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Innovation and Technology: A Panacea to Teaching and Learning Challenges during the Covid-19 Lockdown in South Africa

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ABSTRACT

Innovation and technology brought by the 4th Industrial Revolution (4IR) have become an urgent reality to all teachers because of the need for a virtual classroom. In South Africa, over 13 million students in almost 25,000 schools have been affected by the COVID-19 lockdown. Most school teachers were not trained for online teaching, which was the only safe method of teaching during the lockdown period. This study, therefore, investigated how innovation and technology were utilised to mitigate the virtual classroom problems during the COVID-19 lockdown. This study employed a qualitative research approach using interviews to collect data based on the phenomenological research design. The sample for this study consisted of 12 lecturers purposively drawn from one university in the Eastern Cape Province of South Africa. Thematic content analysis was performed on the data. The findings revealed that a majority of the participants have poor pedagogical skills especially those related to using technologies such as Blackboard, Microsoft Teams, and V-Drive on computers for online teaching engagements during the COVID-19 lockdown; strategies utilised by the participants for their teaching activities during the lockdown included Microsoft Teams, WhatsApp voice notes, email attachments for sending bulky teaching materials to students, and other Computer-instructional resources. Thus, this study recommends an urgent need for capacity development workshops to equip lecturers with computer and ICT skills, knowledge, and strategies for online teaching delivery and increased provision of adequate learning and teaching facilities in all public educational institutions, including those in the rural areas.

KEYWORDS
COVID-19 lockdown; innovation and technology; teaching facilities; training of teachers; virtual classroom

INTRODUCTION

The outbreak of the coronavirus brought a lot of confusion accompanied by anxiety and distress among the global population. The coronavirus, otherwise called COVID-19 and declared as a pandemic, unexpectedly created health, economic, social, and education crises (WHO, 2020a). This perhaps is the reason why Omodan (2020) describes the COVID-19 infection as an emergency of the unknown and subsequently portends short-term and long-term implications on the world in general, including the education system. The sudden shutdown of many institutions and most businesses negatively affected the economy and the smooth running of teaching and learning in schools. The pandemic has so far created the biggest shock and radical change in education where 1.6 billion young people have had their contact schooling suspended (UNESCO, 2020). In South Africa, over 13 million students attending school in almost 25,000 schools have been affected (Department of Basic Education [DBE], 2020).

COVID-19 disease was identified as a respiratory syndrome that was declared a pandemic on March 12, 2020, by the World Health Organisation (WHO, 2020b). South Africa, on the 26th of March, like other countries opted for lockdown intended to manage the spread of the virus which made things more serious as this was the first time of its kind in the present generation. Consequently, everything came to a halt, because there was a need for the schools to cease on-site teaching and move to distance learning. In other words, classroom contact sessions had to switch from being traditional face–to–face teaching to adopting digital methods. After the lockdown, this is where challenge was experienced more especially in the public schools in the rural areas (Harris & Jones, 2020, p.6). Teaching and learning stepped into unseen and new territory which saw teaching and learning activities re-arranged, revised, and re-directed from being a teacher-driven process to a primarily learner-parent, technology-supported online process (Harris & Jones, 2020).

Innovation and technology which are the hallmark of the 4th Industrial Revolution (4IR) had overnight come into existence. Because of the huge imbalances that exist in South African school contexts, some schools were minimally affected whilst others were severely affected and literarily came to a standstill. In addition, huge inequalities between private and public schools were revealed during this period. This resulted in schools being forced to rethink new ways in which teaching and learning can resume as well as thrive in this dangerous and uncertain time in trying to save the school year as well as the lives of teachers and children. In doing this, the measures put in place by governments of various countries, including South Africa, such as the implementation of social distancing to minimize the spread of the infections, hence, lockdown regulations and closure of schools further compound the problem (DBE, 2020).

Given the aforementioned contexts in South African schools, the short period within which schools had to prepare for the lockdown was a situation that could spell disaster for the majority of schools in the country. COVID-19 could have devastating consequences for learning for many years to come in South Africa, especially when such learning is already of questionable

quality (Soudien, 2020). Many inequalities were exposed and which further worsened students' inequalities, thereby exposing the South African dichotomy in its society.

In South Africa, millions of students attend public schools, which offer varying degrees of resources and quality education. For the advantaged schools, moving to online learning was an achievable goal, while for the disadvantaged ones, learning was interrupted and became a difficult task for the duration of the lockdown (Davids 2020). Those students from disadvantaged schools were at risk of losing a great deal of learning and that would set them up for failure in the future (Soudien 2020). Because of the majority of schools being disadvantaged and poor as far as resources are concerned, this statement was to expect too much and prove to be problematic considering the challenges faced by these schools. For many students from disadvantaged schools, this was a recipe for disaster, setting them up for failure from the onset, simply because their schools lack resources such as computers, tablets, the internet, skilled teachers, and other digital learning devices. Therefore, trying to implement such drastic changes in the mode of teaching and learning would in South Africa be an almost impossible feat, especially in under-resourced and struggling schools, in addition, it would put the DBE under enormous pressure and public scrutiny (Jansen, 2020).

During the COVID-19 lockdown, a new status quo with the removal of school routines emanated, which gave assurance, consistency, and predictable outcomes. All these long-standing and familiar routines, in an instance, were gone and teachers and students alike were left with disbelief and uncertainties. It is safe to aver that a lot of confusion and anxiety experienced by all stakeholders, such as the DBE, parents, school principals, teachers, and students alike, marked this period. In a survey conducted by the Young Minds in the United Kingdom, it was found that 74% of teachers and school staff during the school's unspecified period of school closure harmed the mental health of young people (Young Minds, 2020). The fact that young students could not attend schools disadvantaged them a lot because of the lack of learning materials as well as the absence of the teacher or facilitator in front of them. Likewise, they could not focus on their studies due to the disturbance from members of their households (Pastor et al, 2020). The environment, which surrounded the young students, was not conducive to learning, and that affected them negatively (Realyvásquez-Vargas et al., 2020).

In most African countries also, the sudden closure of schools due to the outbreak of the coronavirus obstructed learning and teaching. The countries include, among others, Burkina Faso, the Democratic Republic of Congo, Kenya, South Africa, and many others. In research involving ten African countries including the aforementioned, the findings showed that almost all the students struggled to continue learning in the absence of their teachers and most parents could not offer adequate assistance. In addition, parents complained that their children did not get any support from the teachers during the lockdown, and the assignments that were given were difficult for the children to do without their teachers' guidance. Like in the UK, children in African countries experienced stress, anxiety, isolation, and depression during the lockdown. According to Garcia and Weiss (2020), many factors such as continuous access to the internet,

availability of learning resources at home had positive outcomes for those students who were fortunate enough to access them during the time of complete shutdown of schools. Teaching and learning were affected by many factors during the lockdown, hence the purpose of this paper was to investigate how innovation and technology helped in solving challenges associated with virtual classrooms during the COVID-19 lockdown in South Africa. Thus, the following research questions were raised to guide the study.

Research Questions

- What skills do lecturers in the faculty of education possess for handling online teaching at a university in South Africa?
- What strategies did lecturers in the faculty of education use for remote teaching during the COVID-19 lockdown at a university in South Africa?

THEORETICAL FRAMEWORK AND LITERATURE REVIEW

Theoretical Framework: The Diffusion of Innovation (DOI) Theory

The DOI theory is suitable for this study because it addresses the process through which an innovation or a new way of doing things such as the use of technology spreads among members of a social system. This theory was propounded by Rogers in 2003 (Nazari et al., 2013). Diffusion, according to Rogers, involves a process by which innovations are communicated through particular channels over time within a social system. The e-learning implementation, in higher educational institutions, is not only a case of diffusion but also a major innovation in the education industry as a whole (Buc et al., 2015). In the case of this study, a university is regarded as a social system whose members are lecturers and students. Innovations such as the use of digital technologies are adopted and utilized by faculty as instructional support for an effective teaching and learning process in a university system (Hadullo, 2011). During the COVID-19 lockdown, the innovative idea of online platforms for teaching and learning spread among the education community across the globe. Through research and online engagements, educators at all levels of education shared and communicated innovative ideas, knowledge, and digital skills for e-learning delivery amid threats from the raging pandemic. This study aims at revealing the skills and strategies of education lecturers at a university in South Africa.

Technology and innovation as a necessity for teachers during COVID-19 Pandemic

The advent of COVID-19 has led all institutions across the world to juggle various online pedagogical techniques and endeavour to make better use of technology. That is, many institutions all across the world have digitalized their operations, recognizing the critical need in this situation. During the COVID-19 lockdown, the virtual classroom is not working well. As a result, improving the quality of virtual classrooms is critical at this point (Evans-Amalu & Claravall, 2021; Isidro & Teichert, 2021; Waters et al., 2016) Since the Covid-19 outbreak, online education in Chinese colleges has grown at an exponential rate (Dhawan, 2020); not only in China, many countries have recorded an increase and improvement in

the use of online pedagogy, most especially with the use of the internet of things (Alrashidi, 2020; Mohammed & Isa, 2021).

This new development requires that educators have to modify their entire pedagogical approach to navigating through the new market conditions and adapting to the changing scenarios, resulting in an overnight shift from the traditional classrooms to e-classrooms. During this difficult period, the main question is not whether online teaching and learning environments or virtual classrooms can provide high-quality education; but rather how academic institutions will be able to adopt online learning on such a large scale (Carey, 2020). Any educational institution, anywhere in the world, will be harmed by resistance to change. They will be judged on how quickly they adjust to changes in such a short time and how well they retain quality. Educational institutions' reputations are on the line, and they are being scrutinized. Their ability to adapt is demonstrated by how effectively they behave and preserve the quality of their education in the face of the crisis. The only option is to switch from face-to-face lectures to online platforms. Academic institutions, for example, would not be able to convert all of their college curricula into online resources in a single day (Lee et al., 2021). Similarly, the teacher can alter course contents to fit the online learning platforms for a virtual classroom purpose. Because online teaching differs from face-to-face teaching, a teacher must be well prepared, think outside the box, and be technologically savvy. The teachers should be aware of what should be added to and removed from the course materials. To prevent appearing shallow, they must ensure that the content is appropriately aligned (Dhama et al., 2020).

Problems of Virtual Teaching and Learning

The Association of African Universities (AAU) underlined the importance of integrating alternative means of online teaching and learning, as well as other distance learning strategies (Lee et al., 2021). Other campuses around the United States were affected by the cancellation of the face-to-face contact sessions. According to the conclusions of a poll done by Times Higher Education in China, online higher education will never be able to equal the real-world classroom environment (Lau et al., 2020). Instead, it would generate unfit graduates, leading to increased interpersonal communication discomfort. “Face-to-face interaction will never be matched in quality by other ways of communication,” according to an Australian study (Lau et al., 2020, p. 2). Online courses were shown to be less effective than in-person courses in a study of online vs in-person courses. The reason for this is that in-person classes allow students to socialize with teachers and other students, which encourages them to interact with one another (Lau et al., 2020, p. 2). In an Australian survey of undergraduate students, it was discovered that they preferred face-to-face discussions because they felt more involved and received more immediate responses than they did during online discussions (Adu et al., 2020a).

The Department of Higher Education and Training (DHET) in South Africa had been pressing lecturers to become familiar with the frequent use of modern ICT facilities as a result

of the 4th Industrial Revolution even before the COVID-19 disease broke out in South Africa. Some are asking if online learning modes will continue after the pandemic, now that most colleges throughout the world have adopted it. Due to their preparation for the 4IR, certain colleges were unaffected by the shift during the COVID-19 school stoppage. Students may have difficulties when learning from home since they may not have a quiet location to study, access to computers for coursework, and internet connection. On the teacher's side, the sudden transition to mandatory online learning during the lockdown period may have caught them off-guard in terms of having enough time to plan courses that incorporate digital devices (Adu et al., 2020a). Children from low and middle-income families faced the most difficulties as a result of the pandemic (Adu et al., 2020a).

In universities and colleges, the abrupt shift from face-to-face contact classrooms to virtual teaching and learning platforms did not go down well with everyone. To engage in online learning, individuals must have computer literacy, internet Wi-Fi connectivity, network availability, and workspace. In other words, a favorable environment with all of the necessary online learning and teaching resources is required for effective online learning. According to the United Nations Educational, Scientific, and Cultural Organisation (UNESCO), the closure of Higher Education Institutions (HEIs) has impacted 9,8 million African students, with only 24% having internet access (Tamrat & Teferra, 2020). However, students from low and middle-income families face extra obstacles due to high costs of data, internet connectivity, and unreliable power supply.

Because of the socio-economic issues in the country and the state of some colleges, online teaching may not be very efficient in South African universities, as stated before in this study. Many students, for example, come from low-income families and so cannot buy data to use the internet unless it is provided by their institutions. There is a significant difference between those HEIs that have the technology and teaching resources, as well as, most importantly, skilled teachers, and those that do not have (Tamrat & Tefera, 2020). Similarly, there is a problem with the learning styles, which vary from student to student. Although some students and instructors remain committed to face-to-face traditional learning, the time is ripe for institutions to catch up with the digital world and provide 4IR breakthroughs to 21st-century students. Some lectures, on the other hand, cannot be delivered online, particularly when laboratory experiments, practical lessons, or art performances are required. At some point, the fairness and integrity of online tests may not be ensured unless they are constructed in such a way that students cannot reproduce them. In this scenario, technological advancement on the part of the lecturers must be addressed to discover a technique to supervise online examinations. The institution should think about giving rigorous coaching to students so that they can make the best use of the current technologies for their learning.

Personal attention is also a huge issue facing online learning. Students want a two-way interaction which sometimes becomes difficult to implement. The learning process cannot reach its full potential until students practise what they learn.Sometimes, online

content is all theoretical and does not let students practise and learn effectively. Mediocre course content is also a major issue. Students feel that lack of community, technical problems, and difficulties in understanding instructional goals are the major barriers to online learning (Dhawan, 2020). Students were found in a study to be underprepared for managing their career, family, and social lives with their studies in a virtual learning environment. Students were also found to be underprepared for a variety of e-learning and academic abilities.

How teaching and assessment plans were affected by the pandemic

Distance learning that the country opted for as a way to occupy students during the lockdown did not work efficiently for some students in the rural areas (Dhawan, 2020). However, students from privileged backgrounds were supported by their parents, so they could find a way to learn despite the complete shutdown of schools (Schleicher, 2020). Learning and teaching through the media, such as listening to the school programmes on radio and watching television channels in which different lessons are taught, was most effective to students with the required resources. The process was good for all those who had access to the television, radios, and cell phones with internet data. In any teaching and learning situation, the outcomes achieved through the process of learning and teaching are measured through assessments. Even though, teachers could send assessments through different virtual platforms; they could not reach all the students outside the internet connectivity coverage in rural areas, due to the various challenges mentioned earlier (Schleicher, 2020).

The new COVID-19 protocols observed under the new normal negatively affected teaching and assessment plans in one way or another. The teachers had to develop alternative approaches to monitor the students' learning which was not an easy task for them. Concerning remote teaching, South Africa is not the only country that is negatively affected by remote or online learning. In India among others, four categories of barriers that affected teachers during the teaching and assessment process were identified; and these are the home environment, institutional support barriers, teachers' technical difficulties, as well as teachers' problems (Joshi et al., 2020). These included interruption at home during teaching and conducting of assessments, lack of training for teachers, limited awareness of online platforms, as well as lack of technical knowledge, and negative attitudes. In Pakistan, the lack of high-speed internet also affected the smooth running of online teaching and assessment. Consequently, this affects the progress in assessment submission because teachers are required to be flexible to accommodate students with challenges of internet connectivity (Mahmood, 2020). The above-mentioned concerns are also the realities in South Africa and this affected education during the lockdown period, especially in rural schools.

Teachers' readiness to teach during lockdown

Online teaching is frustrating and has brought stress to most teachers (McLoughlin & Northcote, 2017). Teachers had to adopt the online teaching process which was completely new to some.

Conducting online teaching requires a completely different skill from the one for face-to-face teaching as students learn individually, without group assistance. The teacher cannot even read the students' reactions or facial experiences during online teaching, so the teacher cannot read from their reactions if they understand or not. Most teachers struggle to adjust planning for the face-to-face classes with the online classes. Therefore, this raises a question on how ready were the teachers to teach and their level of competence in embracing online or distance teaching. Kaiser and König (2019) elucidate on teacher competencies as "the context-specific, cognitive performance dispositions that are functionally responsive to situations and demands in certain domains" (p. 599).

The common challenges that were and are still encountered by the teachers and students are: "Lack of general and technological infrastructure (electricity, internet connectivity, and devices); lack of effective and user-friendly distance learning platforms; and lack of staff capacity to support distance learning through quality pedagogical resources" (Lee et al., 2021, p. 8). During the lockdown, teachers were not capacitated with skills for online teaching or distance learning. There was no training conducted for online teaching either by the schools or the Department of Education, teachers were all by themselves in their corners. This posed a problem as teachers and students were not prepared to adopt the distance learning modalities. In addition, in countries such as Australia, Mexico, South Korea, and the United States, the common challenge for teachers was the lack of adequate digital skills which affected the quality of online teaching across the schools (Lee et al., 2021, p. 8). Nevertheless, with the independent and public schools having good infrastructure, and financial resources, and with students from a viable socio-economic background, online learning ran smoothly (Ramrathan, 2020). Still, without proper training of teachers on how to conduct lessons using digital learning platforms, effective teaching could not take place. Furthermore, the inequality in terms of access to education contributed negatively to effective teaching during the lockdown period because most schools had to rely on digital technologies to continue with teaching and learning activities, as well as adequate infrastructure.

Teaching and Learning Challenges during the Lockdown

Communication between teachers and the students was most challenging during the lockdown as some students were not available on social media. The purpose of communication during the online learning and teaching period was to engage students in learning and teaching as it is with the face-to-face contact sessions (Liberman et al., 2020). The purpose was not served for all students especially those in rural areas and those affected by poor socio-economic factors. To most teachers and students, online teaching and learning during the lockdown did not favour them. Even the teachers' capacity to communicate and understand their students' challenges during the lockdown was limited. Liberman et al. (2020) postulate that the COVID-19 crisis affected also all the modalities of learning assessment.

Before the lockdown, teachers were in full control of the measures followed during the assessment, but now they are required to look for alternative approaches which may or may not be trustworthy. Mishra et al. (2020) recommend that face-to-face interaction with students is the best for the teaching and learning process to take place effectively. The idea that no teaching method can surpass the traditional formal education that we know where there is teacher and learner interaction in the same space or classroom has been demonstrated during the lockdown period. This is because the lack of communication between the teachers and the students was a major challenge as some students had no data or experienced poor connectivity, especially for those in rural areas. Although teaching was also done using the media, not all students had access to television or radio, let alone computers and laptops.

Learning environment

During the lockdown, George (2020) affirmed that the educational institutions had to look for unique ways of teaching and learning to find out whether they would accommodate all the students or not. Many students were not in a convenient environment that would be conducive for learning activities. The virtual teaching and learning process needs an environment that promotes effective teaching and learning such as the availability of resources like computer facilities, internet data, and proper space which allows learning to take place uninterrupted. South Africa was not left behind and this brought a lot of discomfort and distress to the students, which then required some therapeutic interventions to assist with these psychological difficulties (Singh et al., 2020, p. 1). For primary school students in urban areas, there are institutions for this service but for the rural schools, these services are not easily available and even considered by most parents.

Conceivable Solutions to Virtual Classroom Challenges

Virtual classrooms should be engaging, interactive, and dynamic. Teachers should provide pupils with time limitations and reminders to keep them aware and focused. To the greatest extent possible, efforts should be made to humanize the learning process. Students should be given individual attention so that they can readily adapt to this new learning environment. To communicate with students, you can use social media and numerous group forums. When it becomes harder to reach out to students via texts, various messaging apps, video chats, and so on, communication is key; content should be such that students may practise and perfect their abilities (Dhawan, 2020, p. 5). Online programmes should facilitate innovative, interactive, relevant, student-centered, and group-based interactions (Dhawan, 2020, p. 5). Educators must devote a significant amount of work to developing efficient online instruction methodologies. Effective online instructions encourage students to provide comments, encourage them to ask questions, and widen the learner's horizons in terms of course contents. Through online instructions, institutions must focus on pedagogical concerns and stress collaborative learning, case-study learning, and project-based learning (Dhawan, 2020, p. 5). The problem for

educational institutions is not just discovering new technology and implementing it, but also reinventing education to assist students and academic staff seeking digital literacy instruction.

METHODOLOGY

Research Approach and Paradigm

This study adopted a phenomenological research design because it attempted to understand how lecturers at one university in South Africa mitigated the challenges associated with teaching and learning during the COVID-19 lockdown using various innovative strategies. Phenomenology is a qualitative research approach to studying the commonality of a lived experience of an individual or a given group (Neubauer et al 2019). The researcher used the qualitative research approach for this study to define, recognize, and understand the human phenomenon, relationship, and discourse. This study sought to explain the challenges caused by COVID-19 lockdown to the teaching and learning environment and explored how they were mitigated using various innovative technologies for teaching and learning in the context of South Africa. Qualitative research allows researchers to gather, synthesize, and deduce knowledge from people through interviews and observations (Adu et al., 2020b). Interpretivism is the best research methodology for this paper because it is concerned with subjectivity and various realities, and it prefers to investigate problems through the lens of personal experience (Adu et al., 2020b). Their results are frequently not generalizable to whole populations, but rather to unique conditions and circumstances. It is often linked to the compilation of qualitative data, which can result in different interpretations (Adu et al., 2020b). Observations, text and narrative research, interviews, case studies, and audio-visual materials are all used to gather evidence for interpretivism. They describe their findings in great detail.

Participants and Sampling Strategy

Tesch (as cited in Ganeson & Ehrich, 2009) notes that the kind of phenomenon investigated determines the suitable number of participants technically considered in any phenomenological study. The number can be from 10 to 25 participants; taking cognizance that phenomenological studies have been conducted with as few as 6 and as many as 25 participants (Ganeson & Ehrich, 2009). Alase (2017) suggests a sample size of 2 to 25 for a phenomenological research tradition. In this study, the sample consisted of 12 lecturers drawn from one university in Eastern Cape, South Africa. Participants were purposively selected from the faculty of education. They were also full-time lecturers engaged at the university where the study was conducted. Table 1 summarises the socio-demographic variables of the participants.

Table 1. Socio-Demographic Variables of Participants

Participant	Gender	Specialization	Number of Years in Service	Rank
Lecturer 1	Male	Mathematics Education	13	Professor
Lecturer 2	Male	Early Childhood Education	6	Senior Lecturer
Lecturer 3	Female	History Education	8	Senior Lecturer
Lecturer 4	Male	Curriculum Studies	5	Lecturer
Lecturer 5	Female	Accounting Education	3	Lecturer
Lecturer 6	Female	Early Childhood Education	11	Professor
Lecturer 7	Female	Mathematics Education	9	Professor
Lecturer 8	Female	Language Education and Curriculum Studies	7	Professor
Lecturer 9	Female	Early Childhood Education	12	Professor
Lecturer 10	Male	Mathematics Education	5	Senior Lecturer
Lecturer 11	Female	Early Childhood	2	Professor
Lecturer 12	Male	Language Education and Curriculum Studies	7	Lecturer

As shown in Table 1 above, 58.3% of the participants were females while the remaining 41.7% were males. The participants' fields of specialisation cut across Mathematics education, Early childhood education, History, Accounting, Curriculum studies, and Language education. The minimum number of years spent in service by the participants was 2 while the maximum number was 13. 50% of the participants were in the professorial cadre while the remaining 50% were both senior lecturers and lecturers respectively.

Data collection techniques

Primary in-depth interviews were utilised to get information from the participants (Alase, 2017), with semi-structured interviews being favoured above other types of interviews. The participants were interviewed on their opinions based on the research questions set for this paper (Adu et al., 2020). Interviews were conducted mainly via WhatsApp calls, phone calls, and

even in-person amid observation of all the COVID-19 protocols. The interviews were also recorded with a tape recorder to supplement the interviewer's transcript.

Data trustworthiness

The term "trustworthiness" refers to how qualitative data is stable, predictable, dependable, consistent, and accurate in the future, resulting in the same results or outcomes as before. Data trustworthiness is concerned with the consideration given to research findings to confirm whether it is worthy of attention or not (Badaru & Adu, 2021). The study adhered to the four characteristics of qualitative research such as dependability, confirmability, credibility, and transferability (Neubauer et al 2019). The dependability of the data is the same as reliability in quantitative research. It is required that participants are allowed to evaluate the findings, conclusion, and recommendation(s) of the study to ascertain whether or not they are generated from the original narratives given by the informants (Badaru, 2019). Confirmability implies objectivity in a qualitative study. It is a criterion that requires that a researcher's influence and judgement should be minimal in a research process; data, analysis, and interpretation are not generated from the imagination of a researcher; but are supposed to come from participants during a fieldwork experience. The credibility of data entails the design of the interview guide in tandem with the research questions and/or objectives of the study (Badaru, 2019). The draft was subsequently critiqued by another research expert in the faculty. It was then revised considering all the suggestions for an improved version. The final draft of the interview guide was subjected to pilot testing. It was afterward refined before utilising it for data collection during the fieldwork. The participants' views were tape-recorded with their permission. The researchers listened well to the recordings and conducted verbatim transcriptions of the recordings. To ensure the transferability of data, the transcripts were returned to the participants for confirmation that they represented the narrations obtained from them during the data collection phase of the study (Badaru, 2019).

Data analysis

The interviews were analysed with the Atlas 6.2 software application. Since the interviews were tape-recorded, the first step of data processing was to transcribe verbatim the information from the tape recorder into a hard copy. "Credible and trustworthy analysis requires and is driven by displays that are focused enough to permit a viewing of a full dataset in the same location and are arranged systematically to answer the research questions at hand" (Miles, Huberman, & Saldana, 2013, p. 108). This enabled the researchers to form a strong bond with the data. The researchers interpreted the data using written transcriptions and first-hand knowledge from the participants. The textual report produced from the participants' responses was also shared with them to confirm that it aligned with their original views expressed during the fieldwork for data collection.

Ethical considerations

The research was carried out with due consideration and adherenceto ethical practices which

included doing good and avoiding harm, obtaining informed consent,guaranteeing the absence of risk or harm to participants, ensuring privacy, ensuring anonymity, and maintaining confidentiality (Cohen et al., 2013). Firstly, there was an ethical clearance secured from the researchers' institution of affiliation to conduct this study. Secondly, we sought the permission of the relevant authorities of the institution where this study was done. Lastly, we assured the participants of their voluntary participation and were also encouraged to complete and sign the informed consent forms for the study. According to Creswell (2013), the researcher should obtain participants' written approvals before the commencement of a phenomenological study.

RESULTS

This study investigated how faculty of education lecturers at one university leveraged innovation and technology for mitigating the virtual classroom challenges during the COVID-19 lockdown in South Africa. In this section, the qualitative data collected from the participants are presented, analysed, and discussed accordingly.

Lecturers' skills for handling online teaching engagements at a university in South Africa

This intended to find out what skills the participants possess for handling online teaching engagements during the COVID-19 lockdown at a university in South Africa. Almost all the participants, 10 out of 12, complained about the lack of skills and knowledge for online learning and teaching. They further mentioned that they did not get any support from the Department of Higher Education and Training (DHET) on how to make it possible to connect virtually with their students during the COVID-19 lockdown. Most of the participants confirmed they only had the traditional face-to-face teaching skills; which implied that they had poor or no skills for online teaching engagements, *see Table 2*. This finding was a pointer to the fact that they were unable to use technologies such as Blackboard, V-drive, and Microsoft Team for their teaching engagements during the COVID-19 lockdown. Some of these participants had the following to say:

> L1: The only knowledge and skills we have are for traditional face-to-face contact with our students, we are not used to online teaching. Our students do not have the facilities for online learning, and some do not have radios to listen to the lessons that are taught there. For that matter, with the lessons conducted on the radios, students cannot ask questions when they need clarity (A male professor).
>
> L2: No skills whatsoever sir. I have put up over two decades in lecturing. I never expected this and I have never tried it because I am not so good at or versatile about computers the little that I know is to use PowerPoint slides to teach and at times record my students' marks. We are short of learning and teaching resources for this purpose which includes computers at school (A male senior lecturer).

L3: To be honest with you sir, I never thought that one day I will be required to do distance learning, so, I do not have any skill of teaching online, using the technologies like a blackboard, V-drive, Microsoft Team, etc (A female senior lecturer).

L4: The majority of our students are a socio-economically disadvantaged community. Most of their parents are illiterate, they cannot assist them academically. So how can we expect them to assist at this time when the schools are closed? Yes, I try to send work using WhatsApp, V-drive and ask them to share the work with other students, although I know that this may be impossible at some point. Yeah, that's it. That is the only skill I have sir (A male lecturer).

Lecturers' strategies for remote teaching engagements at a university in South Africa

Again, a research question was couched to unearth strategies adopted by the participants for online teaching at a university in South Africa. A majority of the participants, 9 out of 12, used WhatsApp and emails, to send and communicate with their students; with an exception of three of the participants who confirmed that they were able to use Microsoft Team and V-drive for their teaching engagements, *see Table 2*. The following narratives from the participants succinctly describe the findings:

L6: I use Microsoft Team to teach my students because the blackboard is not user-friendly to my students. The majority of my students prefer this to other means. However, very few said they live where there is no network at all (A female Professor).

L10: Sir, with our students the only strategy is to send work, is using email attachments and voice recorded WhatsApp. At times I requested their class representative to meet me physically if I have a big volume of reading materials to give the students. However, quality is compromised and nothing is better compared to the face-to-face (A male senior lecturer).

L12: The majority of our students are a socio-economically disadvantaged community. Most of their parents are illiterate, they cannot assist them academically. So how can we expect them to assist at this time when the schools are closed? Yes, I try to send work using WhatsApp, V-drive and ask them to share the work with other students, although I know that this may be impossible at some point. Yeah, that's it. That is the only skill I have sir (A male lecturer).

Table2. A Summary of Findings

Research Questions	Themes	Sub-Themes/Responses
What skills do lecturers in faculty of education possess for handling online teaching activities at a university in South Africa?	Lecturers' skills for handling online teaching engagements at a university in South Africa	i. Traditional face-to-face teaching skills ii. A few computer skills such as the use of PowerPoint Slides for lesson presentations. iii. Poor Online Skills for use of Blackboard, Microsoft Teams, V-drive.
What strategies did lecturers in the faculty of education use for remote teaching activities during the COVID-19 lockdown at a university in South Africa?	Lecturers' strategies for remote teaching engagements at a university in South Africa	i. Microsoft Teams App ii. WhatsApp messaging and Voice Notes iii. Email Attachments

DISCUSSION

The discussion of results, under this section, is based on the summary provided in *Table 2.* The results reveal that the participants possess traditional face-to-face teaching skills, computer skills such as the use of PowerPoint slides, but have poor skills for online teaching engagements. The strategies used by the participants for remote teaching during the COVID-19 lockdown include Microsoft Teams, WhatsApp messaging and voice notes; and email attachments. These findings are elaborately discussed as follows.

Lecturers' skills for handling online teaching engagements at a university in South Africa

In response to the first research question regarding the lecturers' skills for online teaching engagements, most of the participants disclosed that they did not have more than the skills required for traditional face-to-face teaching; they also narrated difficulty experienced with the use of computer tools and other online technologies like Blackboard and Microsoft Teams which

became the alternative platforms for teaching and learning activities during the COVID-19 lockdown. These findings are not in contradiction with what an Indian study found to be barriers against teaching and assessment during the lockdown period (Joshi et al., 2020). According to this study, teaching and assessment were adversely affected by teachers' lack of training for online engagements, poor awareness of online platforms for teaching, lack of skills and knowledge, and negative attitudes towards the use of technologies for teaching purposes. Lee et al., (2021), in another study, identified a lack of staff capacity that would support the online engagement of teachers and learners as one of the challenges of remote learning. These challenges of lack of adequate digital skills of teachers were noted to have affected the quality of online teaching in schools across Australia, Mexico, South Korea, and the United States (Lee et al., 2021). This lack of digital skills, according to Van Dijk, is caused by inadequacy of education or social support (Rambe & Chipunza, 2013).

Lecturers' strategies for remote teaching engagements at a university in South Africa

An attempt at understanding various strategies used by faculty of education lecturers at a university in South Africa informed the second research question. In response to the question, most of the participants mentioned their strategies which included the use of Microsoft Team Application, WhatsApp messaging and voice notes, as well as the email attachments. These findings are in tandem with the suggestion, for overcoming challenges associated with virtual classrooms, by Dhawan (2020), that communication with students could be facilitated through the use of social media and other several messaging apps Rambe and Chipunza (2013) found WhatsApp to be effectively used for redressing 'some information asymmetries that are often seen among students from poor backgrounds' (p.335). The authors stated further that the creation of a viable technological context is possible through WhatsApp for problem-solving and counselling students regarding issues of academics; widening students' access to a bulk of educational resources irrespective of their locations. The findings also revealed that participants chose the Microsoft Team because of its flexible features for voice recording, video chats, and text messaging. Of course, it is understandable why the participants had to resort to using the Email tool for sending bulky documents such as reading materials and class assessments to the students during the COVID-19 lockdown. Attaching such heavy texts via WhatsApp or Microsoft Team might be a bit difficult to do especially when the internet network is not cooperating well.

CONCLUSION

This paper examines innovation and technology as the solutions to teaching and learning challenges during the COVID-19 lockdown in South Africa. There is a lot to be done by the South African government concerning infrastructure to equip students and lecturers during the "new normal" especially universities in the rural areas. 21st-century teaching should involve technological-driven strategies. With the advent of COVID-19 lockdown, lecturers should be braced up with diverse innovative and technological skills to remain relevant. Students need to

be given opportunities to learn using highly sophisticated technologies for classroom training. The Department of Higher Education and Training (DHET) needs to be more innovative and technologically inclined to provide schools with the digital equipment; and lecturers with the right digital skills and strategies, who can handle the 21st-century technologies for teaching and learning, be appointed at the university levels. All lecturers and students must embrace new technologies and become more innovative and skillful in their thinking and professional practices. It is certain that innovation and technology will continue to drive the teaching and learning activities in the post-pandemic era.

Recommendations

In light of the aforementioned findings, this study would recommend that there is an urgent need for capacity development workshops to equip lecturers with computer and ICT skills, knowledge, and strategies for online teaching delivery and increased provision of adequate learning and teaching facilities in all public educational institutions, and including those in the rural areas. It is also important to organise pieces of training on innovation and effective use of digital technologies for students and how to benefit maximally from virtual learning activities. More importantly, lecturers and students should develop the right mindsets and attitudes towards the adoption and use of ICT facilities for the attainment and sustainability of the country's educational goals.

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