A SYSTEMATIC REVIEW OF THE TRANSFORMATIVE IMPACT OF THE DIGITAL REVOLUTION ON HIGHER EDUCATION IN SOUTH AFRICA

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ABSTRACT

This article investigates the transformative impact of the digital revolution on South African higher education institutions through a Systematic Literature Review. Thus, EBSCOHost, Emerald, Google Scholar, SAGE Journals, ScienceDirect, Springer Link, Elsevier, and Taylor & Francis were used to retrieve and analyse information from scholarly publications such as book chapters, reports, peer-reviewed journal articles, and other publications (n = 17) in South Africa between 2019 and 2023. The research questions of the study aided the discovery of significant themes to explore the transformative impact of the digital revolution on South African higher education institutions. The study found that challenges to embracing digital education in South African higher education institutions include resistance to change, marginalisation of certain socioeconomic groups, poor infrastructure, lack of funding, inadequate Fourth Industrial Revolution tools for instruction, and lack of Fourth Industrial Revolution skills training and development. In contrast, the opportunities include increased student enrolment, Massive Open Online Courses, use of technology to end social exclusion, research and development, and curriculum redesign. The study put forward recommendations that key stakeholders of higher education institutions can use to improve the curriculum in the digital revolution. Prospects for future research were suggested. The study concluded that while various challenges exist for the digital revolution in South African higher education institutions, opportunities can be explored.
Keywords: digital revolution, higher education institutions, South Africa, systematic literature review, teaching and learning

INTRODUCTION AND SCOPE OF THE STUDY

In recent decades, Higher Education Institutions (HEIs) have undergone significant changes, primarily resulting from ongoing technology innovations that have transformed curriculum implementation methods (Qolamani and Mohammed 2023). The inception of digital platforms such as artificial intelligence, social media sites, data analytics, and Learning Management Systems (LMS) has transformed teaching and learning. The higher education digital revolution extends beyond incorporating digital tools, resources, and methodologies

into educational frameworks. It involves curriculum transformations that enable students to think critically, develop digital literacy, and develop skills to solve challenges, preparing them for life in the digital era. While this shift presents tremendous opportunities, it also presents challenges for students, lecturers, and key HEI stakeholders (Roehl, Reddy, and Shannon 2013).

The term "digital revolution" is attributed to several authors, but it gained significant momentum during the 1980s. The concept, which is also called the Third Industrial Revolution, refers to technological development from analogue electronics and mechanical devices to the digital tools and platforms available today (Sharma and Shanmugaboopathi 2022). From an academic perspective, the digital revolution has significantly impacted HEIs, reshaping how teaching and learning are delivered, accessed, and experienced (Jakoet-Salie and Ramalobe 2023). The digital revolution in HEIs continues to transform teaching practices and students' experiences, offering opportunities for innovation, accessibility, and improved learning outcomes.

Before the digital revolution, Roehl et al. (2013) believed that teaching and learning were characterised by traditional instruction based on face-to-face lectures, printed textbooks, paper-based examinations, chalkboards/whiteboards, individualised learning, and class discussions. Teaching resources only made use of physical cues, and equipment was instructor-led. Most communication between students and lecturers occurred in class or through an appointment outside class times. Information on how students learnt was also limited to assessments and signed class registers.

With technological innovations changing and affecting how students are taught and how they learn, the digital revolution is constantly evolving. This has presented prospects for teaching and learning, suggesting that new technological advancements are yet to be introduced for pedagogical approaches; thus, students and teachers alike must understand this phenomenon in order to succeed in the digital era (Hiltz and Turoff 2005).

However, the arrival of the digital age presents significant changes for the curriculum. Digital platforms enable lecturers to collect data, analyse it, and provide feedback to students in real-time. This allows lecturers to attain a thorough understanding of students' learning and provide more targeted and relevant solutions (Willis, Campbell, and Pistilli 2013), thereby ensuring student support and effective teaching and learning. Through multiple digital learning tools and platforms, lecturers can keep abreast of students' activities, such as patterns for learning, material interaction, and the duration spent on a particular assessment or assignment (Qolamani and Mohammed 2023). This suggests that student data is no longer limited to grades and performance ratings, which enables lectures to help students

acknowledge their shortcomings and strengths by providing them with detailed feedback throughout their learning. During the COVID-19 pandemic, access to the Internet and digital facilities was critical in enabling teaching and learning at HEIs (Woldegiorgis 2022).

While the digital revolution has significantly evolved in HEIs, it has illuminated the "digital divide" between advantaged and disadvantaged students since a crucial concern in South Africa has been access to higher education, especially for underprivileged students (Woldegiorgis 2022). The digital divide presents unequal learning opportunities as underprivileged students are more likely to experience academic obstacles (Chen et al. 2020). From a teaching perspective, lecturers lack the requisite skills and proficiency to effectively adopt technology to support teaching and learning in the classroom (Bao 2020).

Although a large body of literature has explored HEI curriculum post-COVID-19, limited research has been conducted on the Systematic Literature Review (SLR) approach, which sheds light on the practices and interventions that have been adopted over the past five years, particularly concerning the effect of the digital revolution at South African institutions of higher learning. Consequently, the aim of this research is to advance the field of digital learning in HEIs. The study draws on existing literature findings, but sheds more insight on how key elements for teaching and learning success in HEIs can be applied to the South African context. The findings will provide useful information for key stakeholders in HEIs in South Africa. Thus, this study seeks to answer the following research questions:

- RQ1: What challenges do South African higher education institutions face in embracing digital education?
- RQ2: How can South African higher education institutions embrace digital education opportunities?

RESEARCH APPROACH

The study collected relevant literature for investigation using the SLR methodology. The SLR was conducted according to the Preferred Reporting Items for Systematic Reviews (PRISMA) criteria. Page et al. (2021) define PRISMA as "an evidence-based minimum set of items for reporting in systematic reviews and meta-analyses". Consequently, the following steps were followed to guarantee a thorough and exacting analysis:

Literature search

The researcher followed a full electronic search strategy covering 17 scholarly publications published between 2019 and 2023 to focus on recent challenges and opportunities South

African HEIs experience in embracing digital education. The search keywords and phrases that were used included: "transformative impact of the digital revolution on South African higher education," "transforming tertiary institutions in South Africa through digital innovations," "impact of the digital revolution on South African higher education," "impact of the digital revolution in South African universities," "digital revolutions in higher education in South Africa," "the impact of the digital revolution on higher education in South Africa," "digital innovations in South African higher education," "digital improvements for South African higher education institutions," "challenges of digital innovations in South African higher education institutions," and "opportunities for higher education digital revolution in South Africa".

The researcher used the following eight databases to retrieve scholarly publications used in the systematic review: EBSCOHost, Emerald, Google Scholar, SAGE Journals, ScienceDirect, Springer Link, Elsevier, and Taylor & Francis, as these databases were deemed reputable and were convenient for the researcher.

Inclusion and exclusion criteria

This section presents the criteria for including and excluding publications from the study, which ultimately set the boundaries for the systematic review. Table 1 summarises the criteria adhered to in the study:

Table 1: Criteria for including and excluding publications from the study

Included	Excluded
Scholarly publications published between 2019 and 2023.	Scholarly publications published outside of the study's stipulated timeframe.
Scholarly publications published in South Africa.	Scholarly publications published outside South Africa.
Scholarly publications published in the English language.	Scholarly publications not published in the English language.
Scholarly publications that feature HEIs as the primary focus.	Scholarly publications that do not feature HEIs as the primary focus.
Papers explicitly focusing on the adoption of digital media in HEIs	Papers that do not explicitly focus on the adoption of digital media in HEIs

Source: Researcher's own conceptualisation

Study selection process and data extraction

The researcher selected scholarly publications to address the research questions of the study. Figure 1 shows a diagrammatic representation of the processes involved in including and excluding publications from the study, while Table 2 summarises the number of publications included and excluded in the study. The initial search yielded 61 publications, which were reduced to 47 after removing six duplicate publications. An additional eight were removed

because the full-text article was not available. The publications underwent screening to include journal articles, book chapters, theses, and dissertations before 37 publications were eligible for further assessment. A title and abstract screening were conducted on the 37 publications using the criteria highlighted in Table 1. A final 17 scholarly publications were included for review (see Figure 1 and Table 2).

After selecting the scholarly publications for inclusion, the researcher extracted data using an online form specifically designed for this purpose. Data of interest such as author(s), publication year, title of publication, and journal of publication were extracted from each research deemed eligible for this study. The reporting of the systematic review results was guided by the PRIMSA (see Figure 1).

The PRISMA flow diagram above "is a graphical representation used in systematic reviews and meta-analyses to illustrate the flow of information through the different stages of the review process" (Page et al. 2021). It visually outlines the process for selecting publications for review, from identifying the study to inclusion or exclusion. The below provides an explanation of what typically transpired in each section of the PRISMA flow diagram pertaining to this study:

- *Identifying:* This is where the initial identification of relevant studies began. It involved searching electronic databases.
- *Selection:* During this stage, duplicate publications were removed, and the remaining studies were reviewed based on their titles, keywords, and abstracts to ensure they aligned with the previously defined criteria for inclusion and exclusion.
- *Included:* In this stage, publications aligned with this study's inclusion criteria were included in the systematic review.

Page et al. (2021) are of the view that the PRISMA flow diagram minimises bias and provides transparency and clarity regarding the process used in selecting publications for inclusion in the systematic review.

In Table 2 the purpose was to show the various sources reviewed, how many studies were reviewed per source, and the studies included or excluded from this study.
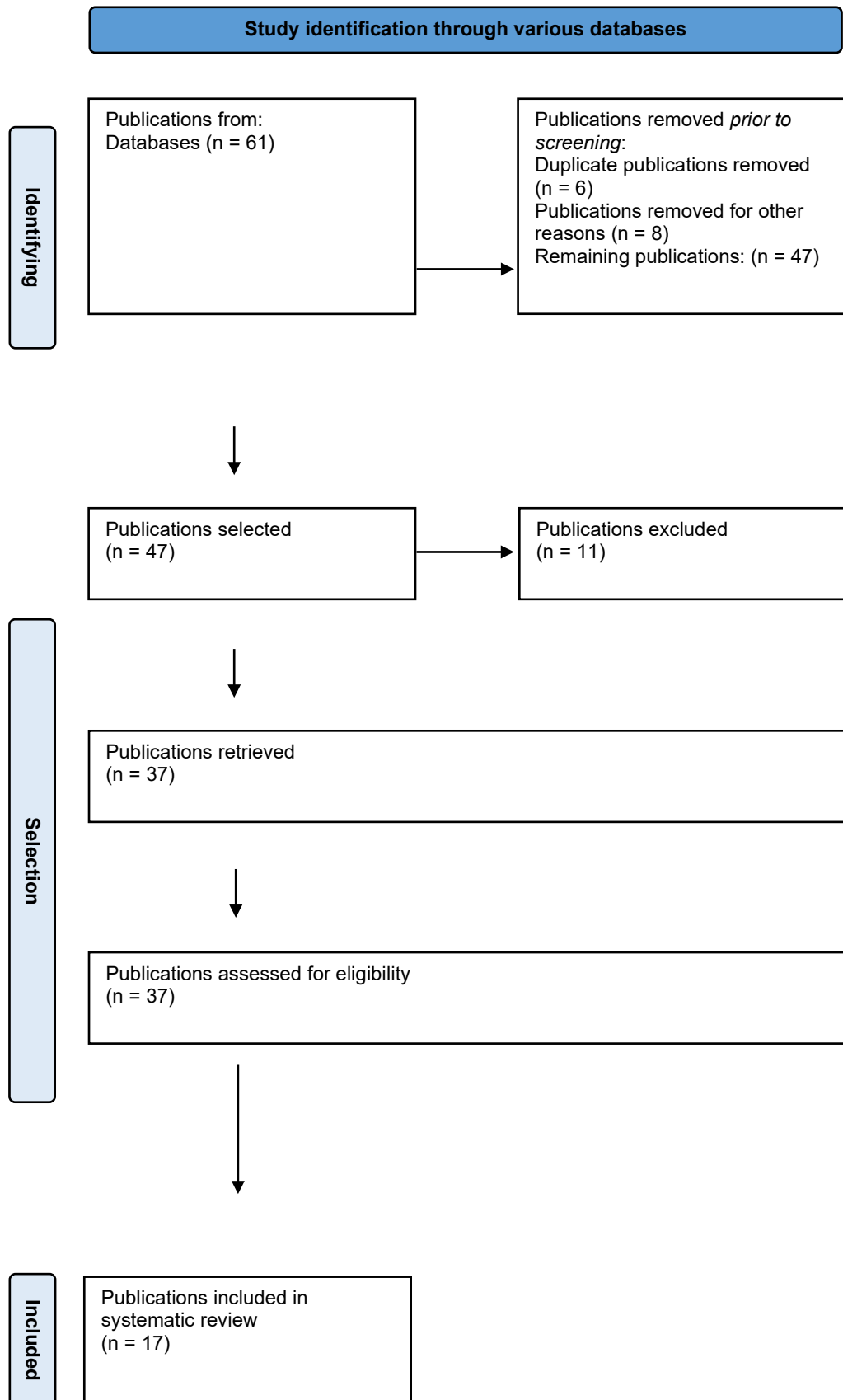
Figure 1: PRISMA flow diagram (Source: Researcher's own conceptualization)

Table 2: Study selection process and data extraction

	Population	Inclusion in the current study	Exclusion from the current study
Journals	51	15	36
Book chapters	6	1	5
Theses and dissertations	4	1	3
Total	**61**	**17**	**44**

Source: Researcher's own conceptualisation

Table 2 and Figure 2 were provided to clarify the steps taken to arrive at the final reviewed publications.

Data synthesis

The results were analysed qualitatively, and a synthesis method was applied. The transformative effect of the digital age at South African institutions of higher learning was discovered, coded, and categorised using a content analysis method. The researcher conceptualised and categorised the data and later evaluated their theoretical applicability. Discrepancies in the categories' definition, formulation, and integration were settled through additional examination of the relevant articles. In the end, 11 recurring themes (challenges and opportunities) were found:

Challenges

- Resistance to change
- Marginalisation of certain socioeconomic groups
- Poor infrastructure
- Lack of funding
- Inadequate Fourth Industrial Revolution (4IR) tools in teaching and learning
- Lack of 4IR skills training and development

Opportunities

- Increased number of student enrolment
- Massive Open Online Courses
- Use of technology to end social exclusion
- Research and development
- Curriculum redesign

REVIEW OF THE LITERATURE

A final 17 studies conducted in South Africa were included for review, providing a comprehensive view of the transformative effect of the digital age at South African institutions of higher learning. Therefore, Table 3 lists the 17 scholarly publications published in various databases used for a systematic review of the study.

Table 3: List of the scholarly publications used in the review

Author(s)	Year	Title of Publication	Journal of Publication
Adeyemo	2023	"The status of digital innovation and data security in South African higher education"	South African Journal of Higher Education
Chomunorwa, Mashonganyika and Marevesa	2023	"Digital transformation and post-Covid-19 education in South Africa: A review of literature"	South African Computer Journal
Lubinga, Maramura and Masiya	2023	"Adoption of Fourth Industrial Revolution: Challenges in South African higher education institutions"	Journal of Culture and Values in Education
Kanyane	2023	"DigitalWork – Transforming the higher education landscape in South Africa"	New Digital Work
Jakoet-Salie and Ramalobe	2023	"The digitalization of learning and teaching practices in higher education institutions during the Covid-19 pandemic"	Teaching Public Administration
Nwosu, Bereng, Segotso and Enebe	2023	"Fourth Industrial Revolution tools to enhance the growth and development of teaching and learning in higher education institutions: A systematic literature review in South Africa"	Research in Social Sciences and Technology
Adu, Badaru, Duku and Adu	2022	"Innovation and technology: A panacea to teaching and learning challenges during the Covid-19 lockdown in South Africa"	Research in Social Sciences and Technology
Kanyemba	2022	"ICT innovation for public higher education administration efficiency in South Africa"	North-West University Repository
Moloi and Salawu	2022	"Institutionalizing technologies in South African universities towards the Fourth Industrial Revolution"	International Journal of Emerging Technologies in Learning
Mhlanga	2020	"Industry 4.0: The challenges associated with the digital transformation of education in South Africa"	The Impacts of Digital Transformation
Mhlanga and Moloi	2020	"COVID-19 and the digital transformation of education: What are we learning on 4IR in South Africa?"	Education Sciences
Masinde and Roux	2020	"Transforming South Africa's universities of technology: A roadmap through 4IR lenses"	Journal of Construction Project Management and Innovation
Coetzee, Neneh, Stemmet, Lamprecht, Motsitsi and Seerco	2021	"South African universities in a time of increasing disruption"	South African Journal of Economic and Management Sciences
Krishnannair and Krishnannair	2021	"Learning environments in higher education: Their adaptability to the 4th industrial revolution and the 'social transformation' discourse"	South African Journal of Higher Education
Mthethwa and Luthuli	2021	"Pandemic on teaching and learning at tertiary institutions: Opportunities and challenges"	African Journal of Public Affairs
Menon and Castrillón	2019	"Reimagining curricula for the Fourth Industrial Revolution"	The Independent Journal of Teaching and Learning
Kayembe and Nel	2019	"Challenges and opportunities for education in the Fourth Industrial Revolution"	African Journal of Public Affairs

Source: Researcher's own conceptualisation

Table 3 lists significant literature that has addressed the transformative effect of the digital

age at South African institutions of higher learning. It identified various challenges and opportunities, which are discussed in detail below.

Challenges of embracing digital education in South African higher education institutions

Resistance to change

Regardless of the institution's formal teaching and learning tools and the availability of platforms such as Zoom, Microsoft Teams, and Google Classroom, Kanyemba (2022) found that lecturers are not fond of adopting new platforms. Instead, they prefer WhatsApp, which they use in both their personal and professional capacity. However, students will not adopt new platforms if their lecturers do not encourage them to use the platform; consequently, it will not gain student's support and participation. Kanyemba (2022) also found that a positive attitude to change is crucial for academics in order for HEIs to advance in the adoption and usage of technology in teaching and learning.

Marginalisation of certain socioeconomic groups

Kayembe and Nel (2019) identified another obstacle impacting the successful deployment of technology in academic institutions: the marginalisation of certain socioeconomic groups. During the COVID-19 global pandemic, teaching and learning continued as a result of digital technology; however, it has presented further challenges by increasing the digital gap (Chomunorwa, Mashonganyika, and Marevesa 2023). These challenges include educational resource setbacks, especially between educational institutions in urban and rural areas, further causing a divide between the "haves" and the "have-nots". According to Chomunorwa et al. (2023), other issues include a lack of suitable devices, limited or no Internet access, poor to non-existent networks, and teachers' and students' technical skills.

The 4IR is considered "the most significant technological phenomenon of this century;" thus, it should be used to achieve positive change. Additionally, it should become the only platform HEIs explore to transform teaching and learning in South African educational institutions (Krishnannair and Krishnannair 2021). Examples of ways it can be used include knowledge as a primary resource, open innovation, human capital development, and information accessibility. Such pointers can provide students with access to learning materials, thereby empowering previously marginalised individuals.

Poor infrastructure

In a study on technology adoption for the efficiency of HEIs, Kanyemba (2022) identified weak Internet connection and inadequate network as hindering the use of the institution's technology portals and the use of technology in teaching and learning. Mdletshe (2019) observed that access challenges often impede the use of LMS in educational institutions in South Africa, as some students do not have the Internet at home or appropriate gadgets. For many students, the high cost of data coupled with poor infrastructure is enough to put them off technology adoption.

According to Adu et al. (2022), the South African government needs to do considerable work in order to support academics and staff in embracing the "new normal," particularly rural-based HEIs that may not have access to modern technological tools due to issues ranging from infrastructure limitations to financial constraints. Teaching plans in the twenty-first century should also consist of technological approaches such as online learning platforms and blended approaches, to name a few. As evidenced during the COVID-19 pandemic, academics should be trained to use various technological infrastructures to continue teaching, and students must be exposed to the use of technology for learning. Moreover, the Department of Higher Education and Training (DHET) should provide educational institutions with digital resources. HEIs must appoint lecturers with the relevant digital skills and experience for teaching in the twenty-first century.

Lack of funding

Kayembe and Nel (2019) found that funding was a key challenge impacting South African HEIs from successfully adopting the 4IR. Education funding has increased in recent years; however, it is insufficient to cover the expenses of HEIs. As a result, lack of funding has led to reduced research incentives as funds are allocated towards tuition fees. However, HEIs face the daunting task of prioritising funds usage between learning technology, tuition, etc. In support of the above, Adeyemo (2023) puts forward the notion that to achieve the digitalisation goal, educational institutions in South Africa must be allocated equal resources and funds. The unequal distribution of resources could hamper the successful adoption of technological learning tools in academic institutions.

Moloi and Salawu (2022) concur that although HEIs continue to adopt hybrid learning, it is necessary to have a nationwide policy that addresses the special grants to bridge the gap on the digital divide for students.

Inadequate 4IR tools in teaching and learning

A study conducted by Nwosu et al. (2023) posits that HEIs experience obstacles in using the

4IR tools in teaching and learning. Although 4IR tools are advantageous for HEIs, reviewing the curriculum and aligning it to technological advancements is necessary. To successfully transition towards the use of digital technology or the 4IR in teaching and learning, pertinent organisations, such as the DHET, should fund previously disadvantaged institutions of learning in order to improve their infrastructure. Lubinga, Maramura, and Masiya (2023) add that the 4IR adoption is often delayed by the state of infrastructure, which is ageing, and the focus on issues pertaining to teaching and learning. Thus, they recommend that HEIs should critically examine their teaching approaches by increasing opportunities to include the 4IR.

Lack of 4IR skills training and development

One of the key challenges identified in the literature is the lack of or limited 4IR skills to effectively engage in successful teaching and learning. Lubinga et al. (2023) state that organisations must develop skills training development plans to address the technology skills challenges staff face. Practical training is necessary to ensure that technological platforms are integrated into teaching and learning in a staggered approach. Clear training plans must also be developed to assist both lecturers and students alike in using technology to implement the curriculum (Kanyane 2023).

As indicated by Moloi and Salawu's (2022) study participants, general training on 4IR-related technology is among the most urgent initiatives HEIs need to provide students with, as students are preparing for the world of work, which will likely require individuals who are technology adept. Moreover, Kanyemba's (2022) study found that the majority of the students and staff believed that they were not trained on how to use the learning portal. This finding proposes that the lack of training negatively impacted staff and student success and indicates a lack of portal use, further hampering lecturers' and students' performance.

Jakoet-Salie and Ramalobe (2023) are of the view that digital illiteracy hinders technology adoption in HEIs. The challenges of the IT Department at HEIs often stem from these issues as they are required to support staff and students but are often unprepared or incompetent. Other issues include dated IT policies, old and neglected infrastructure, and a lack of experience for those responsible for implementing new technologies.

Embracing digital education opportunities in South African higher education institutions

Increased number of student enrolment

In a study focusing on the obstacles of the digital transformation in teaching and learning in

South African universities, Mhlanga (2020) found that HEIs have physical space constraints; as a result, they are limited to admitting a few students annually. Despite these challenges, the digital revolution presents opportunities for HEIs to increase student admissions. As a critical tool that fosters effective teaching and learning implementation, hybrid learning incorporates both face-to-face teaching and online learning activities supported by the 4IR (Masinde and Roux 2020). Using these tools allows HEIs to enrol more students. For example, many students across the globe successfully incorporated 4IR innovations and tools into their day-to-day learning during COVID-19, and many continue to use these tools post the pandemic.

Massive open online courses

Masinde and Roux (2020) studied how the Central University of Technology (CUT) could use 4IR to implement the institution's priority projects. Under student learning and support, the authors identified opportunities to implement online courses through a hybrid learning model. Advantages of this approach include access to learning for marginalised students, convenience, limits student discrimination, and overcomes obstacles to accessing education due to limited resources, such as infrastructure and staff.

In support of the above, Mthethwa and Luthuli's (2021) study posits that online learning respects no borders and cuts across geographical locations. It allows the students to decide when to engage in their lectures. This can happen any time, anywhere, if the student feels like learning. It also empowers students to manage their time and determine their own learning pace. This is also beneficial for employed students and slow students who can engage with the course content in their own time by accessing lecture recordings or scheduling their studies accordingly.

Online collaborative learning

In their study on digitalising curriculum practices in HEIs during COVID-19, Jakoet-Salie and Ramalobe (2023) suggested that the move to e-learning presented numerous opportunities. Thus, researchers predict that online learning will create an extensive educational network. According to Jakoet-Salie and Ramalobe (2023), online collaborative learning encourages students to work together to share ideas and views and establish a common understanding of concepts, resulting in learning success.

Technology to social exclusion

According to Kayembe and Nel (2019), using technology in HEIs can address inequality issues. This suggests that technological innovations can lessen the divide between the

privileged and the disadvantaged and between diverse cultures. In addition, the 4IR enables HEIs to foster partnerships with governmental organisations and private companies. The authors further indicate that South Africa's president, Cyril Ramaphosa, established a 4IR inquiry comprising individuals from various backgrounds and educational institutions, including academics, to collaborate in research and development opportunities aimed at advancing the 4IR. Since its establishment, the inquiry has discussed recommendations for obstacles that are hindering South Africa from fully embracing the 4IR and the opportunities that exist. These discussions have resulted in recommendations for 4IR infrastructure and artificial intelligence, data provision to enable ongoing innovation, and investment in manufacturing, materials, and human capital (South African Government 2020).

Research and development

Masinde and Roux (2020) posit that adopting a blended learning approach will increase research outputs with local and global perspectives. The researchers noted that the CUT has already embarked on 4IR technology-driven research and development. Consequently, the institution has yet again aligned its strategy to technology. However, more efforts are required to include lecturers and students in such efforts.

Kayembe and Nel (2019) also found that private organisations such as the International Business Machines Corporation (IBM) and Microsoft have primarily advocated for the 4IR. These corporations can foster a collaborative approach to research and development opportunities. Additionally, South African institutions of higher learning can collaborate with academic institutions globally through partnership agreements, research collaborations, exchange programmes, virtual collaboration tools, and joint degree programmes, to name a few.

Curriculum redesign

Technology has rapidly become more prevalent in teaching and learning; thus, students rely on its tools for everyday learning. To ensure throughput and understanding of relevant content, HEIs often consider new ways to improve student's performance and learning experiences through technology. Kanyemba (2022) argues that redesigning the digital course is one attempt to help HEIs achieve this. Staying abreast of the evolving landscape of HEIs through digital course content is crucial in increasing or maintaining engagement across all student levels and programmes.

In reimagining curricula for the 4IR, Menon and Castrillón (2019) argued that scrutinising the curriculum for all qualifications is critical if South African HEIs are to

implement technological enhancements presented by the 4IR. According to Mhlanga and Moloi (2020), the entire curriculum should be reconsidered to ensure that students understand the role of technology in their lives and for pedagogy. The prompt attention to the rapid technological enhancements is important for such an exercise.

According to Adeyemo's (2023) study on technological innovation in educational institutions in South African HEIs, the digital revolution could become more pronounced in South Africa as the COVID-19 pandemic revealed disparities in educational access. This enhancement is necessary for developing a transformative technology strategy for South Africa that will present opportunities to access higher education regardless of one's socioeconomic group. Research also suggests that curriculum redesign helps to improve student involvement and success (Van Zyl et al. 2020). Examples of how this can be achieved include providing relevance and contextualisation, active learning strategies, and adopting student-centred teaching practices, to name a few.

WEAKNESSES AND STRENGTHS FOR FURTHER STUDIES

The reviewed literature in this study was solely restricted to publications ranging from 2019 to 2023. Including studies from a broader timeframe could provide both historical and modern insights into the transformative effect of the digital age at South African institutions of higher learning, particularly as the changes resulting from COVID-19 saw HEIs and other academic institutions adopt measures to ensure continued teaching and learning remotely. Moreover, the data collection process was noted as a major flaw. It lacked recourse to other forms of primary and secondary data-gathering techniques, data analysis, and interpretation.

It is further suggested that a mixed methods approach be employed for future studies. An approach of this nature would provide a comprehensive understanding of the phenomenon. In addition, it augments the credibility and reliability of the research results by compensating for the weaknesses of each method with the strengths of each other. Sileyew (2019) propounds that researchers are empowered to explore new phenomena utilising qualitative approaches and results employing quantitative approaches, leading to a robust comprehension of the research topic at hand.

Moreover, both qualitative and quantitative data can complement each other, providing a more nuanced understanding of complex phenomena that cannot be fully captured by either method alone (Neuman 2018; Korstjens and Moser 2018). This astuteness could bring forth a more ingenious comprehension of the stumbling blocks and opportunities of the digital revolution in South African HEIs.

This research was conducted in a South African context. The leading practices of what is

in existence at HEIs may become a replica at both national and international levels.

CONCLUSION AND FUTURE DIRECTIONS

This research intended to advance the field of digital education in HEIs by scrutinising the transformative effect of the digital age on South African HEIs. It became evident that besides various rigorous factors, drawbacks and prospects subsist in cuddling digitalised pedagogy at HEIs. Consequently, the South African HEIs' transformation through the digital era proposed, amongst others, the following recommendations:

- The DHET should allocate substantial funding to HEIs for technology to thrive in pedagogy and instruction.

- All HEIs in South Africa should be provided with equal opportunity and infrastructure to guarantee quality education.

- Students and lecturers should be trained to use 4IR technologies that are incumbent in their curriculum.

- Underprivileged students should be supported through an additional channel, such as face-to-face engagements with lecturers, to curb the digital divide.

- Key HEI stakeholders, such as government bodies, should engage in regular and timely communication with HEIs and lecturers regarding the implementation of technological tools to ensure buy-in.

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