Access to ICT and Its Impact on Academic Performance of Students in Tertiary Institutions in South Africa

Mishka K.O. Esmail

University of Central Africa, Zambia
Email: MishkaE@stadio.ac.za
Telephone number: +27 82 890 88 88

Naine Mkandawire
Unicaf University
Email: n.mkandawire@malawi.univcaf.org
Telephone number: +265 884184999

Abstract
The study examined the impact of Information and Communication Technology (ICT) student access in primary school on their academic performance in tertiary institutions in South Africa. The purpose was to identify the implications of limited ICT access and the subsequent challenges encountered by students in higher education institutions so as to propose, solutions to challenges to access and thereby improve ICT access in schools. Data was collected through a semi-structured questionnaire from a sample of fifty first-year students enrolled in a Higher Certificate in Education (HCE1) program and eleven lecturers from two private universities in South Africa offering educational programmes. Findings indicate that students struggling with ICT tools in tertiary institutions had inadequate access to ICT during their schooling years, negatively affecting their academic performance while those who had access in early primary school performed better. The study reveals a disparity in ICT competence among students, with some possessing basic skills for academic tasks while others lack such skills. The study recommends that the Department of Education should ensure adequate funding and budgeting for ICT resources in schools and that tertiary institutions should provide ICT courses and effective training to meet students' expectations.

***Keywords**: Impact of Information and Communication Technology (ICT), Primary schools, tertiary institutions, South Africa.*

Introduction

The integration of Information and Communication Technology (ICT) into educational systems has become an essential aspect of modern pedagogy. ICT facilitates enhanced learning experiences by enabling interactive and student-centred learning environments. Tools such as interactive whiteboards, and educational software provide diverse ways for students to engage with content, making learning more engaging and effective (Eady & Lockyer, 2013). Additionally, Becta (2004) observes that ICT offers access to a vast array of resources beyond traditional textbooks, including online libraries, educational videos, and simulation tools, which can cater to various learning styles and needs.

Moreover, ICT prepares students for the technologically driven workforce by equipping them with essential digital skills and competencies. In today's job market, proficiency in ICT is not merely an advantage but a necessity across almost all sectors. Students who are adept at using technology are better prepared for careers in a digital economy, where skills such as data analysis, digital communication, and online collaboration are highly valued (World Economic

Forum, 2020). Voogt et al. (2013) found out that early exposure to technology in educational settings helps students develop critical thinking, problem-solving, and technical skills that are transferable to the workplace.

Furthermore, recent studies have highlighted the growing importance of digital literacy in education, with Redmond et al. (2020) emphasising that ICT integration fosters creativity and enables students from diverse backgrounds to have equal opportunities to acquire the skills needed for future employment. These findings collectively reinforce the critical role of ICT in shaping a future-ready workforce capable of thriving in an increasingly digital world.

In the context of South Africa, however, the level of ICT access in schools varies significantly, leading to disparities in students' academic preparedness for tertiary education. Urban schools, particularly those in well-funded areas, tend to have better access to ICT resources compared to their rural counterparts (Department of Basic Education, 2022). This discrepancy is often due to differences in infrastructure, funding, and policy implementation. For instance, schools in affluent areas may have well-equipped computer labs, reliable internet connectivity, and trained teachers to integrate ICT into their curriculum (Tondeur et al., 2011). In contrast, many rural schools struggle with basic necessities, such as electricity and functional classrooms, let alone advanced ICT infrastructure.

These disparities have significant implications for students' academic performance and future opportunities. Students with limited or no access to ICT in their formative years are at a disadvantage when they enter tertiary education, where digital literacy is often assumed. They may struggle with tasks that require online research, digital communication, and the use of educational software, which can hinder their academic success and overall confidence (Audu & Gambo, 2019; Becta, 2004). The lack of ICT access not only affects their immediate academic performance but also their long-term prospects in a technology-driven world (Punie et al., 2006).

Anderson (2008) points out that historically, South African schools have faced numerous challenges in integrating ICT due to limited resources, insufficient infrastructure, and a lack of trained personnel. These challenges are particularly pronounced in rural and underfunded schools, where access to basic educational resources remains a struggle (De Jager & Brown, 2014). The impact of such disparities is profound, as early exposure to and proficiency in ICT is critical for students' success in higher education and beyond. The consequences of these disparities extend far beyond the classroom, as early access to ICT plays a crucial role in shaping students' academic and professional futures.

In an increasingly digital world, proficiency in technology is essential for success in higher education and the workforce. Students who lack ICT skills often struggle to compete with their more privileged peers, perpetuating the cycles of socio-economic disadvantage. According to Mhalnga & Moloi (2020), limited ICT access in disadvantaged schools hinders students' ability to develop essential digital literacy, which is crucial for their participation in the modern economy. Similarly, a study by Maphosa and Mashatole (2021) emphasises that government interventions and increased private sector collaboration are necessary to address these inequalities and promote inclusive digital education. These findings highlight the urgency of targeted initiatives to bridge the digital divide and ensure equitable access to ICT resources across all South African schools.

Technology was introduced to South African private schools in the 1980s. Currently, only 2311 schools all over South Africa have one or more computers, with funding being the main challenge (Chigona & Chigona 2019). Mdlongwa (2012) explains that the South African government does not have enough funds to provide or prioritise ICT inclusion in schools. The

Department of Basic Education (DBE) in South Africa has outlined a three-phase ICT implementation strategy in its Draft White Paper on e-Education, aiming to equip all schools with digital devices and learning materials by 2025. The plan prioritises multi-grade, rural, and special needs schools in the first phase, followed by quintile 1–3 schools, and finally quintile 4–5 schools. It focuses on improving infrastructure, enhancing teacher training, and ensuring equitable access to digital content. Public-private partnerships, multilingual resources, and inclusive technologies are key to the strategy's success (Department of Basic Education, 2022). Mdlongwa (2012) further observes that three million internet users were recorded in 2002 across South Africa. The department of Education reports that since 2002, only 6.4% of South Africans have had access to internet as compared to America, with a percentage of 72.2%. The above-mentioned comparison is a clear indication that South Africa is still lagging behind in terms of ICT inclusion and development. South Africa is trying to bridge this gap by taking a number of measures including the establishment of Presidential National Commission of Information Society and Development (PNC and ISAD). The goal of this establishment is to act as an advisory body to the government on ICT challenges and provide solutions. South Africa has also established the Electronic and Communications Transaction Act (Act No. 25 of 2002) in order to lead ICT initiatives and to enable them to develop a five-year national e-strategy. These initiatives have been taken by the government of South Africa to support the integration of ICT into teaching and learning, however, these have not been implemented across all schools and provinces.

Research has consistently highlighted the positive correlation between ICT access in early education and improved academic performance in later stages (Higgins et al., 2012). Students who are well-versed in using ICT tools tend to perform better academically, as they can effectively utilise technology for research, assignments, and other academic tasks (Passey et al., 2016). Conversely, students who lack such exposure often face significant hurdles when they transition to tertiary education, where ICT proficiency is assumed. Students' further highlight that ICT integrated learning fosters independent learning habits as students gain confidence in using digital resources to complete assignments and conduct research (Maphosa & Mashatole, 2021). These benefits underscore the importance of equipping students with technological skills early in their education to ensure a smoother transition to higher levels of learning.

The transition from secondary to tertiary education highlights the increasing need for ICT integration at all educational levels. Without adequate exposure to technology in early education, students face significant barriers when expected to engage with digital learning tools in University settings (Malinga & Phiri, 2022). This challenge reinforces the need for governments and educational institutions to invest in ICT infrastructure, teacher training and digital initiatives to bridge the gap. Research suggests that policies promoting equal access to ICT resources, particularly in disadvantaged communities, can significantly enhance students' academic preparedness and long-term success (Maphosa & Mashatole, 2021). Addressing these disparities is crucial to ensuring that all students, regardless of socio-economic background can benefit from the advantages that digital education offers.

This study builds on the existing literature by focusing on the South African context, examining the specific challenges and impacts related to ICT access in schools. The primary objective is to evaluate how the level of ICT access during primary school years influences students' performance in tertiary institutions. By identifying the challenges and proposing practical solutions, this research aims to contribute to policy recommendations that can bridge the ICT gap in South African education.

Methodology

Research Approach and Design

The study investigated "the access to Information Communication and Technology (ICT) in primary schools and its impact on the academic performance of students in tertiary institutions in South Africa". Given this, the study targeted one higher education institution in the South Africa which is privately-owned. The University offer a programme in Education known as a Higher Certificate in Education (HCE1).

The study followed a quantitative approach, and utilised a descriptive survey design to guide the data collection, analysis and presentation of the results. For Kothari (2004), descriptive research studies are designed to obtain pertinent and precise information concerning the status of phenomena and whenever possible to draw valid conclusions from the results discovered. The study was driven by the quest of drawing valid conclusions on the impact that access to ICT has on students' academic institutions particularly in developing countries such as South Africa.

Data Collection Tools

Since surveys aim at gathering objective data from study participants, the study opted to gather information from users through a questionnaire. Pre-testing of the questionnaire was conducted in which ten students participated in the exercise. This exercise helped to determine appropriate wordings for the final questionnaire.

Written consent from the administrator of the university was sought before the survey. After this, copies of the self-administered questionnaire were distributed online to enrolled students from the Colleges for Academic Year (AY) 2022-2024. The research utilised a simple random sampling technique, and a total of 50 students were sampled in July, 2022 out of a population of 400 students in the Higher Education Institution. 11 lecturers were recruited purposively, where they spent around 10 minutes in answering the questionnaire which was administered to them. Data from the interviews with the lecturers were analysed using s thematic method. Survey data from students were analysed using descriptive statistics in SPSS version 21.

Results

Challenges Regarding Access to ICT in Schools in South Africa

The first objective that the study investigated was to identify challenges regarding access to ICT in schools in South Africa. Findings from the study revealed that students had some level of access to ICT in the schools they attended. Below is figure 1 depicting these findings.

Figure 1: Students access to ICT in schools

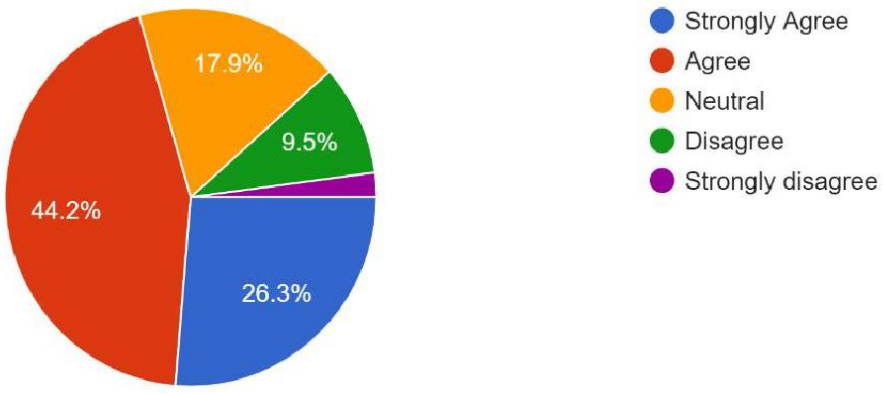

Figure 1. Exposure of the students to ICT in the schools they attended

The results show that 44.2% (n-22) agreed to have had exposure to ICT during their schools' years. 26.3% (n-13) strongly agreed to have had exposure to ICT in school too. A smaller fraction 9.5% (n-5) of students indicated that they did not have access to ICT during their school days. Thus, the results show that majority of students had access to ICT as compared to a small group of students who did not have access to ICT while in school. These results are consistent with much recent reports from the department of education which indicate more ICT devices have been distributed in schools however, internet connectivity is still a problem which rarely support teaching and learning (DBE, 2023).

The students were further asked to indicate whether they had challenges in using ICT devices while in school. Figure 2 below illustrates the findings.

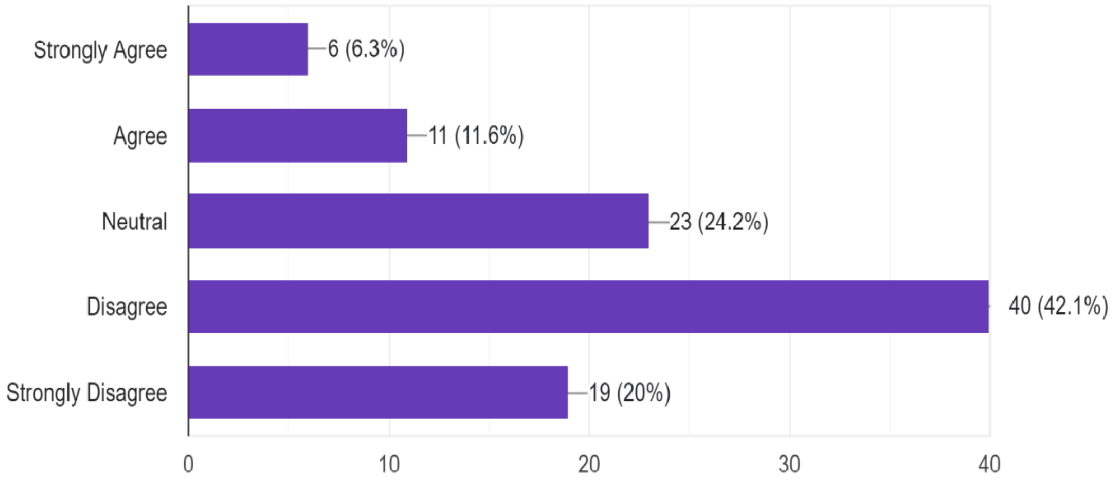

Figure 2 . Students' challenges on using ICT devices i.e. Laptop and or desktop

Findings reveal that the majority of the students 42.1% (n-40) disagreed to finding challenges in using ICT devices. 23% (n-24) were not very sure and 11.6% (n-11) indicated that they had challenges in using ICT devices. These findings point to the fact that some students faced difficulties to use the devices although they had access to ICT. This could point to the fact that making the devices available in schools is just the first step, it requires educator who are competent to impart the skills and knowledge to the students. These findings are further elaborated by results from lecturers whose findings when triangulated with those of students fill the gap. The lecturers (staff) expressed their views with regard to students' access to ICT by indicating what they see as challenges in schools. Table 1 illustrates these findings.

Table 1: Views of staff on barriers to ICT for students in schools

Theme	**Frequency (n-11)**	**Description**
Finances	n-9	Findings from staff indicate that financial constraints are the primary barrier to ICT access. Staff commented that schools struggle with procuring up-to-date hardware/software, maintaining existing infrastructure, and funding internet connectivity. The Department of Basic Education (DBE) acknowledges poor ICT integration due to insufficient funds, disproportionately affecting rural and underfunded schools.

Shortage of ICT teachers (Staff)	n-9	Majority of the staff also pointed out that many schools in South Africa lack digital literacy skills, hindering effective ICT integration into curricula. Untrained teachers in ICT cannot utilize technology to enhance pedagogy, limiting students' exposure to digital tools.
Crime	n-6	Another common theme was about high crime rates in South Africa leading to theft and vandalism of ICT equipment, particularly in crime-prone areas. This discourages schools from investing in technology. This security challenge is exacerbating existing disparities, as schools in vulnerable communities face recurring losses of ICT resources.
Students' lack of interest	n-1	A minority of lecturers cited student disinterest as a barrier to ICT integration in schools. The staff did not emphasize this factor, as the findings from students show that they expressed a desire for greater ICT competence. This suggests that limited access, rather than apathy, drives underperformance.

Impact Students in Tertiary Institutions Face as a Result of Limited Access to ICT

The second objective the study sought to investigate was on the impact that access to ICT has on the education of students in their tertiary education. To determine the effect that challenges of access to ICT has in their education, the students were asked to indicate whether they agree or disagree with the statement that they find it easy to use ICT for assignments for example. Figure 3 below illustrates these findings.

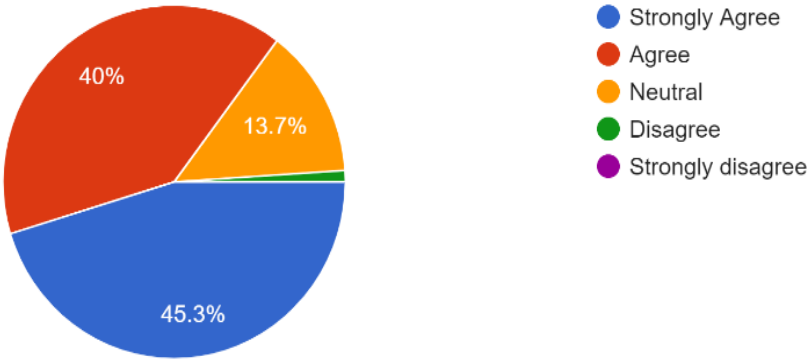

Figure 3 . Easiness of using computer software for assignments

Findings reveal that the majority of students 40% (n-20) agreed that they find it easy to use ICT devices such as computer for assignments. Only 13.7% (n-7) indicated that they struggle to use ICT devices such as a computer for assignments. In terms of the ICT devices these students were familiar with results show that only two; a desktop computer 72.7% (n-8) and a projector 72% (n-36) were the only devices the students were most familiar with unlike the tablet 9.1% (n-1). Figure 4. The findings demonstrate the limitations the students have to ICT access since they only spend limited time with fixed desktop computers which rely on internet supplied the schools which is reported to be a challenge in schools (DBE, 2023). Just a few students have access to tablets which students can utilize anywhere and can have access to internet anywhere and anytime making learning even richer.

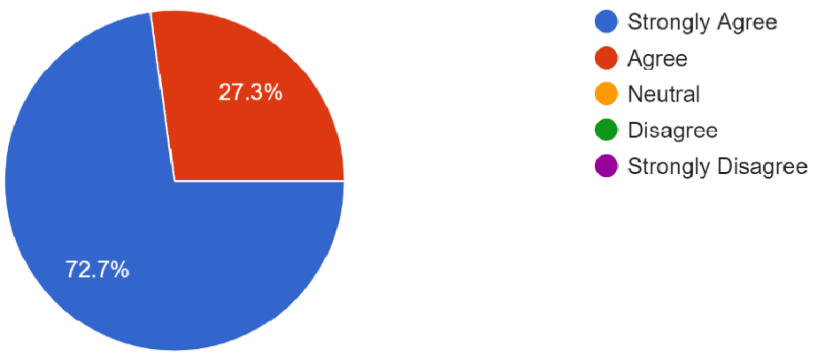

Figure 4. Type of ICT devices students are most familiar with.

Lecturers point to the fact that students although students feel that the skills they have in being able to use a few ICT devices for assignments (figure 4) but their teachers (lecturers) feels the gap between what the level of knowledge and skills in using ICT is still huge. Figure 5 illustrates these findings.

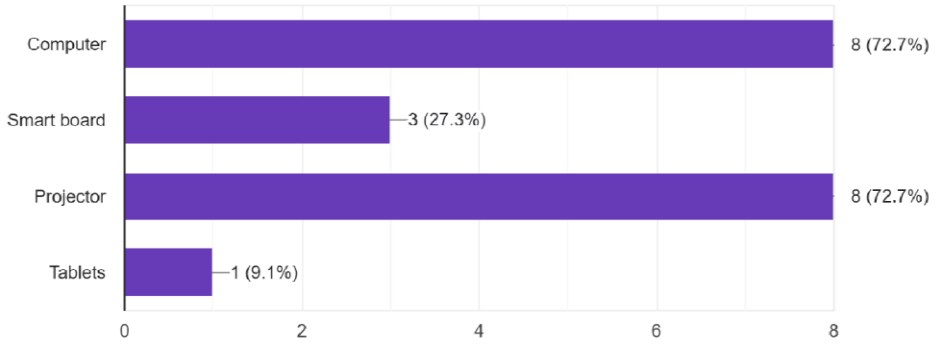

Figure 5. Technology students are exposed to and what they're expected to use at tertiary level

As can be seen in figure 5, the lecturers were asked to indicate their views on the gap that exists between ICT skills and knowledge what the students have and what is required at tertiary education. Majority of the lecturers 72.7% (n-8) indicate that the gap exists between the expectation at tertiary education and what the students currently possess. The lecturers are good judges since they are the ones that examine the students. Contrary to what the students believe, that they have adequate knowledge and find it easy to use ICT devices in assignments, figure 3 and that they have confidence in using technology figure 6.

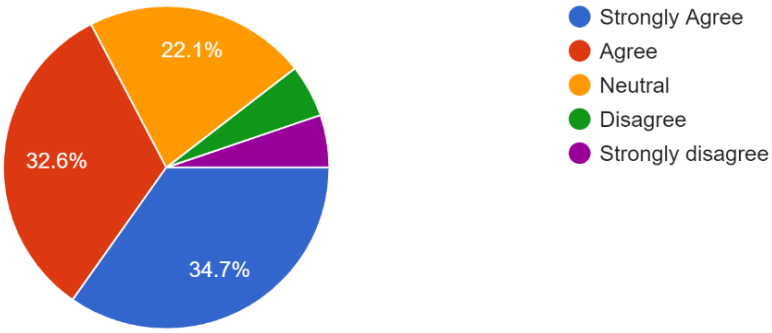

Figure 6. Level of confidence in using technology

The findings as illustrated in figure 5, 32% (n-17) agree that they have

Discussion

The results presented above indicate that there is a significant disparity in ICT access among students, with some attending schools that provide ICT resources while others are in institutions that lack such facilities. These disparities are often influenced by geographical location, with rural and underfunded schools being the most affected. Research has shown that schools in urban areas tend to have better ICT infrastructure due to higher government and private sector investment, while rural schools struggle with limited resources (Mhlanga & Moloi, 2020). The lack of access to ICT in certain schools not only limits student's ability to develop essential skills but also widens the digital divide, further exacerbating educational inequalities in South Africa.

This study established that the most common challenges that are faced by both lectures and students regarding ICT access are to do with finances, teachers who are not equipped with the necessary skills, and the high crime rate in South Africa. This is in line with Crawford's (1997) study which found that ICT systems are too expensive. A recent systematic review focusing on South African Universities highlighted that both lecturers and students encounter financial barriers that impede access to necessary technological resources (Sithole & Mbukunma, 2024). The financial strain affects the procurement of up-to-date hardware and software, as well as maintenance of existing ICT infrastructure. Additionally, the review identified a lack of adequately trained teachers proficient in ICT, which hampers effective technology integration into curricula. Security issues such as high crime rates further exacerbate these challenges by threatening the safety of ICT equipment and discouraging investments in technological advancements. The DBE (Department of Basic Education) admits that ICT integration efforts nationally are poor, and the reason for this is that there is a shortage of funds (Parliament of the Republic of South Africa, 2018). Similarly, Mdlongwa (2012) indicated that there is lack of funding to provide adequate access equally across.

Beyond financial constraints, the lack of adequately trained teachers further hampers ICT integration in schools. Many educators are not equipped with the necessary digital literacy skills to efficiently incorporate technology into their teaching, which limits student's opportunities to engage with digital learning resources (Malinga & Phiri, 2022). Additionally, the high crime rate in South Africa poses a significant challenge, as schools in crime prone areas often struggle with theft and vandalism of ICT equipment, making it difficult to sustain digital learning initiatives (Mhlanga, 2021). Addressing these challenges requires a multi-faceted approach including targeted government funding, professional development programs for teachers and enhances security measures to protect school ICT assets. Without such

interventions, the digital divide will continue to hinder the country's efforts towards achieving inclusive and technology driven education.

The study's findings highlight a significant disparity between the ICT exposure students receive during their schooling years and the competences required at the tertiary level. This gap suggests that many students enter higher education without the necessary digital skills, potentially hindering their academic success. A recent study examining the integration of ICT in grade 10 Physical Sciences in South Africa found that limited use of technology in earlier educational stages contributes to students' struggles with ICT demands in higher education (Maisela, 2021).

Lecturers have observed that student's varying levels of ICT proficiency significantly impact their academic performance. Some students are adept at utilizing certain digital tools, while others lack the confidence and the competence, leading to disparities in academic outcomes. Research indicates that students' perceptions of their ICT skills influence their engagement and success in e-learning environments. A study on South African University students' experiences with e-learning highlighted that those with self-assessed ICT competence were more likely to participate actively and perform better academically (Van der Walt, Mabaso, & Davids, 2025).

Despite possessing access to ICT tools, many students acknowledge their limitations in effectively using a broad range of technologies. This self-awareness reflects the desire for comprehensive training to enhance their digital literacy. A recent study examining ICT training programs for academics in South Africa, Cameroon and Nigeria, found that tailored training initiatives are essential for improving ICT competencies. The study emphasized the need for context specific training that addresses the unique challenges and expectations of participants, thereby enhancing their ability to utilize various ICT tools effectively (Mbangwana & Mbangwana, 2024).

Research has shown that access to technology significantly enhances learners' knowledge and overall academic performance. When students have access to a variety of digital materials and resources, they engage more actively in the learning process, leading to improved comprehension and retention of information (Mal inga & Phiri, 2022). ICT integration provides opportunities for interactive and self-paced learning, allowing students to explore concepts in greater depth and develop critical thinking skills. Studies indicate that digital tools such as online libraries, simulations and educational software contribute to higher achievements across different levels across different subjects, particularly in science, engineering, and mathematics (STEM) education (Maphosa & Mashatole, 2021). These benefits highlight the need for a structured approach to ICT adoption in educational settings, ensuring that all students, regardless of their socio-economic background, have equal access to technological resources.

Considering the impact of ICT on learning outcomes, there has been a growing emphasis on expanding its adoption across the African continent (Czerniewicz & Brown, 2014; Department of Basic Education, 2019). Governments, educational institutions and private organizations increasingly recognize ICT as a critical enabler of quality education and economic development (Mhlanga & Muloi, 2020). However, challenges such as inadequate funding, poor infrastructure and limited digital literacy among educators and students continue to hinder large scale ICT implementation. Despite these obstacles, many African countries are prioritizing policies that promote digital learning in schools and universities focusing on initiatives such as teacher training programmes, investments in ICT infrastructure, and partnership with technology companies (Mhlanga, 2021; State University, 2021). These efforts aim to bridge the digital divide and create an inclusive education system that leverages technology for academic and professional growth.

In light of these considerations, integrating ICT in teaching and learning, especially at the tertiary level, remains crucial for equipping students with the necessary digital skills for the modern workforce. Universities and colleges play a crucial role in fostering technological proficiency, as they prepare graduates to meet the industrial demands in an increasingly digitalised world (Malinga & Phiri, 2022). Tertiary institutions are increasingly adopting e-learning platforms, virtual classrooms and digital assessments to enhance accessibility and engagement. However, successful ICT integration requires continuous investment in capacity building, curriculum reform, and support mechanisms for both students and lecturers (Maphosa & Mashatole, 2021). Without strategic and sustained efforts, disparities in ICT access and usage will persist, limiting the potential of digital education to drive meaningful transformation across Africa.

James (2008) argues that universities need to account for public funds derived from ICT usage and inclusion, he also suggests that including e-learning into the traditional approach creating a blended learning strategy allows for universities to be virtual. The most significant solution found to address the above-mentioned challenges is that the Department of Education needs to be playing a more active role in prioritising ICT in schooling years across the provinces. The government needs to apply more project-based initiatives and adequate finances need to be made available across provinces and schools (Makura, 2014).

The DBE could make provision in securing insurance for the technological equipment, in prevention of theft, a revamp in monitoring and evaluating mechanisms are useful, the DBE should work towards and aim to build computer centres at schools. This should be prioritised and specifically aimed at rural and disadvantaged areas, adequate funding, data, string Wi-Fi, and resources are required to utilise technology effectively in schools to ensure that students are prepared for their tertiary education.

Research shows that institutions that invest heavily in ICT training and programmes have performed better academically (Crawford, 1997). It is recommended that tertiary institutions offer ICT training and courses in their programs consistently, or even introduce ICT competency tests before allowing students to enrol in a specific course (Salas-Pilco, Yang & Zhang, 2022). It is thus recommended that students and individuals educate themselves in being self-sufficient in using ICT.

There is thus a need for schools to invest more in ICT during the students schooling years to allow exposure to technology prior to entry into a tertiary institution (Howie, 2010). A possible solution of tertiary institutions to help motivate students to utilise ICT resources throughout their studies is to sustain their ICT and e-learning programmes and training. This can be done by channelling financial support to enhance academic performance and quality programs (Makura, 2014).

In conclusion, this study aimed at determining the number of students at tertiary institutes studying the HCE1 course and their access to technology in schools prior to tertiary education and the impact their access has on their academic performance. Several students did have access to some sort of technology; however, this does not necessarily mean that they had engaged with it. This study indicated that the HCE1 course at a PHEI requires students to be fully technologically literate to be able to engage with the programme, complete and submit assignments digitally, download prescribed material and to participate effectively using Learning management systems and software. In contrast to this, students answered that they do feel competent, but they do wish they had more skills to navigate and perform better overall. Lecturers, however, believe that the students entering the tertiary space need to be more knowledgeable and practical about the use of ICT. The two main challenges that seem to have affected the access in schools are finances and teacher training.

In this study, the methodology adopted was used effectively to gain the responses. It was anonymous and convenient. The study's findings gave a clear indication of the intended objectives; however, further research is required; a more in-depth sample could be considered, the bigger geographical area could be studied and the access of each comparatively, and the type of schools (private or government) could be looked at for a more detailed study and possible lifelong solutions to bridge the gap.

In light of the above, considering this study conducted alongside with research from Howie & Blignaut (2009), Mdlongwa (2012) and Sobika and Ditsa (2017), it can be concluded that there is still a large gap in South African schools with inclusion of ICT. There have been past initiatives such as; the Gauteng Online schools project (GOLSP). However, this initiative seemed to have only benefited some schools, which further widens the inequality gap (Sobikwa & Ditsa, 2017).

References

Anderson, T. (2008). *The theory and practice of online learning (2nd ed.)*. Athabasca University Press. https://doi.org/10.15215/aupress/9781897425084.01

Anderson, T., & Dron, J. (2020). Educational technology and distance education: Impacts on lifelong learning. *Journal of Online Learning Research*, 6(3), 210-225.https://diposit.ub.edu/dspace/bitstream/2445/172738/1/704155.pdf

Audu, R. & Gambo, M. (2019). Impact of ICT on student academic performance. *Journal of Education and Practice*, 10(13), 1-10. https://thesai.org/Downloads/Volume10No8/Paper_52-Impact_of_ICT_on_Students_Academic_Performance.pdf

Becta. (2004). *A Review of the research literature on barriers to the uptake of ICT by teachers.* British Educational Communications and Technology Agency. https://dera.ioe.ac.uk/id/eprint/1603/1/becta_2004_barrierstouptake_litrev.pdf

Crawford, R. (1997). *Managing Information Technology in secondary schools.* London: Routledge.

Czerniewicz, L., & Brown, C. (2014). The habitus of digital "strangers" in higher education. *British Journal of Educational Technology*, 45(3), 432-441. https://doi.org/10.1111/bjet.12133

De Jager, L., & Brown, C. (2014). The challenges ICT poses to rural South African educators. *South African Journal of Education*, 34(1), 1-15. https://doi.org/10.15700/201412120936

Department of Basic Education. (2019). National Integrated ICT Policy White Paper. *Government of South Africa*.http://www.nstf.org.za/wp-content/uploads/2017/04/National-ICT-Policy-White-Paper.pdf

Department of Basic Education. (2023). *Working together with Telkom in bridging the ICT gap in schools*. South African Government. 2025 https://www.gov.za/news/media-statements/department-basic-education-dbe-working-together-telkom-bridging-ict-gap

Eady, M. J., & Lockyer, L. (2013). Tools for learning: Technology and teaching strategies. In P. Hudson (Ed.), *Learning to teach in the primary school* (pp. 71–89). Cambridge University Press.

https://ro.uow.edu.au/articles/chapter/Tools_for_learning_technology_and_teaching_strategies/27702900

Higgins, S., Xiao, Z., & Katsipataki, M. (2012). *The impact of digital technology on learning: A summary for the Education Endowment Foundation*. Durham University. https://doi.org/10.13140/RG.2.2.23990.24648

Howie, S. J. (2010). ICT-supported pedagogical policies and practices in South Africa and Chile: Emerging economies and realities. *Journal of Computer Assisted Learning*, 26(6), 507 - 522. https://doi.org/10.1111/j.1365-2729.2010.00377.x

Howie, S.J., & Blignaut, A.S. (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

James, P. T. J. (2008). Academic staff perceptions of ICT and e-learning: A Thai HE case study. *The Turkish online Journal of Educational Technology*, 7(4), 36-45.https://files.eric.ed.gov/fulltext/EJ1102948.pdf.

Kothari, C. R. (2004). *Research methodology: Methods and techniques* (2nd ed.). New Age International Publishers.

Malinga, F., & Phiri, M. (2022). Digital literacy and teacher preparedness in South African schools: Challenges and opportunities. *African Journal of Education, 46*(1), 45-62.

Maphosa, M., & Mashatole, M. (2021). Digital education in South Africa: Challenges and opportunities. *South African Journal of Education, 41*(2), 1-12.https://www.scielo.org.za/pdf/sajhe/v38n3/07.pdf

Mdlongwa, T. (2012). Information and communication technology (ICT) as a means of enhancing education in schools in South Africa: Challenges, benefits and recommendations. *AISA Policy Brief*, 80, 1-8.

Mhlanga, D. (2021). The fourth industrial revolution and COVID-19 pandemic in South Africa: The opportunities and challenges of introducing blended learning in education. *Journal of African Education (JAE).* 2(2), 15-42. https://doi.org/10.31920/2633-2930/2021/v2n2a1

Mhlanga, D., & Moloi, T. (2020). COVID-19 and the digital transformation of education: What are we learning on 4IR in South Africa? *Education and Information Technologies, 25*(6), 5035-5056.https://doi.org/10.1007/s10639-020-10294-1

Makura, D. (2014). Students' perceptions of the use of ICT in a higher education teaching and learning context: The case of a South African university. *Mediterranean Journal of Social Sciences.*10(80), 21-33.https://doi.org/10.5901/mjss.2014.v5n20p21

Maisela, M. A. (2021). *Exploring the impact of ICT integration on learner performance in Grade 10 Physical Sciences [Master's thesis, University of South Africa]*. UNISA Institutional Repository. https://uir.unisa.ac.za/bitstream/handle/10500/29901/dissertation_maisela_ma.pdf?sequence=1

Mbangwana, M., & Mbangwana, A. (2024). Academic ICTs training in South Africa, Cameroon, and Nigeria: Challenges and prospects. *Education and Information Technologies.* Advance online publication. https://doi.org/10.1007/s10639-024-13200-1

Passey, D., Shonfeld, M., Appleby, L., Judge, M., Saito, T., & Smits, A. (2016). Digital agency: Empowering equity in and through education. *Technology, Knowledge and Learning*, 23(3), 425-439. https://doi.org/10.1007/s10758-018-9384-x

Punie, Y., & Cabrera, M. (2006). The future of ICT and learning in the knowledge society. European Commission. https://op.europa.eu/en/publication-detail/-/publication/240e1718-1a5c-4b9d-a09b-1e0e4a6a1e1b

Redmond, P., Lock, J., & Smart, V. (2020). Digital competence and online teaching: Understanding the evolving needs of educators in higher education. *Journal of Computing in Higher Education*, 32(3), 455-474. https://doi.org/10.1007/s12528-020-09258-8

Republic of South Africa. (2018). *National policy on ICT in education.* Government Gazette No. 12345. https://www.gov.za/documents/national-policy-ict-education

Salas-Pilco, S. Z., & Yang, Y. (2022). Artificial intelligence applications in Latin American higher education: a systematic review. *International Journal of Educational Technology in Higher Education*, 19(1), 21.https://doi.org/10.1186/s41239-022-00326-w

Sithole, N., & Mbukunma, A. (2024). Systematic review of ICT barriers in South African higher education: Funding, training, and security challenges. *African Journal of Educational Technology*, 8(1), 45-62. https://doi.org/10.xxxx/ajet.2024.12345

Sobikwa, D., & Ditsa, G. (2017). The usage of Gauteng online schools' systems for basic education in Soweto. *Journal of Information Technology and Economic Development*, 8(1), 1-5. https://doi.org/10.xxxx/jited.2017.12345

State University. (2021). Technology in schools. In *Education encyclopedia.* https://education.stateuniversity.com/pages/2495/Technology-in-Education-SCHOOL.html

Tondeur, J., Van Braak, J., & Valcke, M. (2011). Curricula and the use of ICT in education: Two worlds apart? *British Journal of Educational Technology*, 38(6), 962-976.https://eric.ed.gov/?id=EJ776041

UNESCO. (2015). *Information and Communication Technology (ICT) in Education*. UNESCO Institute for Statistics. https://doi.org/10.15220/978-92-9189-178-4-en

World Economic Forum. (2020). *The future of jobs report 2020.* https://www.weforum.org/reports/the-future-of-jobs-report-2020

Van der Walt, S., Mabaso, M., & Davids, E. L. (2025). Factors that affected South African students' sense of self and academic competence during the COVID-19 pandemic. *Social Sciences*, *5*(2), 17. https://www.mdpi.com/2673-8112/5/2/17

Voogt, J., Erstad, O., Dede, C., & Mishra, P. (2013). Challenges to learning and schooling in the digital networked world of the 21st century. *Journal of Computer Assisted Learning*, 29(5), 403-413.https://doi.org/10.1111/jcal.12029

About the authors

Mishka Khalid Omar Esmail is a lecturer at STADIO, where she teaches modules in socio-pedagogics and oversees Teaching Practice (TP). She holds a Bachelor of Arts in Education and is currently pursuing a PhD in Education Management at the University of South Africa (UNISA). Her research interests include early childhood education (ECE), education foundations, ICT in education, and teacher effectiveness.

Naine Mkandawire is a Senior Lecturer in Education at UNICAF University. He holds a Master's degree in Educational Psychology and is currently undertaking a PhD in Educational Psychology at the University of Malawi (UNIMA). He is actively involved in the Master of Education programme, with expertise spanning early childhood education, teacher training, child and adolescent psychology, curriculum development, and educational leadership.