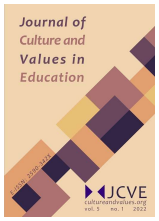

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Reinforcing the Role of ICT in Enhancing Teaching and Learning Post-COVID-19 in Tertiary Institutions in South Africa

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ABSTRACT
The use of Information Communication Technology (ICT) in higher education is becoming more and more prevalent with the over-proliferation of technological development we find ourselves in. The educational landscape in South African tertiary institutions has been affected by the COVID-19 pandemic, resulting in increased use of ICT. In turn, this has transformed these institutions' teaching, learning, and research. Central to this transformation has been challenges facing both teachers and administrators, including the need for a great demonstration of the value of ICT through improved output on teaching, learning and research. This paper examines the use of ICT in enhancing teaching and learning in South African tertiary institutions during and post COVID-19. Using an extensive secondary review approach, the report observes that ICT has been widely embraced in tertiary institutions during the COVID-19 pandemic lockdown. However, a minority of students and lecturers still lack the technological expertise to utilise modern technologies. In addition, limited funding in some rural universities hinders the purchasing of modern ICT equipment to support teaching and learning in tertiary institutions. The paper recommends increasing the value of ICT usage in the teaching and learning process post-COVID-19. Regular workshops and in-service training of both teaching staff, students and administrators in pedagogical issues and administration should be increased.

KEYWORDS
Information communication technology; ICT; teaching and learning; academic transformation; technological innovations; COVID-19

INTRODUCTION

The use of Information Communication Technology (ICT) in higher education is becoming increasingly critical with the over-proliferation of technological development we find ourselves in (Mlambo et al. 2020). Technology use allows learners to increase their willingness to acquire extensive knowledge and improve their learning processes more than what educators could offer (Sima et al. 2020). In South Africa, ICTs are crucial in spearheading social and economic development. The ICT Policy White Paper (2016) regards ICTs as a wide range of technologies that include fixed wireless telephony, computing and information technology, broadcasting, internet, audio and visual content including traditional methods of communication and postal deliveries. Clarke (2020) argues that ICTs can transform how citizens interact, socialise, conduct business, run the government, and uphold accountability to citizens. The unprecedented outbreak of COVID-19 globally triggered large-scale institutional and behavioural shock effects in different facets of human activity, including education and health of students and families (Morris and Chapman, 2020). As noted by UNESCO (2020), COVID-19 affected an estimated 1, 5 billion students globally, ranging from primary to tertiary institutions, as they failed to attend school, fearing the severity of the virus. In South Africa, COVID-19 wreaked havoc in many tertiary institutions, as these were not adequately prepared to migrate to online learning as a responsive measure to curb the spread of the virus (Masha, 2021; Mhlanga & Moloi, 2020). The massive and urgent closures primarily affected tertiary institutions globally as the urge to adopt quick fixes in various digital learning platforms became a reality (Jandrić, 2020). Among the teaching and learning ICTs adopted in some South African universities during COVID-19 are Zoom, Telegram, Microsoft Teams, Blackboard, Google Classroom and Modular Object-Oriented Dynamic Learning Environment (MOODLE). Teras et al. (2020) warn that using these ICTs in tertiary education has redefined and reduced teaching and learning concepts.

Nonetheless, the rapid migration from contact classes to online teaching was the only viable option for many tertiary institutions in South Africa to continue learning. Although nobody anticipated COVID-19 to transform the teaching and learning landscape, Bastani (2019) draws researchers to the previous proclamation by Selwyn (2010), who predicted that ICT would somehow 'disrupt' or revolutionarise' education. The outbreak of COVID-19 inevitably allowed for more technology use in tertiary institutions in South Africa and other nations to increase student engagement with their educators (Williamson, 2020). Utilising digital platforms during COVID-19 was meant to ensure continuity of teaching and learning, although recent research criticises these quick-fix measures as unsustainable in the long term. Post COVID-19 may require tertiary institutions globally to revisit the blended learning approach in universities because online teaching in low-income countries can widen the skills and poverty gap due to lack of access to ICT gadgets (Fuchs, 2020).

Although recent research confirms the use of ICT in improving teaching and learning in South African tertiary institutions, it is vital to provide a critical evaluation of how ICTs, as innovative technology, can help close the gap created by migration to online learning COVID-

19. Examining new approaches that can be used post-COVID-19 is significant to ensure educators deliver quality education to learners. With this understanding in mind, the article responds to the following questions: What challenges are there in using ICT to enhance online teaching and learning during and post-COVID-19 in tertiary institutions? How can ICTs be integrated into teaching and learning to enhance post-COVID-19 epistemic access? What is the future of teaching and learning post-COVID 19 in South African tertiary institutions?

The remainder of the article focuses on the literature review followed by the methodology adopted. The third section provides a presentation and discussion of findings, followed by a section on the conclusions of the study. The last section offers recommendations and direction for further studies.

LITERATURE REVIEW

The implementation of ICT as part of learning depends on the acceptance and understanding of students' and educators' potential benefits (Baytak et al., 2011; Tadeu et al., 2019). Many theories, such as the Technology Acceptance Model, illustrate how end-user acceptance of technology can improve productivity. However, this article adopted the Knowledge Gap Theory as it helps explain the dangers ICT can pose to students from disadvantaged backgrounds. According to the Knowledge Gap Theory, knowledge is not equally obtained by all members of society as persons of respectable economic and social standing have strong capabilities to obtain information (Weng, 2000). As a result, two groups emerge, namely those with higher education based on several topics, and those with lower education who know less (Tichenor et al. 1970). As the COVID-19 pandemic is still haunting nations, the future of education at all levels will be online learning. This theory draws researchers' attention to worrying trends that may further widen the digital gap in tertiary institutions as students from low-income families may be left behind due to poor internet connection, absence of data, and poverty.

ICT and educational transformation during COVID-19

Questions are being posed in the literature regarding the effectiveness of ICTs in transforming tertiary education, and whether ICTs will be more influential post-COVID-19. Albion et al. (2015) argue that using digital technologies in classrooms has not yet produced systemic transformation or promoting "islands of innovation" resulting from teachers' ability to utilise ICTs to innovate in their teaching practices without involving a formal lifelong learning process. The study by Williamson et al. (2019) addressed the critical concerns in education technology research before the outbreak of COVID-19. They argue that educational research should prove how technology can fix existing problems and new challenges caused by education technology. Selwyn et al. (2020) advocate creating a crucial ed-tech agenda and proactivity months before the pandemic**.** Long before the pandemic, leading researchers had already stated advocating for urgent education technology research (Bulfin et al. 2015; Jandrić, 2017). This proposition gathers momentum as the COVID-19 pandemic progresses.

Since past studies have predicted that ICTs will be used in education, there are three main aspects that are likely to be considered: autonomy, capability and creativity (Macgilchrist, 2019). Jandri (2020) suggests that autonomy is achieved by those students who control their learning by working alone and in groups. Educators can provide students the chance to demonstrate their teamwork capabilities to finish a given task; hence, ICTs can be utilised to gather detailed information that can be risky, and at the same time educating students on failure. Through ICTs, educators gain autonomy by preparing study material for students as a strategy to empower students to look for more information as compared to being spoofed in a traditional classroom context (Dooley et al. 2016). As Mertala (2020) denotes, students demonstrate their capabilities by using ICTs and acquiring relevant information on various topics and applying such skills to enhance their learning processes. While engaging students in ICT, educators can make knowledge acquisition more accessible and concepts in learning areas well understood. During the COVID-19 pandemic, ICTs are widely regarded as the only tool to support teaching and learning in tertiary institutions. This may remain the situation in case of a prolonged COVID-19 pandemic period; hence, transforming the education curriculum towards ICT use is fundamental.

Deconstruction of contact lectures and adoption of online learning

The outbreak of the COVID-19 pandemic was arguably the departure point for deconstructing contact lectures and integrating online learning as a strategic and most viable means to continue offering education in tertiary institutions. According to Maribe (2016), there is a perception that integrating technology in higher education would automatically improve students' performance. Nevertheless, there is limited empirical evidence to support the role of technology in enhancing learning. This lack of proof affects all levels of education, notably higher education. Several unanswered questions still exist regarding the efficacy of ICT in teaching despite technology use (Linda & Kirkwood, 2014). In countries such as Liberia and Sierra Leone, ICTs promoted online education to respond to the COVID-19 pandemic (Montoya, 2021). Ghana delayed migrating to online education as the country was undertaking preparations to ensure that both educators and students adjust to the new 'normal' of online education, by especially ensuring that students with disabilities would gain accessibility (Montoya, 2021).

Nonetheless, the way digital technology is employed today is (maybe unwittingly) exacerbating existing socio-economic gaps. The usage of ICT in modern day societies is based on access, attitudes, discourses, skills, structures and availability of infrastructures that are connected to individual societal domains and life chances. Furthermore, ICT use helps in improving citizen participation in political affairs, promote entrepreneurship growth across various races and gender. Noting these contestations, therefore, it can be argued that deconstructing contact lecture sessions and adopting online learning became apparent as institutions in South Africa and globally battled to continue with education while minimising the risk of spreading the COVID-19 virus. Given these sentiments, the post-COVID-19 era may

require tertiary institutions to normalise and get prepared to embrace online education as a contingency measure to respond to pandemics such as COVID-19.

Institutional preparedness and ICT use post-COVID-19

The e-readiness of tertiary institutions globally can promote the ease of adoption of ICT in online teaching and learning. The lessons drawn from the current dilemma of COVID-19 challenge tertiary institutions to reconfigure their institutional systems and be ready to utilise ICTs; evidence on the ground indicates that the COVID-19 pandemic may be in existence for a long time. The study by Hove and Dube (2021) attests to this viewpoint by suggesting that since COVID-19 revolutionaries the future of education, institutions need to devise alternative strategies to promote online education as the most viable option to continue teaching and learning. Similarly, Kanyemba and Hofisi (2019) argue that embracing digital technologies to support teaching and learning requires tertiary institutions to be e-ready, in that their systems and infrastructure should be in place to avoid delays or derailing of students' progress. The use of ICT-related virtual platforms (computers, cell phones, projectors, etc.) requires adequate preparation, as the post-COVID-19 era might be dictated by the recurrent virus and may take a long to end. Drawing from these discussions, institutional preparedness remains a key imperative in promoting online teaching and learning post-COVID-19. Since the Knowledge Gap Theory suggests that knowledge cannot be equally accessible to all members of society, tertiary institutions stand a chance to rectify the digital divide by ensuring that every student has ICT skills and is provided with data and computer to access virtual learning. Tertiary institutions in South Africa need to draw lessons from the current education landscape, with its own problems, and they should capitalise on the weaknesses to prepare institutions for better education delivery in times of pandemics or other natural occurrences that may affect contact lectures.

METHODOLOGY

To examine the role of ICT in enhancing teaching and learning post-COVID-19 in Tertiary Institutions in South Africa, the article adopted an explorative qualitative design based on an extensive secondary review approach. A qualitative research as Kumar (2011) holds draws on deductive reasoning, which maintains that the conclusions and findings are valid when assumptions and theories are precisely aligned in a study. The study utilised peer reviewed journal articles, dissertations and other expansive secondary data sources that inform ICTs, COVID-19, and educational transformation in South Africa. The methodology helps interrogate the use of ICTs in transforming tertiary education in the post-COVID-19 era. Content analysis was therefore utilised to analyse secondary data, which was organised into themes following the objectives of this study. Leedy and Omrod (2015) argue that content analysis helps with detailed and systematic examination of the content of certain body of material with the intention of identifying patterns, themes or biases.

RESULTS

This section offers a discussion of the qualitative findings drawn from documents sampled for this study.

Lack of integration of students and educators in ICT adoption

The adoption of ICTs in tertiary institutions might not be a consultative process; hence, Teras and Kartoglu (2017) posit that online learning often takes various forms that enable modern methods of delivery education assessments. Different education-philosophical and pedagogical bases might sometimes inform and mould online learning. The analyses of data indicated the need to integrate both educators and learners in technology integration sessions to reinforce the online culture amid pandemics such as COVID-19. The merits of using ICTs in tertiary education lie in their ability to provide online designed education such as videos as part of digital learning. The study by Herrington et al. (2010) reiterates that absorbing ICTs within a virtual learning environment is fundamental for establishing relations with stakeholders in research because the online management framework fosters complex and authentic learning. From the review of documents, the researcher noted that involving educators and learners in the creation, implementation and usage of educational technology could also impact how sound technology can support meaningful teaching and learning.

The digital divide in online education

The review of documents revealed that post-COVID-19 tertiary institutions in rural towns of South Africa might experience considerable setbacks in terms of ICT use. This is because the existing digital divide and limited skills can affect rural students who are enrolled in tertiary institutions for the first time. Montoya (2021) argues that promoting remote education requires adequate access to ICT devices such as computers, internet/mobile and educational resources, and access to network, and training for students and educators. Nonetheless, the complexities of distance education have been felt in South African universities, as rural students may be left behind due to their poverty and low household income (Mhlanga and Moloi, 2020). Apart from poverty and inequalities post-COVID 19, Hodges et al. (2020) criticise online learning by citing its failure to uphold sound pedagogical principles and best practices. Selwyn (2020) concurs that quick fixes in education using technology trigger adverse effects on students' learning. As argued by Harwell (2020), online platforms used during the COVID-19 and likely to be used post COVID-19 are blamed for their limited privacy and surveillance, which can adversely impact students' lives and human dignity. These discussions indicate that in the event COVID-19 ceases, the future of education should be returned to traditional methods as a way of integrating other students from disadvantaged backgrounds, including those who struggle to embrace online teaching and learning. This phenomenon concurs with research from South Africa since COVID-19 has exposed the deep structural inequalities among students who may deter proper learning due to the inaccessibility of ICT, inclusive of, among other things, the internet and modern technological devices.

ICTs as 'magic bullets 'in online education

Implementing ICTs in tertiary education in South Africa is not a panacea to ending the problems triggered by COVID-19. The review of extant literature indicated that in many tertiary institutions, ICTs long existed but educators and students were not fully taking advantage of the technological gadgets to improve academic work. Cuban and Jandric's (2015) study corroborates these views, stating that access to ICTs in tertiary education can improve student's academic performance. However, limited evidence supports the idea that educators and students benefitted from using ICT. However, these assertions are subject to criticism given the current educational environment marred by the largescale use of ICTs to promote online learning during COVID-19. Many tertiary institutions globally have transformed their teaching and learning through digital platforms that encourage accessibility and continuity while neglecting the growing digital divide among poor students.

Furthermore, Bayne (2015) criticised how certain ontological assumptions, such as 'technology-enhanced learning,' may limit critical discussion of educational technology. In another study, Knox et al. (2020) argue that digital learning platforms have been chastised for redefining, simplifying, and lowering the concept of learning to fit the education technology revolution narrative better. As a result, Manolev et al. (2019) postulate that although ICTs have redefined and redirected the future of education in many tertiary institutions, they are not 'magic' bullets to tertiary education, though signs of acceptance are high in the event COVID-19 surge persists. In South African tertiary institutions, it is evident that ICTs were widely used when the COVID-19 pandemic broke out. However, post-COVID-19 has shown the need for moving back to contact classes as the feasible means for delivering university education. Therefore, future academic space may be balanced between contact and online classes depending on the severity of the COVID-19 pandemic.

Limited ICT skills

The migration from the old teaching approach towards an ICT based approach to delivering education during COVID-19 was met with unintentional resistance due to scarce digital skills in both educators and learners in South Africa**.** However, digital skills are vital for full participation in society hence governments globally are expected to harness their energies to provide ICT access to bridge the digital divide. In South Africa, the absence of digital skills among educators and students was reported in a study by Masha (2021), who regarded digital inequalities as an obstacle to online teaching and learning. Similarly, Songca's (2021) survey reports on some disadvantages of online education and learning in rural universities such as Walter Sisulu University (WSU) in South Africa, where socio-economic inequalities already exist among students. Dismantling the legacy of apartheid in many rural tertiary institutions remains a stumbling block for ICT adoption. This is because many first-year students, for example, enter university with limited skills to navigate school online portals and other teaching and learning tools, which unintentionally triggers a massive digital divide that may hinder rural students from

acquiring quality education during the COVID-19 pandemic. Nonetheless, the analysis of documents has shown that the benefit of using ICTs in teaching and learning during COVID-19 was unevenly distributed depending on a tertiary institution's economic and social status. The adoption of various online approaches to teaching and learning was necessitated by the desire by tertiary institutions to ensure continuity in education, although under challenging circumstances. However, the skills deficit was a backdrop to ensuring that ICT transformed education in South African tertiary institutions.

Minimal investment in ICTs

Investing in ICT infrastructure is one of the crucial ways of ensuring that teaching and learning continues in the post-COVID-19 era in many countries. This is because the future is uncertain as to when the pandemic will end; hence, preparation for online education is strategic on the part of tertiary institutions. For years, tertiary institutions have not fully utilised ICTs as a model for teaching and learning. As Goodloe and Ardley (2021) observe, ongoing and continuous training is necessary to ensure that educators and students embrace modern ICTs that are influential in teaching and learning post-COVID-19. For example, in some South African universities modern ICT was already available, but both educators and learners were used to contact classes where close engagement is experienced. The outbreak of the COVID-19 pandemic and subsequent lockdown presented numerous challenges as transforming the face of education using ICTs became inevitable. The review of documents has shown that investing in ICTs can be costly in terms of infrastructure, equipment, technical support staff, and training of educators and students (Kirkwood & Price, 2013). Despite the widespread growth in practice, concerns continue to be expressed about the extent to which effective use is being made of ICT to improve the learning experience of students during COVID-19 in South Africa. Nevertheless, limited evidence exists in the literature to support learning enhancement by introducing technology (ICT) into the classroom; hence, its value in transforming education remains equivocal. From these debates, it can be noted that during COVID-19 pandemic lockdown in South Africa, ICTs were employed as innovative alternative mechanisms that replace the traditional contact classes approach, although their effectiveness is largely debatable.

High costs of data

The primary goal of institutions of higher learning is to produce skills by offering quality education in the process ensuring the university reputation remains intact in the global scene (Kandiri, 2014). The outbreak of COVID-19 triggers various challenges for students in South Africa in terms of data. Although many universities provided data to students, it was not enough to surf the internet and conduct all school-related work. This is evidenced in Jarke and Breiter's (2019) study, which notes the dangers of limited student data. It may derail academic progress and create further inequalities among students who cannot afford data due to low-income family backgrounds.

Apart from the high costs of data to purchase ICT, a behavior change was noted among students in tertiary institutions as they became uncontrollable owing to the wide use of digital machines (Knox et al. 2020). The study by Williamson (2020) affirms that excess exposure of students to online services may create a negative outcome in terms of academic performance. Therefore, it can be argued that although ICTs helped a lot in ensuring that students continue with schoolwork amid COVID-19, the absence of monitoring and evaluation on how ICTs are being used triggers other challenges because exposure to harmful sites is rife during remote learning. It remains the call for territory institutions to ensure that in the case of data provided to students, the ICT department must flag unfruitful or harmful websites such as pornographic sites to help students limit their exposure to websites that are not developmental. ICTs, in this case, need proper governance to ensure that they are used positively to respond to the needs of students during and post COVID-19.

Cyber-attacks in online education

The transition from formal, contact learning to virtual learning posed various challenges that included cyber-attacks in tertiary institutions. A cyber-attack refers to the intentional breach of information of an organisation or an individual by a person who intends to benefit by disrupting the victim's work (Goud, 2018). Cyber-attacks manifest themselves in different forms, and during COVID-19, threats emanating from such attacks became many. Kshetri (2021) argues that during the COVID-19 lockdown in America for example, cyberattacks struck schools and universities harder than any other industry. In South Africa, as Sekgololo (2021) holds, cyberattacks threaten e-learning (online teaching and learning) due to the lack of cybersecurity systems to protect both educators and students from the online space. Online learning using tablets, cellphones, PCs and laptops may result in security breaches as some students are unaware of the latest security patches and recommendations, which gave hackers leverage (Naik, 2020). In most circumstances, hackers would cyberbully their victims or access home networks and accounts of unsuspecting students, resulting in data loss or log-in details to access user accounts. FA NEWS (2020) notes that universities face cyber risks that may affect storing of institutional and student data, engagement of vendors, independent contractors, or service providers that may pose as third parties, among others. Such threats may affect university systems or lead to data leakage through hacking. South Africa's poor ranking exacerbates cybercrime (cybersecurity breaches with criminal intent); the country is the third affected country globally after Russia and China. Financially, projects have revealed that South Africa loses close to R2.2 billion annually owing to cybercrime, and the percentage is ever-increasing. In tertiary institutions, phishing, hacking, and other forms of cybersecurity breaches are experienced in various institutions. It appears like a growing culture that threatens the future of education even post-COVID-19. The fear associated with cybercrime is that neither students nor educators can avert the cyberattacks, resulting in students or institutional data being compromised. Based on the threat of cyberattacks nationally, the South African government

has a long way to ensure that solid cybersecurity systems are in place to minimise data breaches that may derail or compromise the integrity of tertiary institutions among other government departments. Providing cybersecurity resiliency should inform future planning of tertiary institutions as threats emanating from cyberattacks should be avoided in the short term and post-COVID-19 to promote online teaching and learning.

CONCLUSION

The analysis of documents revealed that ICTs were widely embraced in tertiary institutions during the COVID-19 pandemic lockdown. However, a minority of students and lecturers still lack the technological expertise to utilise modern technologies. The growing digital divide associated with poverty and inequalities was a significant constraint to using ICTs in tertiary institutions, as students from low-income families are excluded from online learning. The lack of integration of students and educators is another hindrance that needs to be considered in South African tertiary institutions when planning to adopt ICTs as part of teaching and learning. The analysis of documents further revealed that threats from cyber-attacks may hinder education transformation in tertiary institutions during COVID-19. The review of literature revealed that in some tertiary institutions in South Africa, students and educators do not possess the vital digital expertise to avoid hacking, phishing, and other forms of cyberattacks. This creates a gap for tertiary institutions to invest in sophisticated software that guarantees cyber security resilience, which is vital for protecting institutional data. Based on these conclusions, next section offers recommendations in the of the study.

Recommendations

Policy level: At this level, the government of South Africa needs to have the political will to address challenges facing tertiary institutions regarding ICT. By increasing funding to tertiary institutions, the government can help promote online teaching and learning in times of pandemics such as COVID-19. In addition, the government can design more ICT policies that are supported with dedicated budgets to support tertiary institutions to meet the demands of online educations, such as buying data and laptops for vulnerable students.

Organisational level: At the organisational level, universities in South Africa are encouraged to prepare their educators and students to embrace ICT as a responsive measure to the effects of the COVID-19 pandemic. This can be done by initiating regular workshops and in-service training of teaching staff and administrators in pedagogical issues and digital platforms such as Teams and Zoom. Equipping staff and students makes universities stand stronger post-COVID-19 as preparedness for disasters like COVID-19 is key to continuing education.

The study was limited by reliance on ICT and tertiary education documents in South Africa. Future qualitative studies may be conducted to examine students' perceptions in selected universities in South Africa on how they used ICTs to improve their academic performance during the COVID 19 pandemic.

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