests that access to technology tools and WILL can significantly influence technology integration in teaching and learning within private schools in South Africa.

Table 15: Measuring influence of will, skill and technology tools on technology integration using the regression model

Model	**Unstandardised Coefficients**		**Standardised Coefficients**		
	B	**Std. Error**	**Beta**	**t**	**P-value**
(Constant)	2.915	0.620		4.705	0.00
TOOLS	0.165	0.233	0.067	0.709	0.48
WILL	0.248	0.147	0.160	1.688	0.09
SKILL	-0.135	0.059	-0.218	-2.274	0.03

The regression was further validated using the Analysis of Variance (ANOVA). The regression model was statistically significant ($p < 0.05$). This means the model, consisting of will, skill and technology tools, can credibly predict technology integration. The regression model was also validated using R^2. An R^2 value of 63.3% was achieved. This means that 63.3% of the variability in technology integration is explained in the model that consists of

will, skill and technology tools. This is sufficient given that, in theory, R^2 should be high and able to explain at least 60% of the variability in the dependent variable.

Table 16: Validation of regression model using ANOVA

Model	Sum of Squares	Df	Mean Square	F	P-value
Regression	1.259	3	0.420	3.606	0.016
Residual	11.982	103	0.116		
Total	13.241	106			

Table 17: Model validation using R-squared values

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.7954	0.6327	0.5182	0.3411

5.8 Hypothesis Testing

The three hypotheses formulated for the research were tested concerning the regression model in Table 15 above. The detailed test of each of the three hypotheses follows below.

Hypothesis statement 1

H_0: Increasing the will or attitude of educators and management staff towards the use of technology for teaching and learning does NOT lead to higher levels of technology integration in a classroom environment

H_1: Increasing the will or attitude of educators and management staff towards the use of technology for teaching and learning leads to higher levels of technology integration in a classroom environment

It is observed in Table 15 above that the p-value of the coefficient of will or attitude of educators and management staff is more than 0.05 ($p > 0.05$). Therefore, H_0 is not rejected (at the 0.05 significance level). Hence, it is concluded that the will or attitude of educators and management staff towards using technology for

teaching and learning does NOT necessarily lead to higher levels of technology integration in a classroom environment.

Hypothesis statement 2

H_0: Increasing the skill or competency of educators and management staff towards the use of technology for teaching and learning does NOT lead to higher levels of technology integration in a classroom environment

H_2: Increasing the skill or competency of educators and management staff towards the use of technology for teaching and learning leads to higher levels of technology integration in a classroom environment

Table 15 above shows that the p-value of the coefficient of skill or competency of educators and management staff is less than 0.05 ($p < 0.05$). Therefore, $\mathbf{H_0}$ is rejected (at 0.05 significance level) in favour of H_2. Hence, it is concluded that the skill or competency of educators and management staff towards using technology significantly influences technology integration in a classroom environment. However, given that the coefficient of skill is negative, it shows that skill has an inverted influence on technology integration in a classroom environment.

Hypothesis statement 3

H_0: Enhancing educators' and management staff's access to technology tools for teaching and learning does NOT lead to higher levels of ICT integration in a classroom environment

H_3: Enhancing educator's and management staff's access to technology tools for teaching and learning leads to higher levels of ICT integration in a classroom environment technology tools for teaching and learning leads to higher levels of ICT integration in a classroom environment.

Table 15 shows that the p-value of the coefficient of educators' and management staff's access to technology tools for teaching and learning is more than 0.05 ($p > 0.05$). Therefore, $\mathbf{H_0}$ is not rejected (at the 0.05 significance level). Therefore, no statistical evidence suggests that enhancing educators' and management staff's access

to technology tools for teaching and learning leads to higher levels of ICT integration in a classroom environment.

6. Discussion

Educators and management staff in private schools in South Africa demonstrated a general positive attitude towards using technology in teaching and learning. This is supported by the extant literature, which revealed that positive attitudes and willingness (on the part of educators) towards the use of computers effectively drive ICT integration in classroom teaching and learning (Agyei & Voogt, 2011; Kafyulilo, Fisser & Voogt, 2014).

The study findings revealed high technology competencies (skills) among educators in South African private schools. This bodes well with Agyei and Voogt's (2011) conjecture, which states that ICT skills proficiency is a prerequisite to improve ICT integration in classroom teaching and learning. However, the findings indicated that management personnel were largely unconvincing about the skill levels associated with using technology in education. These findings were consistent with prior studies, which postulated that management personnel in education hardly have high levels of skills compared to educators. Management personnel are seen as overseers who provide leadership in encouraging the professional development of educators rather than being involved in the day-to-day operations (Cakir, 2012) of teaching and learning.

The findings also revealed that there are increased levels of access to technological tools (access to computers at the office/computer laboratory or staff common room/library, and access to Internet connectivity at school/office) for educators to contribute towards the use and integration of ICT for classroom teaching and learning. These findings are consistent with the literature over the years, which suggests that access to and availability of technological resources at schools can contribute to effective transformation in education (Shah, 2022; Zhao & Frank, 2003). It has been argued that confidence in using technology tools increases as anxieties and fear of using technology tools decrease. This can be supported by increased frequency, availability and use of technology tools in education.

The literature proposes that an increased attitude (will) towards technology leads to increased technology competencies (skills) (Velazquez, 2007). On the contrary, this study found that WILL and SKILL demonstrated a weak and negative correlation, which is insignificant. According to the study findings, this could perhaps be attributed to low motivation amongst the educators, as the educators' technology competencies (skills) were favourably high. There seems to be a possibility of misalignment between educator skills and attitudes (will). A study revealed that the positive attitudes of educators are positively correlated towards the experience of educator technology tools in education and had a significant impact on the creativity of the educators when using technology tools, and technology integration in classroom learning (Van Braak, Tondeur & Valcke, 2004). Contrary to the theory above, the findings of this study revealed that WILL and Technology Integration demonstrated a modest and positive association, which was not significant. This could be attributed to school personnel having an undisputed positive attitude towards technology, but being limited by the non-availability of technological tools for integration purposes within classroom teaching and learning.

The regression model indicated that technology in education competency or SKILL significantly influences technology integration in teaching and learning in private schools in South Africa. The literature highlighted that an increase in skills or competencies towards the use of technology leads to higher levels of technology integration in a classroom environment (Cavas, Cavas, Karaoglan & Kisla, 2009; Christensen & Knezek, 2014). However, the inverted relationship noted in this study between skill and technology integration seems to imply that an increase in educator competencies or skills leads to decreased technology integration. One consideration for this interesting finding may be driven by the phenomenon where respondents have perhaps overestimated their skills. The section of the questionnaire that focused on SKILL included some questions on their level of confidence in, for instance, using word processors, email applications, electronic gradebooks, and the internet for sourcing educational resources. Since these questions required respondents to estimate or self-assess their skills and express confidence in them, this could lead to overrating their skills. Previous literature has noted that self-assessment of digital

skills may lead to either overrating or underrating respondents' skills (Van Deursen & Van Dijk, 2010). Thus, this may influence the noted high levels of skills contrasted with lower technology integration. This also points to educators who may possess technical skills but have not received sufficient pedagogical training on integrating technology into their teaching and learning endeavours. A misalignment between skills and classroom practice and limited professional development may hinder effective technology integration. Additionally, based on this, we note that ICT integration may have additional dimensions to it, and it is suggested that this is further interrogated in future research that focuses on in-depth interviews with educators.

The regression model showed no statistical evidence to suggest that technology tools can significantly influence technology integration in teaching and learning within private schools in South Africa. These findings are inconsistent with the literature, which confirms that increased access to technology tools leads to higher levels of technology integration in a classroom learning environment (Knezek et al., 2000; Knezek & Christensen, 2015). The findings also indicated that educators' attitudes towards using technology for teaching and learning do not necessarily lead to higher levels of technology integration in a classroom environment. This is also not consistent with the literature, which confirms that an increase in educator will or attitude towards the use of technology leads to higher levels of technology integration in a classroom environment (Knezek et al., 2000; Meelissen, 2008; Velazquez, 2007). Based on some of the results that are incongruent with extant literature we suggest further investigation of educators perceptions through alternative methods such as interviews and focus groups where researchers can probe further in the discussions and solicit a deeper understanding of the nuances of the issues experienced by educators with ICT integration in their daily operations and teaching endeavours.

7. Recommendations and Policy Perspective

Based on the outcomes of the study, the following recommendations and policy implications are put forward for consideration:

According to Nussbaum and Diaz (2013), when organisations commence with daunting interventions such as integrating technology into classroom learning and teaching, it is important to provide educators with guidance on integrating existing resources with technology. Such pre-implementation interventions help alleviate the negative attitudes of staff members towards integrating technology into classroom learning. Providing the necessary support to educators and implementing a phased approach to technology integration has yielded better integration results. Sang et al. (2010) further support the significance of using an integrated approach to implement ICT integration within classroom learning and teaching.

According to the literature, ICT can support education in improving educator and student performance (Ojo & Adu, 2018). In South Africa, ICT integration in the classroom is still limited mainly in marginalised schools, which could be attributed to the fact that many educators still lack the necessary skills to integrate ICT in a classroom teaching and learning context (Bialobrzeska & Cohen, 2005). Also, Ojo and Adu (2018) highlight the need for the South African government to support efforts towards integrating ICTs in schools, including making funding available for schools. Their study supports the arguments in Bialobrzeska and Cohen's (2005) research, where the findings noted that increasing ICT skills lead to higher levels of technology integration in a classroom environment. Furthermore, Morales et al. (2005) highlight that skill development in technology predicts technology integration. Hence, this study recommends that schools continue to encourage educators to use ICTs and support them in acquiring superior ICT skills to increase ICT integration in the classroom. The negative association between ICT skills and ICT integration noted in this study can be used further to investigate context-specific support for ICT integration in schools.

In terms of the results of the study related to the positive educator attitudes and high levels of technology skills, it is suggested that South Africa's policies and strategies on educator professional development should continue to focus on providing educators with the necessary training to integrate ICT tools into their teaching. Education-related policies could emphasise continuous educator development programs focusing on pedagogical approaches to technology integration, not merely the technical skills.

Policy implications also suggest the need for more robust infrastructure development to ensure equitable access to technology tools across all schools, particularly under-resourced public schools. This focus should build on the seminal draft of the White Paper on e-Education by the government and aim towards accelerating digital transformation in education.

Another suggested approach is to target educators during their initial teacher training programs and ensure the programs include early exposure of trainee educators to technologies as pedagogical tools (Mlambo, Rambe & Schlebusch, 2020). There must be a focus on developing educators' ICT pedagogical practices (Ifinedo et al., 2020). The training of educators should be both pre-service and in-service, and it should be broader than just technology. Instead, it should encapsulate instructional design and how to use technology better to enhance learner interest, attention and motivation (Adukaite et al., 2016). In essence, the ongoing professional development of educators is highlighted as a significant consideration.

It is also recommended that further research be conducted on best practices to deliver subject content using technology. Some educators are more experienced than others in specific pedagogies that may benefit learners, e.g., a collaborative approach to ICT integration best practices (Tondeur, Scherer, Baram, Siddiq, Valtonen & Sointu, 2019). Educators can share skills, challenges, and experiences by collaborating in design teams to enhance their teaching instructions and styles and improve skills, knowledge, and the success rate of ICT integration in schools (Kafyulilo et al., 2014).

Government departments, policymakers, and various education sector stakeholders could further advocate for the inclusion of technology integration in leadership training for school management. Policies should also provide frameworks for broader institutional support for innovation and build a culture of innovation across schools in private and public settings. Policies may also focus on interventions that aim to grow positive attitudes regarding technology across all educational levels, focusing on educators and learners.

The study also recommends reviewing and evaluating management staff and educators' ICT profiles to formulate better interventions for their mandate as change agents for successful ICT integration in classroom teaching and learning (Tondeur et al., 2019). This implies that school employees, such as managers and educators, are trained based on the gaps identified in their ICT profiles and given targeted and personalised support to solve the ICT and other skills gaps of these two essential groups.

Indeed, there is a strong case for considering the integration of ICTs in all schools, whether public, private, rural or urban-based (Dzansi & Amedzo, 2014). The implemented ICT solutions should also align with the needs of the schools, learners and educators. The schools should also provide adequate technology resources and time for educators to use the tools. It is also suggested, as per Gibbone, Rukavina and Silverman (2010), that educators should be afforded sufficient time to use and experience the appropriate technology tools.

8. Conclusion, Limitations and Future Research

This study adopted the WST Model to understand school management and educators' perceptions of integrating ICT into teaching and learning practices. The study contributed to the literature on the Will, Skill, Tool Model (WST) within private schools rather than a public school setting. As far as the authors are aware, there has been limited empirical evidence about ICT integration in South African private schools, which are generally better resourced than the public schools. As such, further research is still required. This study was limited to three schools in the Gauteng Province of South Africa. This may be considered a relatively small sample. It is thus suggested that future studies expand into other provinces across rural and urban settings since the nine provinces of South Africa may experience different challenges about ICT integration in the classroom. Future studies should aim for a larger sample and different educational contexts to validate the findings. Also, since the study relied on a quantitative questionnaire, future iterations may adopt additional qualitative methods or a mixed-methods approach to collect rich data related to school management and educator perceptions. Another recommendation for future research is to

examine how attitudes and competencies mutually influence technology integration and the interactions between will, skills and tools.

References

Admiraal W, Louws M, Lockhorst D, Paas T, Buynsters M, Cviko A & Kester L 2017. Teachers in school-based technology innovations: A typology of their beliefs on teaching and technology. *Computers & Education*, 114: 57–68.

Adukaite A, Van Zyl I & Cantoni L 2016. The role of digital technology in tourism education: A case study of South African secondary schools. *Journal of Hospitality, Leisure, Sport & Tourism Education*, 19:54-65.

Agyei DD & Voogt JM 2011. Exploring the potential of the will, skill, tool model in Ghana: Predicting prospective and practising teachers' use of technology. *Computers & Education*, 56(1):91-100. https://doi.org/10 .1016/ j.compedu.2010.08.017

Aktaruzzaman M, Shamim MR & Clement CK 2011. Trends and issues to integrate ICT in teaching learning for the future world of education. International Journal of Engineering & Technology, 11(3):114-119. http://citeseerx.ist.psu.edu/viewdoc/summary?doi=10.1.1.207 .6203.

Aldosari H S & Mekheimer MAA 2013. The bandwagon effect in the adoption of E-Learning systems in language learning - An appraisal. *GSTF Journal on Computing*, 2(4):61-81. https://d16.globalstf.org/ index.php/joc/article/view/607.

Attuquayefio S & Addo H 2014. Using the UTAUT model to analyse students' ICT adoption. *International Journal of Education and Development Using ICT*, 10(3):75-86. https://files.eric.ed.gov/fulltext/ EJ1059042.pdf.

Bialobrzeska M & Cohen S 2005. *Managing ICTs in South African schools: a guide for school principals*. Braamfontein: South African Institute for Distance Education (SAIDE).

Buabeng-Andoh C 2012. Factors influencing teachers' adoption and integration of information and communication technology into teaching: A review of the literature. *International Journal of Education and Development Using ICT*, 8(1):136-155. https://files.eric.gov/fulltext /EJ1084227.pdf.

Cakir, R. (2012). Technology integration and technology leadership in schools as learning organisations. *The Turkish Online Journal of Educational Technology - TOJET*, 11(4):273–282. http://www.tojet.net/ articles/v11i4/11427.pdf.

Cavas B, Cavas P, Karaoglan B & Kisla T 2009. A study on science teachers' attitudes toward information and communication technologies in education. *The Turkish Online Journal of Educational Technology - TOJET*, 8(2):20-32. http://www.tojet.net/articles/v8i2/822.pdf.

Christensen R & Knezek G 2008. Self-report measures and findings for information technology attitudes and competencies. In J Voogt & G Knezek (eds). *International handbook of information technology in primary and secondary education*. New York, NY: Springer.

Christensen R & Knezek G 2014. *The technology proficiency self-assessment (TPSA): Evolution of a self-efficacy measure for technology integration*. Paper presented at IFIP KEYCIT. Pottsdam: Universitat Pottsdam.

Dawes, L. (2001. What stops teachers using technology? In M Leask (ed). *Issues in teaching using ICT*. London, England: Routledge.

Diller J & Moule J 2005. *Cultural competence: A primer for teachers and educators*. Belmont, CA: Wadsworth.

Du Plessis A & Webb P 2012. Teachers' perceptions about their own and their schools' readiness for computer implementation: A South Africa- n case study. *Turkish Online Journal of Educational Technology-TOJET*, 11(3):312-325. http://www.tojet.net/articles/v11i3/1130.pdf

Dzansi DY & Amedzo K 2014. Integrating ICT into rural South African schools: Possible solutions for challenges. *International Journal of Educational Sciences*, 6(2):341-348.

Ertmer P A & Ottenbreit-Leftwich A 2013. Removing obstacles to the pedagogical changes required by Jonassen's vision of authentic technology-enabled learning. *Computers & Education*, 64(1):175-182. https://doi.org/10.1016/j.compedu.2012.10.008

Ertmer PA, Ottenbreit-Leftwich AT, Sadik O, Sendurur E & Sendurur P 2012. Teacher beliefs and technology integration practices: A critical relationship. *Computers & Education,* 59(2):423-435. https://doi.org/10. 1016/j.compedu.2012.02.001

Eteokleous N (2008). Evaluating computer technology integration in a centralised school system. *Computers & Education*, 51(2):669–686. https://doi.org/10.1016/j.compedu.2007.07.004

Fandiño Parra Y 2012. The impact of ICT training through wikis on in-service EFL teachers: Changes in beliefs, attitudes, and competencies. *HOW Journa*l, 19(1):11-32 https://www.howjournalcolombia.org/index.php/how/article/view/35.

Farjon D, Smits A & Voogt J 2019. Technology integration of pre-service teachers explained by attitudes and beliefs, competency, access, and experience. *Computers & Education*, 130:81-93.

Ghavifekr S, Kunjappan T, Ramasamy L & Anthony A 2016. Teaching and learning with ICT tools: Issues and challenges from teachers' percepti- ons. *Malaysian Online Journal of Educational Technology*, 4(2):38-57. http://mojet.net/article/teaching-and-learning-with-ict-tools-issues-and-challenges-from-teachers-perceptions.

Ghavifekr S, Razak AZA, Ghani MFA, Ran NY, Meixi Y & Tengyue Z 2014. ICT integration in education: Incorporation for teaching & learn- ing improvement. *Malaysian Online Journal of Educational Technology*, 2(2):24-45. http://mojet.net/article/ict-integration-in-education-incor poration-for-teaching-learning-improvement.

Gibbone A, Rukavina P & Silverman S (2010). Technology integration in secondary physical education: teachers' attitudes and practice. *Journal of Educational Technology Development and Exchange*, 3(1):27–42. http://aquila.usm.edu/jetde/vol3/iss1/3.

Graham MA, Stols G & Kapp R (2020). Teacher Practice and Integration of ICT: Why Are or Aren't South African Teachers Using ICTs in Their Classrooms. *International Journal of Instruction*, 13(2):749–766.

Gwala, N. and Mawela, T., 2024. Investigating the Internet Skills of Older Adults in South Africa. *Artha Journal of Social Sciences*, 23(3), pp.49-78. https://doi.org/10.12724/ajss.70.3

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2019). Multivariate data analysis (Eighth edition). Cengage Learning EMEA

Hart, SA, & Laher S 2015. "Perceived usefulness and culture as predictors of teachers attitudes towards educational technology in South Africa." South African Journal of Education, 35(4):1-13. https://doi.org/10.157 00/saje.v35n4a1180

Hernandez, R.M., (2017). Impact of ICT on education: Challenges and Perspectives. *Journal of Educational Psychology-Propositos y Representaciones*, 5(1):337–347. https://doi.org/10.205111/pyr2017.v5n 1.149

Hew KF & Brush T (2007). Integrating technology into K-12 teaching and learning: Current knowledge gaps and recommendations for future research. *Educational Technology Research and Development,* 55(3):223–252. https://doi.org/10.1007/s11423-006-9022-5

Hew KF & Tan CY (2016). Predictors of information technology integrati- --on in secondary schools: Evidence from a large scale study of more than 30,000 students. PLoS ONE, 11(12):e0168547. https://doi.org/10. 1371/journal.pone.0168547

Hofmeyr J & McCay L 2010. Private education for the poor: More, different and better. Focus, 56:50-56. Available at https://hsf.org.za/ publications/focus/focus-56-february-2010-on-learning-and-teaching /private-education-for-the-poor-more-different-and-better Accessed 11 March 2023.

Hofmeyr J, McCarthy J, Oliphant R, Schirmer S & Bernstein A 2013. *Affordable private schools in South Africa*. Johannesburg: Centre for Development and Enterprise (CDE).

Howie SJ & Blignaut AS 2009. South Africa's readiness to integrate ICT into mathematics and science pedagogy in secondary schools. Education and Information Technologies, 14(4):345-363. https://doi. org/10.1007/s10639-009-9105-0

Ifinedo E, Rikala J & Hämäläinen T 2020. Factors affecting Nigerian teacher educators' technology integration: Considering characteristics, knowledge constructs, ICT practices and beliefs. *Computers & Education*, 146:103760.

Jadhav, P., Gaikwad, H., & Patil, K. S. (2022). Teaching and learning with technology: Effectiveness of ICT integration in schools. *ASEAN Journal for Science Education*, 1(1), 33-40.

Jung J (2020). The fourth industrial revolution, knowledge production and higher education in South Korea. *Journal of Higher Education Policy and Management*, 42(2):134–156. https://doi.org/10.1080/1360080X.2019.1 660047

Kafyulilo A, Fisser P & Voogt J 2014. Teacher design teams as a professio-nal development arrangement for developing technology integration knowledge, skills of science teachers in Tanzania. *Education and Infor- rmation Technologies*, 21(1):301-318. https://doi.org/ 10.1007/s10639-014-9321-0

Kassim, N. L. A. (2023). 4IR, 5IR, society 5.0, and values in education. *IIUM Journal of Educational Studies*, *11*(1), 1-2.

Khan M, Hossain S, Hasan M & Clement CK 2012. Barriers to the introduction of ICT into education in developing countries: The example of Bangladesh. *International Journal of Instruction*, 5(2):61-80. http://www.e-iji.net/dosyalar/iji_2012_2_4.pdf.

Kim MC & Hannafin MJ 2011. Scaffolding problem solving in technology-enhanced learning environments (TELEs): Bridging research and theory with practice. *Computers & Education*, 56(2): 403-417. https://doi.org/10.1016/j.compedu.2010.08.024

Knezek G & Christensen R 2001. Instrument for assessing the impact of technology in education. *Computers in Schools*, 18(2-3):5-25. https://doi.org/10.1300/J025v18n02_02

Knezek G & Christensen R 2015. The will, skill, tool model of technology integration: Adding pedagogy as a newmodel

construct. In DG Sampson, JM Spector, D Ifenthaler & P Isaias (eds). *Proceedings of the cognition and exploratory learning in digital age*. Ireland: Maynooth.

Knezek G & Christensen R 2016. Extending the will, skill, tool model of technology integration: Adding pedagogy as a new model construct. *Journal of Computing in Higher Education*, 28(3):307-325. https://doi.org/10.1007/s12528-016-9120-2

Knezek G, Christensen R, Miyashita K & Ropp M (2000). *Instruments for assessing educator progress in technology integration.* Denton, TX: Institute for the Integration of Technology into Teaching and Learning (IITTL).

Kozma RB (2003). *Technology, innovation, and educational change: A global perspective: A report of the Second Information Technology in Education Study: Module 2*. Eugene, Or.: International Society for Technology in Education (ISTE).

Kozma RB (2008). Comparative analysis of policies for ICT in education. In J Voogt & G Knezak (eds). *International handbook of information technology in primary and secondary education*. Boston, MA: Springer.

Law N, Pelgrum WJ & Plomp T 2008. *Pedagogy and ICT use in schools around the world: Findings from the IEA SITES 2006 study* (Vol. 23). New York, NY: Springer Science & Business Media.

Lewin, K. M., & Sayed, Y. (2005. *Non-state secondary schooling in sub-Saharan Africa? Exploring the evidence in South Africa and Malawi*. London: Department for International Development. (Educational papers.)

Mac Callum, K., & Jeffrey, L. (2014). Factors impacting teachers' adoption of mobile learning. *Journal of Information Technology Education*, 13(1):141–162. https://doi.org/10.28945/1970

Machin S, McNally S & Silva O (2007). New technology in schools: Is there a payoff? *The Economic Journal*, 117(522): 1145–1167. https://doi.org/10.1111/j.1468-0297.2007.02070.x

Mdlongwa T (2012). *Information and Communication Technology (ICT) as a means of enhancing education in schools in South Africa:*

Challenges, benefits and recommendations. Pretoria: Africa Institute of South Africa. (Policy brief 80, August 2012.)

Meelissen, M. ((2008). Computer attitudes and competencies among primary and secondary school students. In J Voogt & G Knezak (eds). *International handbook of information technology in primary and secondary education*. Boston, MA: Springer.

Meladi, O. and Awolusi, O.D., 2019. The influence of information communication technology (ICT) integration on teaching and learning in South African schools. *Journal of Education and Vocational Research*, 10(2), pp.47-64.

Miller L, Naidoo M, Van Belle JP & Chigona W 2006. School-level ICT adoption factors in the Western Cape schools. In *Fourth IEEE International Workshop on Technology for Education in Developing Countries (TEDC'06)*. Piscataway, NJ: IEEE.

Mlambo S, Rambe P & Schlebusch L 2020. Effects of Gauteng province's educators' ICT self-efficacy on their pedagogical use of ICTS in classrooms. *Heliyon*, 6(4):p.e03730.

Morales C, Knezek G, Christensen R & Avila P 2005. *The will, skill, tool model of technology integration. A conceptual approach to teaching and learning with technology.* Mexico City, Mexico: ICLE.

Ngao, A. I., Sang, G., & Kihwele, J. E. (2022). Understanding teacher educators' perceptions and practices about ICT integration in teacher education program. *Education Sciences,* 12(8), 549.

Niederhauser DS, Howard SK, Voogt J, Agyei DD, Laferriere T, Tondeur J & Cox MJ 2018. Sustainability and scalability in educational technology initiatives: Research-informed practice. *Technology, Knowledge and* Learning, 23(3):507-523. https://doi.org/10.1007/s10758-018-9382-z

Nussbaum M & Diaz A 2013. Classroom logistics: integrating digital and non-digital resources. *Computers & Education,* 69:493-495. https://doi.org/10.1016/j.compedu.2013.04.012

Ojo OA & Adu EO 2018. The effectiveness of Information and Communication Technologies (ICTs) in teaching and learning in high schools in Eastern Cape Province. *South African Journal of Education,* 38(1): S1-S11.

Peralta H & Costata FA (2007). Teachers' competence and confidence regarding the use of ICT. *Sísifo-Educational Sciences Journal,* 3(7):75–84. http://repositorio.ul.pt/bitstream/10451/7008/1/(2007)PERALTA,H&COSTA,F(ICTCompetenceConfidence)S%C3%8DSIFO3eng.pdf..

Reynolds D, Treharne D & Tripp H 2003. ICT - the hopes and the reality. *British Journal of Educational Technology*, 34(2):151-167. https://doi.org/10.1111/1467-8535.00317

Sang G, Valcke M, Van Braak J & Tondeur J 2010. Student teachers' thinking processes and ICT integration: Predictors of prospective teaching behaviors with educational technology. *Computers & Education*, 54(1):103-112. https://doi.org/10.1016/j.compedu.2009.07.010

Sasota RS, Cristobal RR, Sario IS, Biyo JT & Magadia JC 2021. Will–skill–tool (WST) model of technology integration in teaching science and mathematics in the Philippines. *Journal of Computers in Education*, 8(3):443-464.

Schiller J 2003. Working with ICT. *Journal of Educational Administration*, 41(2):171-185. https://doi.org/10.1108/09578230310464675

Schwab K 2015. *The fourth industrial revolution: What it means and how to respond*. New York, NY: Crown Business.

Shah, S. S. (2022). Teaching and learning with technology: Effectiveness of ICT integration in schools. *Indonesian Journal of Educational Research and Technology*, *2*(2), 133-140.

Smaldino SE, Lowther DL, Russell JD & Mims C 2008. *Instructional technology and media for learning*. Upper Saddle River, NJ: Pearson Education.

South Africa Department of Education (SA DOE) 2003. *Draft White Paper on e-Education. Transforming learning and teaching through ICT*. Pretoria: Author.

South African Market Insights 2020. *South Africa's education statistics*. Available at https://www.southafricanmi.com/education-statistcs.ht ml. Accessed 15 September 2020.

Stuart LH, Mills AM & Remus U 2009. School leaders, ICT competence and championing innovations. *Computers & Education*, 53(3):733-741. https://doi.org/10.1016/j.compedu.2009.04.013

Tondeur J, Scherer R, Baram E, Siddiq F, Valtonen T & Sointu E 2019. Teacher educators as gatekeepers: preparing the next generation of teachers for technology integration in education. *British Journal of Educational Technology*, 50(3):1189-1209. https://doi.org/10.1111/bjet. 12748

Van Braak J, Tondeur J & Valcke M 2004. Explaining different types of computer use among primary school teachers. *European Journal of Psychology of Education,* 19(4):407-422. https://doi.org/10.1007/BF031 73218

Van Deursen, A..J and Van Dijk, J.A., 2010. Measuring internet skills. *International journal of human-computer interaction*, 26(10), pp.891-916. https://doi.org/10.1080/10447318.2010.496338

Velazquez CM 2007. Testing predictive models of technology integration in Mexico and the United States. *Computers in the Schools*, 24(3-4):153-173. https://doi.org/10.1300/J025v24n03_11

Voogt J & Pelgrum WJ 2003. ICT and the curriculum. In R Kozma. *Technology, innovation and educational change: A global perspective*. Washington, DC: International Society for Technology in Education.

Wilson-Strydom M, Thomson J & Hodgkinson-Williams C 2005. Understanding ICT integration in South African classrooms. Research: Information and communication technologies. *Perspectives in Education*, 23(1):71-85. https://hdl.handle.net/10520/EJC87344.

Zhao Y & Frank KA 2003. Factors affecting technology uses in schools: An ecological perspective. *American Educational Research Journal*, 40(4):807-840. https://doi.org/10.3102/002831 2040004807