6

Digital Revolution in Higher Education in the Covid-19 and Post Covid-19 Era

Reuben Dlamini

Introduction

The economic value of higher education is extremely important as the context and curriculum relevance of programme offerings have the potential to impact economic activities. Hence, the declaration of the COVID-19 pandemic by the World Health Organisation resulting in University closures can widen the access gap to higher education. There is evidence that the participation of students in higher education from lower socioeconomic groups has been increasing (Moore et al., 2013). However, the sudden closure of universities in 2020 and the shift to remote teaching and online learning presented a huge challenge to the effort to sustain the education processes and curriculum coverage. Several studies indicate that digital education (online teaching and learning) became an alternative during the pandemic period in an

R. Dlamini (✉)
Wits School of Education, Johannesburg, South Africa
e-mail: Reuben.Dlamini@wits.ac.za

F. Maringe and O. Chiramba (eds.), *Online Teaching and Learning in the COVID-19 Era*, https://doi.org/10.1007/978-3-031-42402-1_6

effort to complete the academic year and the curriculum (Altunçekiç, 2021; Dlamini & Ndzinisa, 2020; Hodges et al., 2020; Khoza & Mpungose, 2020; Starkey et al., 2021). However, the shift to emergency remote teaching (ERT) and online learning has proven to be a challenge, especially in an unequal society like the Republic of South Africa and Africa at large.

While considering the importance of curriculum coverage and completing the academic year, the inequalities that exist in higher education, especially the socioeconomic inequalities, were made visible. Coincidentally, the reality was that "lecturers have not been adequately prepared to provide ERT and this has serious implications for systemic inequalities and epistemic injustice" (Dlamini & Ndzinisa, 2020, p. 62). Pre-pandemic, academic staff were already battling with the decolonisation of the curriculum and the pedagogical integration of information and communication technology (ICT) in their classrooms. Clearly, the curriculum already had structural defects due to the legacy of colonialism that was premised on the exclusion of the majority from participating in the economy (Chatterjee et al., 2020; Gethin, 2020). Hence, Dlamini and Ndzinisa (2020) raised the importance of understanding the tension between technology, context, and pedagogy while exploring innovative approaches and inclusive pedagogies to ensure that universities are keeping up with the contemporary needs of teaching and learning. This is to avoid a situation where "the technological tail wag the pedagogical dog" (Moll, 2012, p. 17). Thus, beyond the transition lies rethinking and reimagining our pedagogical practices that underpin the digital revolution in higher education.

Factors such as quality digital educational resources and digital equity have serious repercussions in the transition to avoid student exclusion or students being locked out. There is a need for institutions of higher learning to consider digital strategies and architectures to help them recover from the pandemic and embrace new drivers and enablers that will contribute to a systematic move to remote teaching and online learning. Given the shift to digital learning platforms, there is an urgent need to pay attention to students' learning and remote teaching. Resta and Laferrière (2008) identified the following five components of digital equity: hardware, software, internet connectivity, high-quality digital

content, and digital fluency. It is worth noting that the complex nature of ERT and the online transition has been recognised in a number of studies (Affouneh et al., 2021; Dlamini & Ndzinisa, 2020; Khlaif & Salha, 2020; Khlaif et al., 2021). This signifies the importance of a seamless transition to mitigate the risk of widening participation in tertiary education. However, the rising inequalities in a stagnant economy have serious implications for the widening of participation in higher education, and in turn, have serious implications for the economic and social development of any country (Butcher & Clarke, 2021). Hence, the quality of teaching and learning as well as the learning conditions must be inclusive and accessible.

As a researcher and lecturer in a higher education institution, I experienced the transition to ERT as suddenly with no consideration of the complexities of ERT and online learning. In essence, academic staff were forced to change their instructional and pedagogical activities and students were compelled to learn online in a country and a continent (Africa) with extreme inequalities. In terms of course design, content presentation, and assessment activities, ERT and online learning are different from traditional face-to-face learning. Hence, the aim of the study is to understand the digital revolution in higher education during the pandemic period and to place South Africa at the centre to explore the challenges of the transition in order to mitigate the risk of students being left behind and to apprehend the future of tertiary education. The study seeks to answer the following questions:

- What are the elements of digital education that enable inclusivity in the context of emerging economies?
- What are the factors affecting the digital revolution in higher education that can ensure inclusivity and continuity in curriculum coverage?
- How are the factors affecting the digital revolution in higher education influencing the implementation of digital education in an emergency situation in an unequal society?

Method

Through a metasynthesis approach a critical perspective on technological determinism shaped the arguments and questions that digital technologies raise in an unequal society due to socioeconomic inequalities. The metasynthesis approach entails a thoughtful examination of the research methodological process to generate and analyse data (Minnaar, 2011). This chapter aimed to continue the discourse on digital revolution in higher education insights from the studies included were used to substantiate the argument on technological determinism, exaggerated techno-optimism and help to answer the questions on digital technologies in an unequal society.

Literature searches were conducted in the Google Scholar database using forward citation snowball searching (Wohlin, 2014). According to Wohlin (2014) "In forward snowballing, for papers included, look where the paper leading to the new paper is referenced and identify papers referenced in a similar way" (p. 7). In the forward snowballing approach papers being examined were studied using Google Scholar by first studying the titles and then followed by the abstracts. Studying the abstracts provided with more information on the paper then a decision is made to include it and that's when the entire paper is read and those citing the paper are examined and the status of the publishing journal or avenue is verified to ensure that only credible studies are included. In Google Scholar the following was examined via the following criteria:

- Title
- Credibility of the Publishing Venue—checking on the editors standing in the field and also the reviewers especially with conference proceedings.
- Author(s)—their standing in the field.
- Google Scholar Cited by to ensure relevant evidence towards the theme of the chapter

Studies were appraised as suitable for inclusion using the criteria above and forward snowballing showed a higher precision as 241 records were

screened, but 34 studies were included and analysed according to established guidelines for the synthesis of both quantitative and qualitative research. A number of iterations were performed looking at the number of those who cited the work and also the impact factor of the different publications were considered. While the forward snowballing showed a higher precision, but the trick is on the search string. Upon examining each paper based on the above information the reference lists were examined and also where and how the paper is referenced was important. The research questions played an important role as all included papers needed to help answer the three research questions.

Digital Revolution in Higher Education

> We underline the importance of removing barriers to bridging the digital divide, particularly those that hinder the full achievement of the economic, social and cultural development of countries and the welfare of their people, in particular, in developing countries. (World Society on the Information Society, 2005, p. 1, article 10)

In order to fully implement digital solutions, there must be a consideration of the "complex factors, resources, and interventions required for supporting social inclusion" (Resta & Laferrière, 2008, p. 765). As pointed out earlier, quality digital educational resources and digital equity are core to the digital revolution in higher education. The idea of digital education is to offer advanced digital learning platforms that enable distributed cognition; however, it is important to understand the elements of digital education that enable inclusivity in the context of emerging economies. Therefore, the question is asked, what are the elements of digital education that enable inclusivity in the context of emerging economies? Institutions of higher education were already investing in digital learning platforms in an effort to accommodate large classrooms because digital education has been a long-term strategy to enable ubiquitous education.

COVID-19 coincided with the massification of higher education and the long-term strategy, which already created a dilemma, especially for academic staff who had to deal with large classrooms and the constant changing social structures affecting instructional activities. When juxtaposing the challenges academic staff had to deal with in creating an inclusive classroom in traditional face-to-face teaching with the challenges in ERT, the demands for new pedagogical approaches are visible. However, in the former it was business as usual while the latter demanded immediate creativity on how to present content and continue teaching to ensure that the academic year was not lost. There are many variations in the level of access or digital equity for social inclusion that has serious consequences for ensuring that all students are connected to learning resources while lecturers have well-developed digital fluency. With the well-rehearsed Western-centric higher education divorced from the contextual realities of developing economies, the pandemic period made visible some of the structural and curriculum gaps.

From a digital education researcher's point of view, digital education has the potential to inform the creation of more inclusive curricula that acknowledge the backgrounds of students in an unequal society. However, there must be basic digital infrastructure, and connectivity issues and digital fluency issues must be addressed to realise the benefits of digital education. According to Hughes, Michener, Mohamed and McDuff (2019), "inclusive curriculum, encompassing diverse perspectives and strategies, is more rounded, relevant and meaningful" (p. 3). This work is not in anyway subscribing to what Díaz Pabón et al. (2021) called "playing the familiar academic game of moaning about gaps and lacunae, as if we are not getting our fair share of pudding at the dinner table" (p. 107). This is about challenging the adoption of a Western-centric approach to digital education as a template for the implementation in higher education, especially during the COVID-19 and post-COVID-19 era.

While the South African case may not represent or be a true reflection of the African continent, South Africa's levels of inequality are documented as the highest of all countries that have data on inequality (Bhorat et al., 2017; Chatterjee et al., 2020; Gethin, 2020; Statistics South Africa, 2019). During the pandemic period, the transition to

digital education was highly skewed across the 26 South African universities because of limited digital resources and the ever-present funding pressures. Dlamini and Dewa (2021) made visible the uneven distribution of digital practices and literacies that exist despite technology being considered "the hallmark of civilization" (Brock et al., 2010, p. 1041). Previously disadvantaged or historical black universities suffered the most because of inequitable government funding and distribution of digital resources. In order to maintain instruction during the COVID-19 pandemic, moving to digital platforms could enable ubiquitous teaching and learning in networked environments. However, the speed with which the transition had to happen was unprecedented, creating a less-than-ideal situation for under-resourced universities. While connectivism has recently been acknowledged as the new learning theory for a digital age, in South Africa and Africa at large we have a unique context that requires specific and not generalised attention. Therefore, research on digital education enabled through educational technology,

> needs to be pursued more vigorously along social scientific lines, with researchers and writers showing a keener interest in the social, political, economic, cultural and historical contexts within which educational technology use (and non-use) is located. (Selwyn, 2010, p. 66)

Any "technological determinism" approach is flawed because we cannot have a situation where "the technological tail wag the pedagogical dog"(Moll, 2012, p. 17). There are structural defects in the current higher education environment because of the legacy of apartheid; thus, a radical adoption of digital education can create cleavage among students, among the haves and the have-nots. In a level playing field, connectivism is ideal for the digital revolution in higher education or education in general as it "reflects the many shifts in contemporary cultural narrative including increased recognition of systems, complexity, and interrelatedness" (Tschofen & Mackness, 2012, p. 125). This is in an ideal context with complex networks; however, in an under-resourced and unequal society, the complexities and challenges are beyond neural and social networks. In this chapter we engage with the four key principles for

learning emanating from the connectivist thought: "autonomy, connectedness, diversity, and openness" (Tschofen & Mackness, 2012, p. 125). We use this to understand the interplay between digital affordances and digital revolution in higher education. The functionality of sociotechnical configurations do enable the four key principles for learning, but it is dependent on the social fluency of the participants.

Unfortunately, technological adoption and appropriation in society are treated similarly to legislative acts to establish a framework for public order. Lacking foresight in the unpredictability of complex digital technology configurations could have unintended consequences to accessing tertiary education. Embracing digital education is the way to go, but it is complex. Hence, there is a need to look at the various dimensions of online learning (digital education) from a different point of view than that of technology affordances (Hodges et al., 2020; Means et al., 2014). Technology affordances in education are well documented, but there must be well-developed digital educational resources represented in multiple ways that are inclusive, and it should not be like the current conditions where students are treated as a homogeneous group. Mentis (2008) pointed out that there must be "reciprocal interaction between technology and pedagogical practices" (p. 217). Dlamini and Ndzinisa (2020) established that "institutional structures are rigid and not welcoming to new pedagogical practices" (p. 56). To avoid the perception that digital education is weaker than the traditional Western-centric university, any transition (revolution) must be informed by instructional design principles and dedicated services (institutional factors), taking full advantage of the technology affordances aligned with curriculum objectives.

Instructional design principles are well-researched to generate appropriate educational activities for a wide range of diversity (Elias, 2010). In this context, South Africa has been firmly part of the international community; however, the rampaging effect of the pandemic had a negative impact on traditionally underrepresented groups. Hence, adopting teaching strategies that were not contextual with no value to diversity meant widening the participation and inequalities in student experiences. Thus casting doubt on leveraging technology affordances while the students' context is neglected.

The Social Determinants of Inequalities in Higher Education

In the past 10 years, South Africa has embraced the massification of higher education. The vast majority of students are not expected to attend highly endowed universities such as the University of Cape Town, the University of the Witwatersrand or equivalents, but are accommodated in lower-status and less-endowed universities. Importantly, promoting inclusive digital access in schools and local communities has been central to fostering digital knowledge competencies to facilitate social collaboration that is aligned with the socio-constructivist approach on the active construction of knowledge through the use of technology (Mhlongo et al., 2017). Hence the importance of answering the question, what are the factors affecting the digital revolution in higher education that ensure inclusivity and continuity in curriculum coverage? Along with the expansion of digital education, the actualisation of ICT or digital affordances is dependent on all actors' digital knowledge competencies as an enabler in the digital economy.

According to Dlamini and Dewa (2021), the integration of ICT "is associated with an inclusive learning environment and the reduction of educational inequality by enhancing learning opportunities and capital accumulation" (p. #). In lieu of this, the social factors widening inequalities in higher education could be attributed to limited exposure and epistemological access because of social and cultural capital. According to Lin (2008), social capital is "resources embedded in one's social networks, resources that can be accessed or mobilised through ties in the networks" (p. 4); Bourdieu (1983) ascertained that cultural capital can be a source of social inequality. Dlamini and Dewa (2021) through Bourdieu (1986) lens having access to digital skills and competencies indicate cultural capital hence digital fluency is no longer an option in higher education. Many discussions of ICT affordances in education understate the importance of context and overstate the pedagogical affordances. The danger of overstating the affordances can be exaggerated techno-optimism.

The Republic of South Africa invests far more in consultants for the development of well-written education policies than in addressing the socioeconomic structural deficiencies. Policies that are informed by

context and supported by meaningful investments have the potential to reduce education inequalities. Socioeconomic structural deficiencies underlie many education inequalities in Africa, more so in South Africa, and compel lecturers to deal with non-education activities such as poverty instead of focusing on education matters. Shifting attention to non-educational activities affects curriculum coverage and financial resources. Such social determinants of inequalities in higher education between and within countries are avoidable. Hence, strengthening the existing lower-status and less-endowed universities could reduce tertiary education disparities.

Digital education solutions are not enough; however, establishing equitable tertiary education and narrowing education access could reduce the gap to economic participation. Students' attainment is clearly multi-dimensional and complex, but there is evidence that education disparities are striking between the rich (advantaged group) and the poor (marginalised group). Relying on a student-deficit model is flawed, and the argument that students from particular backgrounds do not have the appropriate facility to do well in higher education has no merit. This chapter argues that to ensure equality of opportunity for all students in higher education all countries, especially developing economies, must place higher education equity as a shared priority to which the public and private sector of society must contribute in order to build sustainable education equity. Inclusive curricula and increased investments towards action on social determinants of higher education access are also a must to close the gap on the increasing inequalities within and between countries in higher education institutions.

The Intersection of Digital Technology & Digital Education

Digital technology complements the existing administrative and academic infrastructure of education systems and applications. However, what constitutes a digital evolution is not merely rolling out digital technologies to enable ubiquitous education. Hence, the question is,

how are the factors affecting the digital revolution in higher education influencing the implementation of digital education in an emergency situation in an unequal society? Given that the physical "brick and mortar" classroom has lost its monopoly in education, there are many purported digital affordances that need to align with education. Distributed cognition is intimately connected to digital education; hence the importance of understanding the elements of digital education and digital affordances that enable inclusivity in the classroom. Despite the fact that digital technologies have been widely accepted in higher education, as evidenced by the proliferation of digital strategies (Dlamini & Ndzinisa, 2020; Khoza & Mpungose, 2020; Mhlongo et al., 2017), there is a dearth of knowledge on human computer interaction in education, especially in developing economies, to inform professional education practices.

The potential benefits of digital technologies in higher education are enormous, as detailed by a number of studies (Abad-Segura et al., 2020; Dlamini, 2021; Drennan & Moll, 2018; Flavin & Quintero, 2018; Salas-Rueda, 2020). However, the "provisioning of ICT infrastructure must not be construed as automatically affording learners attainment because there is intrinsically nothing in the provisioning of ICT tools that automatically guarantees cognitive development" (Dlamini & Nkambule, 2019, p. 922). To know about technology is not enough, and in my view, understanding the interplay between the technical and pedagogical dimension make it clear that this is not a linear process. Hence the pedagogical integration of ICT in education is multidimensional and complex as it brings together different knowledges. As a result, education practitioners need to develop their digital fluency and technological pedagogical knowledge to realise a seamless transition.

Of particular interest in the higher education context is the development of inclusive educational architecture focusing on leveraging various technologies in the transition to the Fourth Industrial Revolution. Our claim on the Fourth Industrial Revolution 4IR is premised on digital innovations that exacerbated the new game-changing technologies transforming our professional and personal practices. The pillars of digital education are curricular digitalisation and institutional digitalisation. However, in order to realise inclusive digital education, there

is a need for digitally fluent human talent that is supported by robust digital transformation teams to enable both academic staff and students to navigate academic obsolescence. The focus on the multidimensional interaction of both academic staff and technological innovations must be well supported in order to develop a richer teaching and learning environment.

When one considers the complexity of digital technology integration in the classroom, there must be research to develop good practices to inform instructional delivery that enables richer engagement with content and interaction among learners and the lecturers. In recognising the digital technologies' affordances, there is evidence that learning in a multiplicity of settings can be achieved in higher education (Kearney et al., 2012). This will replace students sitting in classes listening to lectures, memorising pre-packaged assignments, and regurgitating information. However, in the context of South Africa and Africa, breaking the traditional schemes demands sizeable investments in private–public partnerships. Central to the digital revolution in higher education is learning management systems (digital learning platforms). Although learning management systems support ubiquitous education and distributed cognition, digital infrastructure and digital skills are essential and core to the revolution.

The focus needs to shift to complex instructional systems supporting integrated face-to-face and online learning where lecturers and students co-create subject knowledge. The complex instructional systems, such as learning management systems, enable lecturers to track students' performance and provide automated predictions of future progress via dashboards (Sarikaya et al., 2018; Williamson, 2016). Incorporating dashboards to exploit datasets to support decision-making processes and facilitate understanding is as important as digital learning platforms. Dashboards are used to visualise and manage data to generate knowledge to support data-driven decision making (Sarikaya et al., 2018; Vázquez et al., 2019). There is evidence in the literature that dashboards offer impactful directions for future education and research as they are the primary interface to big data (Sarikaya et al., 2018; Vázquez et al., 2019; Wexler et al., 2017). In addition to supporting data-driven decision making, dashboards provide insights into how students engage with the

learning materials and allow students to view their progress at glance (Roberts et al., 2017).

This has implications for self-regulated learning and academic achievement because in the process it increases self-reflection and self-awareness, allowing students to make adjustments to their learning approach (Roberts et al., 2017; Sarikaya et al., 2018; Vázquez et al., 2019; Wexler et al., 2017). Upon engaging with their dashboards, lecturers can reflect on their pedagogical approach, which could lead to behavioural changes in their teaching practices. Evidently, the intersection of learning management systems and dashboards leads to smart education as students' interaction with content and their progress can be accessed in real time. The interplay between the two technologies has a huge role in learning in real-time and providing timely feedback, and it gives lecturers the opportunity to study students' patterns in the class regarding their performance in different topics in a subject. This can be done without the laborious quantification used in current traditional education settings.

Discussion and Conclusion

Socioeconomic disparities are central to the inequalities in the social distribution of education in South Africa and Africa at large. The concept of social determinants should occupy a pivotal place in the new reconfiguration and the rethinking of universities given students' social and economic circumstances. Hence the importance of understanding the factors affecting the digital revolution in higher education to ensure inclusivity. As we know, these social factors undermine access to quality higher education and could widen the gap to access tertiary education. The class disparities in emerging economies across the globe must be eradicated through new policies and an equity dimension in the reconfiguration of the higher education space to reduce inequality in educational attainment.

There must be a broader commitment from governments to promote education equity and make financial resources available to all

students, especially those from disadvantaged communities and poverty-stricken families. At the national level, governments could follow the determinants-oriented as identified in the previous sections to secure greater education equity, especially in institutions of higher education. There is evidence in the literature that the fundamental determinants of education inequality are the social and economic circumstances. These determinants have a significant impact on students' success in higher education, and in the long run, those students get socially and economically excluded.

The long-term effects of such exclusion are detrimental to the future prospects of those students to participate in economic activities related to income and working conditions. This also affects the social fabric of their communities; hence access to higher education is not optional. This validates the importance of social and cultural capital in the networked society. The social fabric of communities is a key component to addressing social determinants of tertiary education, especially epistemological access. Digital education has the potential to enhance learning opportunities and capital accumulation, but digital infrastructure and resources must be well-established and be systematically supported. The proliferation of digital technologies alone has not in any way resulted in reduced social gradients in higher education (the greater the degree of socioeconomic inequalities, the steeper the gradient of education inequality). Yet, students participating in higher education institutions expand their social networks, thereby stimulating professional and personal development. Thus the issue of digital affordances must be supported through policies and investments to avoid exaggerated techno-optimism.

References

Abad-Segura, E., González-Zamar, M. D., Rosa, A. L. D. L., & Cevallos, M. B. M. (2020). Sustainability of educational technologies: An approach to augmented reality research. *Sustainability, 12*(10), 4091.

Affouneh, S., Salha, S., & Khlaif, Z. (2021). The bright and dark sides of online learning in Palestine during the pandemic. In B. H. Khan, S. Affouneh, S. H. Salha, & Z. N. Khlaif (Eds.), *Challenges and opportunities for the global implementation of e-learning frameworks* (pp. 24–34). IGI Global.

Altunçekiç, A. (2021). University instructors' views on distance medical education activities. In A. Bozkurt (Ed.), *Handbook of research on emerging pedagogies for the future of education: Trauma-informed, care, and pandemic pedagogy* (pp. 284–300). IGI Global.

Bhorat, H., Naidoo, K., Odusola, A., Cornia, G. A., & Conceição, P. (2017). *Income inequality trends in sub-Saharan Africa: Divergence, determinants, and consequences*. UNDP Regional Bureau for Africa.

Bourdieu, P. (1983). Erving Goffman, discoverer of the infinitely small. *Theory, Culture & Society, 2*(1), 112–113.

Bourdieu, P. (1986). The forms of capital. In J. G. Richardson (Ed.), *Handbook of theory and research for the sociology of education*. Greenwood Press.

Brock, A., Kvasny, L., & Hales, K. (2010). Cultural appropriations of technical capital: Black women, weblogs, and the digital divide. *Information, Communication & Society, 13*(7), 1040–1059.

Butcher, J., & Clarke, A. (2021, March). Widening HE participation in the arts: Impacts of an access module on learner preparedness. *Arts and Humanities in Higher Education*, 14740222211004884.

Chatterjee, A., Czajka, L., & Gethin, A. (2020). Estimating the distribution of household wealth in South Africa. United Nations University World Institute for Development Economics Research.

Díaz Pabón, F. A., Leibbrandt, M., Ranchhod, V., & Savage, M. (2021). Piketty comes to South Africa. *The British Journal of Sociology, 72*(1), 106–124.

Dlamini, R. (2021). Factors constraining ICT integration in schools: The case of Gauteng province. *The Independent Journal of Teaching and Learning, 17*(2), 28–43.

Dlamini, R., & Dewa, A. (2021). Beyond optimistic rhetoric: Social and cultural capital as focal deterrents to ICT integration in schools. *International Journal of Education and Development using ICT, 17*(3).

Dlamini, R., & Ndzinisa, N. (2020). Universities trailing behind: Unquestioned epistemological foundations constraining the transition to online instructional delivery and learning. *South African Journal of Higher Education, 34*(6), 52–64.

Dlamini, R., & Nkambule, F. (2019). Information and communication technologies' pedagogical affordances in education. *Encyclopedia Education & Information Technologies, 1*, 1–14.

Drennan, G., & Moll, I. (2018). A conceptual understanding of how educational technology coaches help teachers integrate iPad affordances into their teaching. *Electronic Journal of e-Learning, 16*(2), 122–133.

Elias, T. (2010). Universal instructional design principles for Moodle. *The International Review of Research in Open and Distributed Learning, 11*(2), 110–124.

Flavin, M., & Quintero, V. (2018). UK higher education institutions' technology-enhanced learning strategies from the perspective of disruptive innovation. *Research in Learning Technology, 26*.

Gethin, A. (2020). Extreme inequality and the structure of political cleavages in South Africa, 1994–2019. *World Inequality Database*, Working paper no. 2020/13.

Hodges, C., Moore, S., Lockee, B., Trust, T., & Bond, A. (2020). The difference between emergency remote teaching and online learning. *Educause Review, 27*, 1–12.

Hughes, A. L., Michener, C., Mohamed, K., & McDuff, N. (2019). Curriculum co-creation as a transformative strategy to address differential student outcomes: The example of Kingston University's Student Curriculum Consultant Programme. *Compass, 12*(1).

Kearney, M., Schuck, S., Burden, K., & Aubusson, P. (2012). Viewing mobile learning from a pedagogical perspective. *Research in Learning Technology, 20*(1), n1.

Khlaif, Z. N., & Salha, S. (2020). The unanticipated educational challenges of developing countries in Covid-19 crisis: A brief report. *Interdisciplinary Journal of Virtual Learning in Medical Sciences, 11*(2), 130–134.

Khlaif, Z. N., Salha, S., Fareed, S., & Rashed, H. (2021). The hidden shadow of Coronavirus on education in developing countries. *Online Learning, 25*(1), 269–285.

Khoza, S. B., & Mpungose, C. B. (2020). Digitalised curriculum to the rescue of a higher education institution. *African Identities*, 1–21.

Lin, N. (2008). A network theory of social capital. *The Handbook of Social Capital, 50*(1), 69.

Means, B., Bakia, M., & Murphy, R. (2014). *Learning online: What research tells us about whether, when and how*. Routledge.

Mentis, M. (2008). Navigating the e-Learning terrain: Aligning technology, pedagogy and context. *Electronic Journal of e-Learning, 6*(3), 217–226.

Minnaar, A. (2011). Student support in e-learning courses in higher education–insights from a metasynthesis "A pedagogy of panic attacks." *Africa Education Review, 8*(3), 483–503.

Mhlongo, S., Dlamini, R., & Khoza, S. (2017). A conceptual view of ICT in a socio-constructivist classroom. *Proceedings of the 10th Annual Pre-ICIS SIG GlobDev Workshop*, Seoul, South Korea.

Moll, I. (2012). Learning and computing: Theoretical perspectives on the pedagogic integration of ICTs. In K. McCabe, & K. van Wyk (Eds.), *Teaching and e-Learning in the South African classroom*. Macmillan.

Moore, J., Sanders, J., & Higham, L. (2013). Literature review of research into widening participation to higher education. Report to HEFCE and OFFA. AimHigher Research & Consultancy Network.

Roberts, L. D., Howell, J. A., & Seaman, K. (2017). Give me a customisable dashboard: Personalized learning analytics dashboards in higher education. *Technology, Knowledge and Learning, 22*(3), 317–333.

Resta P., & Laferrière, T. (2008). Issues and challenges related to digital equity. In J. Voogt, & G. Knezek (Eds.), *International handbook of information technology in primary and secondary education* (vol. 20). Springer. https://doi.org/10.1007/978-0-387-73315-9_44

Salas-Rueda, R. A. (2020). Design, construction and evaluation of a web application for the teaching-learning process on financial mathematics. *International Journal of Emerging Technologies in Learning (iJET), 15*(8), 100–115.

Sarikaya, A., Correll, M., Bartram, L., Tory, M., & Fisher, D. (2018). What do we talk about when we talk about dashboards? *IEEE Transactions on Visualization and Computer Graphics, 25*(1), 682–692.

Selwyn, N. (2010). Looking beyond learning: Notes towards the critical study of educational technology. *Journal of Computer Assisted Learning, 26*(1), 65–73.

Starkey, L., Shonfeld, M., Prestridge, S., & Cervera, M. G. (2021). Covid-19 and the role of technology and pedagogy on school education during a pandemic. *Technology, Pedagogy and Education, 30*(1), 1–5.

Statistics South Africa. (2019). Inequality trends in South Africa: A multidimensional diagnostic of inequality. Statistics South Africa: Pretoria, Report No. 03–10–19. http://www.statssa.gov.za/publications/Report-03-10-19/Report-03-10-192017.pdf

Tschofen, C., & Mackness, J. (2012). Connectivism and dimensions of individual experience. *International Review of Research in Open and Distributed Learning, 13*(1), 124–143.

Vázquez Ingelmo, A., García Peñalvo, F. J., Therón Sánchez, R., & Conde González, M. Á. (2019). Extending a dashboard meta-model to account for users' characteristics and goals for enhancing personalization. In M. Caeiro-Rodríguez, Á. Hernández-García & P. J. Muñoz-Merino (Eds.), *Proceedings of LASI-SPAIN 2019. Learning Analytics Summer Institute Spain 2019: Learning Analytics in Higher Education (Vigo, Spain, June 27–28, 2019). CEUR Workshop Proceedings Series* (No. 2415, pp. 35–42).

Wexler, S., Shaffer, J., & Cotgreave, A. (2017). *The big book of dashboards: Visualizing your data using real-world business scenarios*. John Wiley & Sons.

Williamson, B. (2016). Digital education governance: Data visualization, predictive analytics, and 'real-time' policy instruments. *Journal of Education Policy, 31*(2), 123–141.

Wohlin, C. (2014, May). Guidelines for snowballing in systematic literature studies and a replication in software engineering. In *Proceedings of the 18th international conference on evaluation and assessment in software engineering* (pp. 1–10).

World Society on the Information Society (WSIS). (2005). Tunis commitment. World summit on the information society, Tunisia 2005. http://www.itu.int/wsis/docs2/tunis/off/7.html