AUTHOR:
Dr Nkhangweleni Patrick Mafenya[1]

AFFILIATION:
[1]University of Venda, South Africa

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Exploring technology as enabler for sustainable teaching and learning during the Covid-19 pandemic at a university in South Africa

Abstract

This paper discusses the use of technology as enabler for sustaining teaching and learning by reviewing various local and international publications. Since the outbreak of the coronavirus (Covid-19) in 2020, the Departments of Basic and Higher Education in South Africa ordered all institutions of learning to shut down and start using online education as a substitute for face-to-face teaching and learning processes. This sudden transition has without doubt caused an incredible amount of harm and disruption in our education system. In view of this, I am interested in exploring how a traditional, face-to-face university used technology effectively as a delivery tool to sustain teaching and learning during the Covid-19 crisis. The review conducted was aimed at answering the research questions: How can continuity of teaching and learning be strengthened during emergency situations such as that posed by the Covid-19 pandemic? Secondly, what were educators' and students' experiences and attitudes towards the use of technology as enabler for sustaining teaching and learning during the Covid-19 pandemic? To answer the research questions, I conducted data searches with the help of librarians and other international primary search source indexes such as ProQuest, EBSCOhost, Educational Resource Information Centre (ERIC), Google Scholar, SAGE and Academic Search Premier. A total of 85 empirical papers were reviewed and analysed so that an aggregated understanding of using technology as enabler could be established. The results of this systematic document review revealed that technology has the potential to provide immediate feedback, improve workloads and access to education, thus making it an agent of sustainability. In addition, the review conducted revealed that Covid-19 reinforced the importance of technology and virtual learning in education.

Keywords: *connectivism, coronavirus (Covid-19), online learning, pandemic, sustainable development*

1. Introduction

The purpose of this study was to provide a deep understanding about the effectiveness of using technology as a pedagogical tool to sustain teaching and learning during the Covid-19 pandemic. Within this broad aim, the study intended to explore educators' and students'

experiences, perceptions and attitudes towards the use of technology as a learning tool, particularly during the Covid-19 pandemic. The outbreak of the Coronavirus (Covid-19) necessitated an abrupt transition from on campus, face-to-face sessions to online learning at higher education institutions (Dhawan, 2020). The advent of the Covid-19 pandemic and the resultant worldwide uptake of remote forms of teaching and learning are heralded as the much-needed catalyst to radically transform the ways in which teaching and learning is understood, designed, enacted, and evaluated. Digital technology played a significant role in enabling teachers to teach students at a distance, using tools that enable both synchronous and asynchronous communication with whole class, groups and individual children or young people, access to learning materials, and interactive and collaborative activities (Starkey *et al.*, 2021). South Africa, like many countries across the world, has faced the Covid-19 pandemic by implementing rapid and firm measures that have helped to limit the spread of the virus (Mahaye, 2020). These measures included imposing curfews across the country and forcing people to stay at home. Schools were closed at short notice in most countries, and thus there was little time for planning, distribution of resources and the preparation of teachers, learners and families for the lockdown to come (Bozkurt & Sharma, 2020).

To ensure the continuity of education for students, face-to-face classes were moved online, and all learning activities were conducted remotely. While access to the internet and computers is high in developed countries, African universities – particularly in the South African context – are still battling because of the intensity of the factors that led to the digital divide (Mpungose, 2020). It is important for universities to ensure continuity during this pandemic and to consider this a unique opportunity to develop new pedagogical approaches based on the instructional design principles of online teaching and learning (Fowler, Hill & Obradovich, 2020). Through this digital transformation, educators were asked to supply students with teaching materials and instruct students directly via remote digital tools. The Covid-19 pandemic forced students to be physically, emotionally, and socially separated from their educators, peers, and institutions (Dhawan, 2020). In developing countries like South Africa, some of the lockdowns and social distancing measures aimed at controlling or stopping the spread of Covid-19 created confusion, anxiety, and fear of disease transmission (Mpungose, 2020). Although the closure of many institutions of higher learning helped to prevent the spread of Covid-19, using online education as a substitute for traditional classes was not easy, because most institutions were not technologically and pedagogically ready for online learning. In addition, students and their lecturers were also not prepared for this sudden transition or migration to online teaching and learning. Furthermore, the Covid-19 pandemic presented opportunities and challenges to all educational institutions, regardless of their nature (Fowler, 2020). Besides the social and economic challenges inherent there, lecturers and students also faced personal challenges such as lack of access to internet connectivity, lack of equipment for online learning, and unreliable power supply (Mahaye, 2020). Whereas face-to-face interactions enable both lecturers and students to determine one another's emotions, online teaching and learning limit this. This study therefore intends to find out if indeed student support using technologies can help students who are geographically, physically and emotionally dispersed to feel less isolated from their educators, the institution and other students. Indeed, given the challenges posed by Covid-19 in the world, online education is the best method to sustain teaching and learning (Teymori & Fardin, 2020).

2. Literature review

Covid-19 was first reported in Wuhan, Hubei Province, China in December 2019. Covid-19 is a disease that is caused by a severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). On the 20th of March 2020, the World Health Organisation (WHO) declared Covid-19 a pandemic because of the rate at which it was spreading and devastating human lives (Kamble *et al.*, 2021). This pandemic has caused a lot of harm and disruption to peoples' lives. For example, many countries have witnessed economic meltdown, reduced working hours, school closures, redundancies in the manufacturing industry and unprecedented unemployment rates (Hwang & Holler, 2020). Governments all over the world, including the South African government, introduced a country-wide lockdown to contain or control the spread of Covid-19 (Zhang, Wang & Wang, 2020). South Africa reported its first confirmed Covid-19 case on the 5th of March 2020 in KwaZulu-Natal, and by the 15th of March 2020 there were about 1585 confirmed cases (Mahaye, 2020). President Cyril Ramaphosa declared a national state of disaster in terms of the *Disaster Management Act 57 of 2002*. The main objective of declaring the state of disaster was to promote an integrated and coordinated system of disaster management, with special emphasis on prevention and mitigation by national, provincial and municipal organs of the state, statutory functionaries and other role-players involved in disaster management and communities (Mahaye, 2020).

The president, in collaboration with the National Command Council, declared a 21-day national lockdown commencing on the 26th of March 2020 to help curb the spread of the disease and minimise its impact on the South African society. As schools and higher education institutions were ordered to close to contain the spread of the virus, traditional face-to-face classes were moved to an online delivery system. Almost twenty years ago, long before having the technologies we are now accustomed to, researchers (Brown, Bull & Pendlebury, 2013; Omoroguiwa, 2012) claimed that they witnessing a paradigm shift in higher education, where institutions were migrating from traditional to online learning. This paradigm shift has been enhanced by recent technological developments. The use of modern technologies is still in its infancy in many countries across the world. However, Covid-19 presented the opportunity for both students and their instructors to employ technology as an agent to sustain teaching and learning (Stauffer, 2020). The sudden transformation into online learning has posed substantial challenges for educational activities globally, and particularly in resource-scarce countries where educational institutions, educators and students are generally not ready for this unexpected disruption to traditional teaching and learning methods (Heng & Sol, 2020). Before the outbreak of the Covid-19 pandemic, most of the higher education institutions were teaching their students using traditional face-to-face classroom methodologies. However, the outbreak of the Covid-19 pandemic brought challenges with the use of technology at public institutions. This included inadequate infrastructure, poor internet connectivity and lack of digitally competent educators (Yan, 2020). Teachers had to move from a space in which they have years of experience to the unknown and challenging world of online, remote correspondence and socially distanced teaching. Research conducted by Mpofu (2020) indicates that some of the educators who have to use these technologies are largely ageing and technophobic. The instructional methods used on an online platform differ completely from the traditional face-to-face classroom method that educators use. By its nature, online learning depends entirely on technological devices and the internet; therefore, it is undeniable that technology is the most pressing challenge to online learning, especially if those involved

in the process of teaching and learning are not digitally competent due to inexperience or insufficient training (Jalli, 2020).

Jalli (2020) further argues that a lack of internet access poses great challenges for students to study online. With online learning as the replacement of the physical classroom amid the pandemic crisis, many students were vulnerable to falling behind in their studies (Yan, 2020). The outbreak of Covid-19 revealed a serious gap that exists between the rich and the poor, especially in South Africa (Mahaye, 2020). For example, students from low socio-economic families are unable to afford broadband connection and pertinent devices such as computers, laptops or tablets to support their online learning. Instead, they resorted to the use of smartphones to access lessons and learning materials, complete assignments and take exams (Heng & Sol, 2020). The unprecedented shift to online learning has also increased concerns regarding cybersecurity, cyberbullying, online violence and exploitation, as well as other psychological issues caused by difficulties and uncertainties associated with online learning during the Covid-19 pandemic (Yan, 2020). As online learning and technologies continue to evolve, several terminologies associated with online learning are used. For example, they include e-learning, online learning, distance learning, blended learning, and hybrid learning (Heng & Sol, 2020). With online learning, students submit their work and receive feedback online. Students can also connect and interact with their peers online, and sometimes they can be together in an online class with an instructor while working through their digital lessons, materials, or assessments (Stauffer, 2020). The use of technology to transform learning and assessment has been a strategic goal for many governments globally.

3. Conceptualising learning in the digital era

The rapidly evolving technological landscape in the 21st century has meant that university lecturers were forced to adapt their teaching approaches without a clear roadmap for attending to students' needs (Kop & Hill, 2008). As a result, George Siemens and Stephen Downes's (2009) connectivist learning theory is the initial lens through which to conceptualise learning in this digital age because of its varying attributes from traditional face-to-face learning to e-learning. Thus, Siemens and Downes (2009) define their theory as a learning theory for the digital age characterised by the influence of technology in the field of education. The theory argues that learning is the process of building networks of information, contacts and resources that are applied to real-life problems. Contrary to the traditionalist view, the basic principle behind connectivism is that knowledge is constructed through social interaction through networks. Furthermore, connectivists believe that knowledge is stored on the internet and can be sourced by anyone with access to the internet and to networks on information.

Connectivism presents a model of learning that acknowledges the tectonic shifts in society where learning is no longer an internal, individualistic activity. Connectivism, therefore, inclines towards the belief that knowledge exists outside of the individual who makes connections between information to build new knowledge (Siemens & Downes, 2009). In their theory, they point out that traditional learning theories such as behaviourism, cognitivism and constructivism have limitations, because they were developed at a time when technology did not have the impact on learning to the degree it does today. Siemens and Downes's (2009) assertion that these theories were developed when knowledge was growing more slowly prompts a question: how does connectivism compare to other learning theories and how does it differ from the established paradigms?

In addition, I found this theory useful and relevant for this study because it regards technology as a tool that can be utilised to facilitate student-lecturer-content interaction so that both (lecturer and student) become co-creators of knowledge using emerging technologies as enablers instead of being passive recipients of information as it is alleged in behaviourism and cognitivism. Again, connectivist pedagogy makes it easier for students to engage in online discussion groups where they share information freely through this connected web. Furthermore, this also provides them with a chance for collaborative learning. The nature of this study, with its focus on exploring the effectiveness of using technology as a delivery system during the Covid-19 crisis, is consistent with a connectivist epistemological position.

4. Research methodology

As previously mentioned, this paper's objectives were to explore how technology was used effectively to enhance teaching and learning during the Covid-19 pandemic. Furthermore, the paper wanted to determine educators' and students' experiences and attitudes towards the use of technology as a delivery system. Before looking for relevant primary studies, I started by identifying the problem, formulating the review question, retrieval process, inclusion, and exclusion criteria. Although I recognised that there are many studies on technology as enabler for sustaining teaching and learning that pre-date this period, the timeframe chosen coincided with the rapid growth of qualitative studies on the Covid-19 pandemic, which led to a sudden transition to online learning. Despite the variations from a typical meta-analysis, I began this review in the manner common to all literature reviews; that is, by circumscribing the time period for inclusion (2019–2022). To identify studies that are related to the topic, objectives and the research question, I completed an electronic literature search by submitting the search terms to the librarians and other international primary search-source indexes such as ProQuest, EBSCOhost, Educational Resource Information Centre (ERIC), Google Scholar, SAGE, and Academic Search Premier. The following search key terms were used: Covid-19, e-learning, distance learning, pandemic, lockdown, social distance, online learning, isolation, the internet, heutagogy, connectivism, transactional distance, distance learning, sustainable development, etc. I used purposive sampling to locate studies on students' perceptions and experiences regarding the use of ICT as a delivery tool for teaching and learning during the pandemic. This literature review was centred around the following two research questions: How can continuity of teaching and learning be strengthened during emergency situations such as that posed by the Covid-19 pandemic? What were lecturers' and students' experiences and attitudes towards the use of technology as enabler for teaching and learning during the Covid-19 pandemic? Before obtaining the full text of the identified qualitative studies, I applied inclusion and exclusion criteria.

4.1 Inclusion and exclusion criteria

The selection criteria for this study had to meet the following inclusion criteria: a primary qualitative research design, English language, relevance to the research topic, a focus on technology-enhanced learning, published between 2019 and April 2022 in peer-reviewed journals, articles, newspapers, or books, magazines, public and government websites, or portals. All studies published before 2019 were excluded, even though they had information on technology as enabler for online teaching and learning. Once the processes of retrieval, inclusion and exclusion criteria were completed, the process of systematic review started. To minimise bias against non-published research literature, I conducted a search through ProQuest Dissertations and Theses to locate studies published between 2019 and 2022.

Before these studies were considered for inclusion, they had to pass through various standards of academic rigour for their suitability for inclusion in the final review. Failure to conduct a sufficiently exhaustive search is the most important threat to the validity of any integration. In this case, I stopped searching for more information when the search engines ceased to produce any new relevant studies. The search yielded 85 primary qualitative studies on technology-enhanced teaching and learning. From the 85 studies screened, twenty-seven (27) articles were rejected, because they either did not refer directly to technology as an enabler for sustaining teaching and learning, or they had a quantitative research focus. Furthermore, the issue of extracting primary qualitative studies was problematic, because during the search for these studies I came across very good quantitative primary studies that were relevant to the research topic, but I was forced to eliminate them because they were not qualitative by nature. Quantitative studies were not included because of the pre-determined clause set at the beginning of the search "only peer-reviewed primary qualitative studies should be included". After passing various standards of academic rigour, six (6) studies were rejected at the level of research focus. Another fifteen (15) studies were rejected because they did not comply with the set criteria for qualitative research. A total of thirty-five (35) studies were included for this synthesis, because they met all the inclusion criteria as shown in Table 1 below. Each study was scored according to the rating scale and a percentage was calculated.

4.2 Screening criteria

Table 1: Screening criteria for inclusion and exclusion

1	Articles published between 2019 and 2022
2	Research question stated clearly and adhered to
3	Relevance to the research topic
4	Research design clearly stated
5	Aims of the study clearly described
6	Sampling procedure clearly described
7	Data collection setting identified
8	Using English language
9	How were data recorded and ethical aspects described?
10	How were themes and categories identified?
11	Credibility (member checks, validation of data)
12	Clear statement of findings
13	Was research useful and relevant?

I followed the directions of a descriptive study in reporting or presenting the results of this study.

5. Results and discussion

Based on a review of several papers on the effectiveness of using technology to enhance teaching and learning, I will present results of the research conducted. Since the Covid-19 pandemic hit the world, and technology was introduced as a learning tool to bridge the transactional distance that exists between the students and their lecturers, for students in

most of the schools globally, technology-enhanced learning became trendier and more global (Rahmat, Syakhrani & Satria, 2021). A constrained timeframe for this study and the restrictions on communication and travel imposed by Covid-19 led to the adoption of a document review research design.

In this systematic literature review, the first theme that emerged from the studies reviewed was that of access to ICTs. Adedoyin and Sokyan (2020) examined the challenges and opportunities brought by Covid-19 on teaching and learning and they found that key challenges that are related to Covid-19 are technological infrastructure, digital competence, socio-economic factors, assessment and supervision, heavy workload, and compatibility. By its nature, online teaching and learning depend entirely on technological devices and the internet; therefore, technology is undeniably the most pressing challenge to online learning, especially if those involved in the process of teaching are not digitally competent due to inexperience or insufficient training (Adedoyin & Sokyan, 2020). For many educational institutions, the sudden shift to online learning has created an unexpected workload, particularly on building e-platforms and integrating external applications into their systems in a timely manner (Adodoyin & Sokyan, 2020). The above results are in line with those of Kamble *et al.* (2020), who examined learners' perceptions of transitioning from traditional face-to-face learning to one that uses technology as a delivery system.

The findings revealed that the Covid-19 pandemic has posed several challenges to developing countries like South Africa, including a lack of internet connectivity, access to technological platforms by students and educators, familiarity with online teaching and learning approaches, and adoption of technology. Reliance on technology and a lack of continuous internet connectivity hinder the transition of learners towards online learning in less developed countries. In addition, Kamble *et al*. (2020) found that poor network connectivity is exacerbated by lack of technological infrastructure, which in turn limits institutions for higher education to reach out to the students in the online learning environment, thus hampering their learning. In his study entitled, "Online learning: A panacea in the time of Covid-19 crisis", Dhawan (2020) examines the importance of online learning during a period of a crisis and pandemics such as Covid-19. In the study Dhawan (2020) identifies problems that are associated with online learning. The results of Dhawan's (2020) study revealed that web learning is a panacea in times of the Covid-19 pandemic. Similarly, Dhawan's (2020) findings concur heavily with those of Heng and Sol (2020), who indicate that online learning and its variations such as e-learning and distance learning are a panacea for sustaining teaching and learning during the Covid-19 crisis. A similar study was conducted by Paschal and Mkulu (2020) in which they explored the effectiveness of online learning with a focus on five universities in Africa. The findings revealed that university students prefer technology as a delivery tool because it has the potential of overcoming the physical distances that exist between students and educators, students and the institution. Mishra, Gupta, and Shree (2020) conducted a study in which they examined the use of online teaching and learning in higher education during the lockdown period of the Covid-19 pandemic. The results revealed that technology has become a game changer, because it has the potential to transform teaching and learning. Currently, the proliferation of technologies is seen as a powerful and irresistible force that is happening rapidly. There is a sense that the phenomenon, in this case, technology as a delivery tool, is unstoppable. In addition, internet technology has helped in moving learning from traditional correspondence through traditional post office delivery to a more advanced open learning.

The second theme which emerged from the review was that of migrating from traditional, face-to-face learning to technology-enhanced learning. Despite the challenges experienced by higher education institutions globally, Covid-19 came as a blessing in disguise (Heng & Sol, 2020) because it paved the way for the digital transformation of education and enhanced the adoption of ICT in the classroom. Due to Covid-19, many educational activities, including institutional inspections and testing, have been paused. These pauses gave governments and education authorities a rare opportunity to rethink education. Furthermore, literature shows that educational institutions need to invest in developing and improving existing online learning platforms. In a study entitled, "Move to online during Covid-19 lockdown", Ogbonnaya, Awoniyi, and Matabane (2020) found that the flexibility of online learning increases students' motivation to learn. However, poor internet connectivity, the high cost of data, unreliable power supply, lack of appropriate devices, the inability to manage their time effectively, and family interruptions were some of the challenges experienced by most students in higher education. Besides, online learning enables students to communicate and collaborate actively with their peers and lecturers anywhere anytime. Amir *et al.* (2020) conducted a study in which they examined students' perspectives of classroom and distance learning during the Covid-19 pandemic at the University of Indonesia. Despite some noticeable challenges, the study found that students are interested in adapting to the new learning methods of full distance learning. In addition, the results of the study by Amir *et al*. (2020) show that Covid-19 not only changed the utilisation of technology in education, but also future teaching strategies. Mafenya (2021) conducted a study in which lecturers and students' perceptions of migrating from traditional learning to one that uses technology as a delivery system were explored. The review revealed that the majority of the student population preferred traditional face-to-face classroom learning. The Covid-19 emergency has made it clear that technologies alone do not represent a panacea. Students and instructors have faced different obstacles in remote teaching due to the existing limitations related to technological, pedagogical and social challenges.

The third major theme which emerged from this review is lecturers and students' attitudes toward technology as a delivery system. The study revealed that there is a belief among lecturers and students that to initiate and implement educational technology successfully in the teaching-learning programmes depend strongly on the participants' support and attitudes. In this research study, students' attitudes and acceptance toward e-learning have transpired to be more positive and favourable. Again, people's attitudes play an important role in influencing the effectiveness of using technology for education purposes from a variety of perspectives. The study found that perceptions and attitudes about ICTs are affected by many factors, such as the users' experiences, lack of resources, lack of professional training, gender, academic qualification, age, lack of institutional support, and lack of time (Zare-ee, 2011). These findings are consistent with the literature that reveals that the successful integration and implementation of educational technologies depend largely on the attitudes of educators who determine how ICT is used (Uslu & Bümen, 2012). From this discussion a conclusion could be drawn that the Covid-19 pandemic caused students to develop a positive attitude towards the use of educational technologies for learning purposes. It is also tempting to conclude that, to embrace technology as a delivery tool for sustaining teaching and learning purposes, there is a need to start by altering people's attitudes so that all stakeholders are prepared to accept and to be educated within the new context or reality. Similarly, studies conducted by Adnan and Anwar (2020) and Kamble *et al*. (2021) report that the development of lecturers and students' positive attitudes towards ICTs is a key factor in the enhancement of computer

integration and avoidance of their resistance to computer use. Thus, ICT attitudes are a key issue in technology adoption and diffusion.

Although the Covid-19 outbreak was a disaster for the health of communities, it should be considered as an opportunity, especially for educational systems around the world, to plan and enhance the substructures of the new educational generation. The present study found that studies conducted in most parts of the world have supported online education, even though there have been challenges with the sudden transition from traditional face-to-face to online teaching and learning. While some believe that the unplanned and rapid move to online learning – with no training, insufficient band-with, and little preparation – will result in a poor user experience that is unconducive to sustain growth, others believe that a new hybrid model of education will emerge, with significant benefits. Additionally, the findings show that students in remote/rural and lower socio-economic areas believe that access to technology and reliable internet are a major concern. The literature reviews conducted indicate that distance learning have a negative impact on student learning, citing social isolation of students and social disconnection as areas of major concern.

6. Conclusion

The present study documented the use of technology as enabler for sustaining teaching and learning during the Covid-19 crisis using a systematic literature review as its data collection approach. The study presented evidence that, despite some challenges brought by the Covid-19 pandemic, technology has the potential to sustain teaching and learning, especially in times of crisis like the Covid-19 pandemic. The sudden closure of universities globally due to Covid-19 pandemic, albeit undesirable, presented an opportunity for transformation in the education systems. Findings of the study revealed that students and lecturers had challenges with learning online because of the shortage of infrastructure to engage in meaningful online learning. The findings further revealed that if properly utilised, technology has the potential to reduce the gap that exists between the student and the instructor, students and their peers. During the Covid-19 pandemic, new communication technologies, particularly the internet and mobile cell phones, appeared to offer exciting possibilities for overcoming geographical access and cost barriers to learning.

Despite the hardships that people faced, Covid-19 led to a total digital transformation of the teaching and learning processes. Like any other research undertaking, this document review faced several challenges and criticisms, such as data collection and analyses. According to Xu (2007), one should consider a document review premature if there are fewer than 10-12 quality studies on an interesting phenomenon. Fortunately, in this study I obtained 35 primary qualitative studies, which were more than adequate to continue with the review. Another challenge was the setting up of inclusion and exclusion criteria. However, I dealt with this challenge by setting parameters for time cut-off (2019–2022), location, subjects, language of publication and nature of publication. The availability and accessibility of qualified primary studies were also problematic. To deal with this challenge, I conducted a systematic and exhaustive literature search using multiple databases to search for relevant studies. In addition, a combination of electronic and hand searches was also conducted. Data analysis was also a challenge. When conducting this systematic document review, I realised that there were studies that contained both quantitative and qualitative data. To deal with this challenge, I extracted the qualitative component for inclusion into the study. Like many studies conducted amid the Covid-19 crisis, the study provided a fertile ground for further research on

how Covid-19 had an impact on teaching and learning at many institutions across the globe. For example, a study could be conducted to determine how institutions of higher learning managed the spread of the Covid-19 pandemic on their campuses. In addition, research could be conducted to measure and determine the effectiveness of technology-enhanced teaching and learning when compared to the traditional face-to-face delivery system. Again, a study could be carried out on how institutions that are preparing to move away from the traditional classroom system could prepare their migration to an online delivery system. In conclusion, it could be argued that before any institution decides to migrate to an online teaching and learning delivery system, it is important to make sure that all external barriers such as uneven access to the internet are thoroughly dealt with, because failure to address these challenges could jeopardise the whole process.

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