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DIGITAL TRANSFORMATION IN HIGHER EDUCATION AND SUSTAINABILITY: LESSONS FOR DISADVANTAGED UNIVERSITIES IN SOUTH AFRICA

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Abstract

The sudden emergence of the COVID-19 pandemic highlighted the urgent need for sectors, including higher education, to adopt technology to ensure the sustainability of teaching and learning practices. This prompted extensive discussions within higher education research about the role of digital education in sustainability. This paper contributes to these debates, examining how technological integration has reshaped higher education institutions, unveiling opportunities and challenges that warrant scholarly attention. Higher education institutions must embrace transformative pedagogy, content, methods, and technology changes to address global sustainability needs. Digital education is pivotal in advancing the 17 Sustainable Development Goals (SDGs). Employing qualitative content analysis, this conceptual paper investigates the digital transformation and sustainability of higher education in disadvantaged South African universities, focusing on six themes: the role of technology in digital learning, the transformation of higher education, the identification and enhancement of digital education resources, strategies for maintaining digital education, and the prospects of these strategies. The paper provides practical implications for implementing digital education in South Africa's disadvantaged higher education institutions, highlighting opportunities and threats that influence digital education policies. It concludes that some threats have been

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converted into opportunities through strategic adoption by these universities, aligning their visions with the UN's SDGs, AU's Agenda 2063, South Africa's National Development Plan 2030, and the imperatives of the 4th and 5th Industrial Revolutions, which emphasise complex problem-solving skills.

Keywords: Digital Education, Transformation, Higher Education, Sustainability, Lifelong Learning

Introduction

Pandemics, natural disasters, and sustainability challenges increasingly threaten the global landscape. The sudden onset of the COVID-19 pandemic underscored the necessity for sectors, including higher education, to adopt technology for sustainable teaching and learning practices. Kativhu (2021) describes the pandemic as a catalyst that accelerated digital learning adoption, particularly in South African rural universities. Digital education plays a crucial role in achieving the 17 Sustainable Development Goals (SDGs) (Trevisan et al., 2023), and higher education institutions are expected to address societal challenges (Kräusche & Pilz, 2017).

To meet global sustainability needs, higher education must adopt transformative pedagogies, content, and technologies that resonate with today's tech-savvy students and unlock their potential in the global south. Digital education prepares a technologically oriented workforce (Gabriel et al., 2022; Trevisan et al., 2023). This paper explores strategies for disadvantaged universities in South Africa to enhance and sustain digital education for sustainable development. Quality education (SDG 4) is a right for all students, enabling them to contribute meaningfully to their economies (Hall et al., 2022).

Upskilling lecturers and students is crucial for transforming educational practices. Amaral et al. (2015) advocate for training university stakeholders in digital education for sustainability. Higher education institutions must lead digital transformation to foster Agenda 2030 by the UN, Agenda 2063 by the AU, and South Africa's National Development Plan 2030 (Vallez et al., 2022; Trevisan et al., 2023).

As technology permeates all aspects of life, universities should align their content, methodologies, and infrastructure with sustainable development goals (Fuchs et al., 2020; Kapitulinová et al., 2018). Education for sustainable development should promote knowledge, skills, and values that support the SDGs (Giddings, Hopwood, &

O'Brien, 2002). Digital education is a powerful tool for achieving sustainability by enhancing learner engagement and real-life applicability. Collaboration between academics and technologists can drive innovation and improve educational outcomes (Giddings et al., 2020).

Background

Globally, institutions operate in an increasingly interconnected digital landscape where stakeholders expect seamless, personalized services (Balyer & Öz, 2018; Limani et al., 2019). The production of information and knowledge acquisition are crucial, as organizational and national success relies on their practical application (Marks et al., 2020). Digital transformation, which profoundly impacts an organization's core components, is often driven by the need to keep pace with market changes and technological disruptions rather than by choice due to costs and risks (Thompson, 2013).

While often used interchangeably, digitization, digitalization, and digital transformation are distinct. Digitization converts analog objects into digital forms, whereas digitalization improves processes through digitized data and automation (Mahlow & Hediger, 2019). Digital transformation, however, strategically alters organisational processes and builds new competencies through digital technologies (Marks et al., 2016), aiming to enhance operational performance and align IT with organisational processes (Norton et al., 2020). It drives competitive advantage, workflow efficiency, productivity, and customer satisfaction (Omar, 2020; Limani et al., 2019).

In higher education, digital transformation focuses on managerial strategy (Jackson, 2019), asynchronous collaboration (Hazemi et al., 2012), and communication tools (Bond et al., 2018). The COVID-19 pandemic accelerated this process, prompting significant changes in instruction, competencies, and assessment methods (García-Morales et al., 2021). Despite challenges, digital transformation is essential for achieving SDG 4 (Nosratabadi et al., 2023) by improving education quality, inclusion, and administration (UNESCO, 2023a).

This paper explores digital transformation strategies in disadvantaged South African universities to meet SDG 4 and address the disparities in digital education access (Chisango & Marongwe, 2021). Digital education, while beneficial, must bridge rather than widen the gap between affluent and disadvantaged institutions (Fataar, 2021). Thus, it seeks to provide sustainable digital education solutions in the context of South Africa's inequalities.

South African context

Digital education in higher education institutions is essential for promoting sustainable development. It is crucial to consider the South African context to develop effective strategies. Like many other countries, South Africa faces natural disasters and pandemics that necessitate the adoption of digital education, as seen during the COVID-19 pandemic. However, South Africa's significant inequalities impact its higher education sector (Fataar, 2021; Dube, 2020; Chisango & Marongwe, 2021).

In an opinion piece on "The Future of Tertiary Digital Education in South Africa," Samushonga (2021) cautioned against the uncritical adoption of digital education due to issues such as limited access to necessary hardware, internet, data, and airtime. This perspective suggests that South Africa may struggle to implement digital education effectively for sustainable development. Fataar (2021) and Samushonga (2021) agree that digital education could exacerbate existing educational inequalities without careful planning, further disadvantaging already marginalised communities.

Boughey and Mckenna (2021) emphasise acknowledging and addressing contextual realities. As key drivers of education for sustainable development, universities must develop practical solutions and ensure they have the necessary ICT infrastructure to support digital education (Trevisan et al., 2023). This approach is vital to ensure equitable access to quality education and to meet sustainable development goals.

Purpose of the Paper

The 4th and 5th industrial revolutions have transformed all aspects of life, including higher education. The COVID-19 pandemic highlighted the critical role of digital technologies, prompting sectors, notably higher education, to embrace technology. Kativhu (2021) and Trevisan et al. (2023) agree that the pandemic accelerated the adoption of digital education to maintain academic continuity. In the face of global sustainability challenges, higher education institutions, as creators and innovators of knowledge, must leverage digital technologies to equip their graduates with essential technological skills. This paper advocates for adopting digital education to promote sustainability in teaching and learning, particularly in disadvantaged South African universities.

Theoretical Framework

This paper employs the Technology Acceptance Model (TAM) to understand and predict user acceptance and adoption of technology (Davis, 1987; Taherdoost, 2018; Malatji et al., 2020). TAM suggests

that an individual's intention to use technology is influenced by perceived usefulness and ease of use. Perceived usefulness is the belief that technology will enhance job performance, while perceived ease of use refers to the assumption that the technology is user-friendly and accessible of complexity (Davis, 1987; Taherdoost, 2018; Malatji et al., 2020).

Applying TAM to disadvantaged universities in South Africa, successful digital transformation depends on stakeholders perceiving the technology as both useful and easy to use (Hewavitharana et al., 2021; Nazir & Khan, 2022; Henao-Ramírez & Lopez-Zapata, 2022). For instance, faculty may adopt digital learning platforms if they enhance student engagement (perceived usefulness) and are intuitive (perceived ease of use). TAM also highlights the impact of external factors, such as social influence and facilitating conditions, on technology adoption (Hewavitharana et al., 2021; Nazir & Khan, 2022; Henao-Ramírez & Lopez-Zapata, 2022). In South African disadvantaged universities, institutional support, access to resources, and cultural norms can shape stakeholders' attitudes towards digital technologies.

By applying TAM principles, these universities can better understand the factors influencing technology acceptance and adoption (Davis, 1987; Taherdoost, 2018; Malatji et al., 2020). Addressing concerns related to perceived usefulness, ease of use, and external influences can help these institutions leverage digital transformation to enhance sustainability, improve educational outcomes, and fulfill their mission of providing quality higher education to underserved communities.

Typological Design Methodology

The paper employs a typological design methodology, which categorises or classifies phenomena into distinct types based on shared characteristics, features, or attributes (Doty & Glick, 1994; Bailey, 1994; Jaakkola, 2020; Reed et al., 2021). This approach aims to create a systematic framework for understanding complex phenomena by identifying patterns, relationships, and variations within a given domain (Jaakkola, 2020; Reed et al., 2021; Hong et al., 2017). It often involves combining qualitative and quantitative methods, such as thematic, cluster, or factor analysis, to develop typologies. By organising data into typologies, researchers can gain insights into the diversity, structure, and dynamics of the phenomenon under study, facilitating comparison, interpretation, and theory-building (Hong et al., 2017; Sandberg & Alvesson, 2021). This methodology enhances the research findings' clarity, rigor, and depth (Jaakkola, 2020; Sandberg & Alvesson, 2021).

The typological design is appropriate for this conceptual paper on "Digital Transformation in Higher Education and Sustainability: Lessons for Disadvantaged Universities in South Africa." It provides a structured framework for categorising and analysing the complex phenomena of digital transformation and sustainability issues in higher education. This approach allows for systematically classifying different dimensions, types, or characteristics of digital transformation initiatives and sustainability practices within disadvantaged South African universities. By organising diverse factors and variables into distinct typologies, the methodology facilitates a deeper understanding of the interrelationships and patterns that influence the adoption, implementation, and impact of digital transformation in these institutions. Additionally, it enables the comparison of digital transformation strategies and sustainability practices, identifying commonalities, variations, and best practices that can inform future research, policy, and training. The structured nature of the typological approach enhances the rigor, clarity, and depth of the analysis, providing valuable insights into the complex relationship between digital transformation, sustainability, and higher education in the context of disadvantaged universities in South Africa. The themes discussed in the paper were identified, categorised, and analysed using this typological design.

Themes

The place of technologies in digital learning, digital transformation in higher education, identification of digital education resources, enhancement of digital education, strategies to maintain the use of digital education, and prospects for strategies in digital education.

The Place of Technologies in Digital Learning

The emergence of internet-based technologies has transformed the academic environment, significantly aiding colleges and universities in their digital transition (Akour & Alenezi, 2022). This shift has notably improved communication between students and lecturers in higher education (Sayaf et al., 2021). In 2023 and beyond, integrating these technologies is essential, not optional, for optimising hybrid learning environments and preparing for the future of education (Fourtane, 2022). While traditionally confined to classrooms, these technologies enable learning to occur anytime and anywhere, urging educators and students to embrace digital change in modern culture (Li et al., 2022).

The COVID-19 pandemic accelerated technology adoption in higher education, prompting institutions to develop long-term strategies for digital transformation (Fourtane, 2022). This shift has created a

paradigm where higher education institutions are crucial stakeholders in advancing technology to meet the demands of a rapidly changing world (Santos et al., 2019). Both lecturers and students benefit from digital technologies: students become information and communication technology-literate, acquiring 21st-century skills (Haji et al., 2017), and lecturers improve their teaching methodologies and accessibility (Akour & Alenezi, 2022).

However, the necessity for increased access to digital technologies for communication between students and lecturers remains a challenge (Batista et al., 2021). Higher education institutions, alongside corporate organisations, must create and implement technological infrastructures that provide the right channels for learning (Akour & Alenezi, 2022). These technologies should support teaching and learning objectives, fostering interaction between students and teachers (Comi et al., 2017).

Empirical evidence underscores the importance of technology in digital learning. Studies have shown that social media enhances student engagement, peer contact, and student-teacher interaction (Alkhatlan & Al-Daraiseh, 2017; Shafiq & Parveen, 2023). During COVID-19, 59% of lecturers found online technologies as effective as in-person courses for measuring student learning (Orozco et al., 2023). Social media platforms such as WhatsApp, Facebook, and YouTube helped maintain connections and continue education during crises (Mbodila et al., 2020; Orozco & Giraldo-García, 2020; Bartosik-Purgat et al., 2017).

The critical role of technology in digital learning is evident. An assessment of digital learning in post-secondary education in Canada highlighted the expected increase in online and hybrid course offerings post-pandemic (Johnson & Seaman, 2020). The pandemic revealed educational institutions' inadequacies, emphasising the need for technology and human resources to transform education models and build inclusive, resilient learning systems (UNESCO, 2023b). To remain relevant, higher education institutions must reinvent their learning environments through digital transformation, enhancing student-teacher relationships and adapting to crises (Schleicher, 2020).

Digital Transformation in Higher Education

Digital technologies and online resources are now integral to all aspects of teaching and learning, driving innovations in instruction and teacher training and transforming higher education institutions (HEIs) (Limani et al., 2019). Higher education has entered a new era, enabling students to achieve high learning outcomes through

technology-enhanced instruction (European Commission, 2017). The characteristics of the higher education environment, such as the rise in global university rankings, nationwide declarations of top-tier universities, regional controls and structures, international standards for quality assurance, and the internationalisation of HEIs, significantly impact education and research (Alotaibi, 2022; Mystakidis et al., 2014).

Digital transformation in higher education facilitates the tracking of training hindrances and reduces risks within universities (Wang et al., 2023). Effective digital transformation strategies can help students acquire 21st-century skills, enhancing their flexibility, creativity, and adaptability with technology (Oliver & Jorre de St Jorre, 2018).

However, numerous challenges inhibit digital transformation in higher education globally. A study in the United Arab Emirates identified challenges such as a lack of a holistic vision, digital transformation competency, IT skills, IT infrastructure, affordability, and budget constraints (Marks et al., 2020). Other documented challenges include digital literacy deficits, resistance to change, risk aversion, inadequate IT infrastructure, budgetary constraints, lack of leadership for change, insufficient strategic planning, and attitudes toward integrating digital technologies in educational systems (Gkrimpizi et al., 2023).

The main objective of digital transformation strategies is to harness modern technologies' potential quickly and innovatively (Bones, 2016). Robust and adequate planning involving stakeholders and experts within and outside organizations is essential for effective digital transformation (Bounfour, 2016). This comprehensive approach impacts the planning and implementation of a sustainable digital era, ensuring the optimal choice and enhancement of educational resources.

Identification of digital education resources

As creators and innovators of new knowledge, universities must prioritise the use of digital technologies, particularly in rural areas, to ensure continuity during crises and maintain parity with students from prestigious institutions. The COVID-19 pandemic compelled all higher education institutions to deploy resources for remote online learning, exposing significant weaknesses in infrastructure and lecturer competencies (Nandy et al., 2020; Marshall & Wolanskyj-Spinner, 2020). Additionally, students often lack the necessary skills and confidence for online learning (Johnson & Lock, 2018). Despite these challenges, most institutions continued their educational programs by deploying various digital resources.

Post-pandemic higher education institutions globally are adopting policies to facilitate digital transformation, operating fully online, hybrid, or blended learning environments. Research during the crisis demonstrated the effectiveness of diverse digital educational resources in enhancing access and engagement. These studies revealed that students come from diverse backgrounds, including those with disabilities, necessitating carefully selecting digital education resources to meet varied needs (Beyene et al., 2023; Dalton et al., 2019; Orozco et al., 2023).

Examples of practical digital education resources include using social media applications such as Facebook, WhatsApp, and YouTube for student-teacher interaction and pre-recorded lessons to facilitate two-way communication (Orozco et al., 2023). In Bangladesh, students positively perceived mobile learning (Biswas et al., 2020). In Ethiopia, technologies like the Telegram app for blind users and screen readers like JAWS and NVDA were highlighted as essential tools for inclusive education (Beyene et al., 2023).

These studies indicate that diverse technologies can help bridge the digital divide among students, underscoring the importance of selecting appropriate digital education resources for disadvantaged institutions. This careful selection and implementation of digital technologies are crucial for the effective digital transformation of higher education institutions.

Enhancement of the use of digital education

Education is a fundamental human right that should be universally accessible (UNESCO, 2023; UN Agenda 2030, SDG4). Given the current global crises, such as floods, pandemics, and climate change, digital education is essential to ensure every child has access to education (UNESCO, 2023a; Trevisan et al., 2023). During the COVID-19 outbreak, historically disadvantaged universities in South Africa struggled to administer online classes due to inadequate gadgets, ICT infrastructure, skills, data, and connectivity (Songca et al., 2021; Fataar, 2021; Landa et al., 2021; Marongwe & Garidzirai, 2021). UNESCO (2023a) highlights that countries with insufficient ICT infrastructure experienced significant learning interruptions during the pandemic. Many students could not access education, underscoring the necessity of digital education.

To address this issue, Trevisan et al. (2023) and UNESCO (2023a) advocate for adopting and maintaining digital education to transform the education system and ensure sustainable teaching and learning processes. As creators and innovators of new knowledge, universities must continue to offer educational services that promote

inclusivity, resilience, and lifelong learning, as outlined in SDG 4 (UNESCO, 2023a). This goal requires the availability and deployment of appropriate technologies and the development of digital competencies among students and lecturers.

Sustaining digital education involves keeping up with technological advancements, such as those introduced by the fourth industrial revolution, and creating an enabling learning environment with necessary instructional technologies. Modern technologies engage students, making learning more fascinating and interactive (Al Mahdi, 2023). Transforming traditional classrooms into digital learning spaces using projectors, computers, and other technologies enhances the learning experience (Haleem et al., 2022).

Research indicates that various technological tools motivate students to use asynchronous materials, improve pedagogy and practice, and foster a learning culture (Al Mahdi, 2023). According to the Organisation for Economic Co-operation and Development (OECD), the effective use of digital technologies transforms teachers' and students' teaching and learning experiences (Tremblay et al., 2023). Therefore, enhancing digital education requires comprehensive, coherent, and coordinated policy infrastructure to support good practices (Tremblay et al., 2023). Digital education offers benefits such as access to course materials from anywhere and anytime, collaborative learning, and personalised and flexible learning experiences (Singh, 2023). Enhanced digital education can significantly improve educational outcomes compared to traditional technology-aided instruction.

Strategies to maintain the use of digital education (Sustainability in the use of digital education)

Education is pivotal for achieving sustainable development, with SDG 4 emphasising the need for inclusive, equitable quality education and the promotion of Education for Sustainable Development (ESD) (UN, 2015). Higher education institutions (HEIs) have a crucial role in redefining education to meet sustainability goals, alongside their traditional roles of teaching and research (Omar, 2020). However, HEIs face challenges such as meeting diverse needs, providing equitable access to resources, and ensuring fairness and inclusion to make educational practices more sustainable (Klugman, 2011).

Sustainability in digital education initiatives remains challenging across various contexts (Gunn, 2010). While no universal solution exists, successful strategies from different contexts can be considered. Online learning, particularly, can enhance educational access for working students in developing countries (Azeiteiro et al.,

2015; Leal Filho et al., 2023). Technology-assisted education has simplified access to resources and can support the achievement of SDGs and lifelong learning in ESD (Azeiteiro et al., 2015; Portuguez et al., 2020). However, digital inequality poses a barrier, necessitating approaches that promote more sustainable digital learning (Letseka et al., 2018).

To achieve sustainability in digital transformation, HEIs must circulate digital technologies, strengthen collaborations with external stakeholders, and accommodate diverse stakeholder perspectives tailored to specific contexts (Leal Filho et al., 2023; Gunn, 2010). For instance, a study at a rural university highlighted the need for collaboration between rural-based universities and public and private stakeholders to sustain digital learning. Such collaborations ensure the provision of necessary infrastructure, training for staff and students, and regular monitoring and review of digital education models (Makgahlela et al., 2021).

Conclusion

The paper concludes that all institutions of higher learning should embrace digital transformation since it is no longer an option. Digital education's sustainability is achieved when digital technologies are distributed and circulated, and collaboration with different stakeholders is strengthened and facilitated. This will work towards the reduction of inequalities experienced in South Africa in terms of the digital divide.

Implications and Future Research

The study's findings have significant implications for policy, practice, and future research to enhance digital inclusion, equity, and sustainability in higher education. Policymakers can use these insights to inform national and institutional changes needed to support digital transformation in disadvantaged universities. Key policy recommendations include improving funding allocations, enacting regulatory reforms, and developing capacity-building programs for faculty and staff to enhance digital infrastructure and capabilities. Policies should also focus on ensuring equitable access to digital resources, addressing digital literacy gaps, and promoting inclusive teaching practices catering to diverse student needs.

The findings emphasise the potential of digital transformation to improve equity and inclusion, particularly for marginalised communities and underserved populations. They can guide strategic planning and the development of tailored digital transformation strategies within disadvantaged universities, prioritising investments

in digital infrastructure, faculty development, and student support services to ensure the successful implementation of digital initiatives. In practice, the study suggests that leveraging digital technologies can enhance student engagement, retention, and success by creating more interactive, personalised, and accessible learning experiences. This involves using online learning platforms, digital assessment tools, and support services. Furthermore, professional development opportunities, training programs, and incentives should be provided to encourage faculty and students to adopt digital pedagogies.

Policy implications also include exploring how digital transformation can enhance the sustainability and resilience of disadvantaged universities against external challenges such as resource constraints, political instability, and environmental threats. Recommendations include using digital technologies to optimise resource allocation, streamline administrative processes, and foster collaboration and innovation.

While the paper contributes to the literature on digital transformation and sustainability in higher education, particularly for disadvantaged universities in South Africa, it acknowledges limitations due to the use of secondary data. Future research should employ different methodologies and consider advantaged universities to build on these findings.

Lessons for Disadvantaged Universities

Digital transformation is no longer a process undertaken by wealthy or well-positioned institutions of higher learning but a necessary approach to sustainable development in education for every university considering the experience of COVID-19, disadvantaged inclusive.

Enhancement of the use of digital education must consider the provision of ICT infrastructure that keeps pace with modern trends. Besides, regular training for teaching staff and students must be enshrined in whatever digital transformation policy is in operation at every institution of higher learning.

The sustainability of digital learning, especially in disadvantaged higher education institutions, is a product of the collaborative effort involving all concerned stakeholders in the planning and implementation of the digital transformation process. This includes the university (the management, support staff, lecturers, and students), the government, and the private sector (internet and non-internet providers).

The identification, selection, and adoption of digital education resources must be based on the availability and accessibility and the class of users (able and disabled). This is to ensure the reduction and possible elimination of the existence of the digital divide that has impeded online learning.

Resources

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