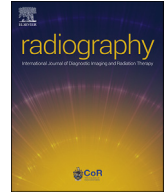




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Online teaching and learning through the students' eyes – Uncertainty through the COVID-19 lockdown: A qualitative case study in Gauteng province, South Africa



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ARTICLE INFO

Article history:

Received 7 July 2021

Received in revised form

19 October 2021

Accepted 29 October 2021

Available online 8 November 2021

Keywords:

COVID-19

Online learning

Teaching and learning

University students

Lockdown

ABSTRACT

Introduction: In South Africa, online learning has been adopted to maintain the momentum of learning. The need for social distancing has resulted in the cancellation of many face-to-face activities that comprised the curriculum within higher education. This study explored the experiences of undergraduate diagnostic radiography students of online teaching and learning during the COVID-19 lockdown period.

Methods: A qualitative case study design was adopted. Purposive sampling was employed to select undergraduate diagnostic radiography students at the study institution. One-on-one online interviews were audio recorded with fourteen (n = 14) students from second to fourth year and were transcribed verbatim. Data were analysed through content analysis.

Results: Two main themes emerged: (1) Maintaining balance in the new 'normal'; (2) Enablers for an inclusive learning environment. The change in the method of teaching has highlighted the requirements for adequate teaching and learning. The students in the study were of the view that they deserve an equal opportunity to quality online education.

Conclusion: The study reveals that the participants were concerned about the transition from face-to-face lectures to the online system. They felt they were required to adjust without adequate consideration of the prerequisites for the process, such as devices and data availability.

Implications for practice: Radiography is both technical and theoretical. Therefore, the integration of online teaching and learning could be used to enhance digital literacy within the South African context.

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Introduction

Coronavirus disease 2019 (COVID-19) was declared a pandemic by the World Health Organization (WHO) on 11 March 2020.¹ COVID-19 is a highly communicable disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) which emerged in Wuhan, China.^{2,3} It spreads among individuals through close contact and has resulted in millions of infections and deaths worldwide.⁴ The COVID-19 pandemic has invoked social distancing, which has become a new 'normal' within communities due to the

unpredictable nature of the reinfection rate.⁵ In the history of humankind, COVID-19 has been the worst threat to human existence.⁶ The emergence of the disease has resulted in education institutions having to take the big leap from contact lectures to online remote teaching and learning since the early spring of 2020.⁷

In South Africa (SA), the learning environment has changed dramatically to maintain the momentum of learning. Khoza and Biyela⁸ describe the learning environment as a learning programme that can be facilitated through contact lectures, as well as online and blended learning. However, the need for social distancing has resulted in the elimination of contact activities that comprise the curriculum in the majority of South African universities.⁹ Online learning was introduced as a means of ensuring that education continues. It can be defined as instruction delivered on a digital device that is intended to support learning.^{10–12} Interestingly the transition to online within the health sciences has been gradual.¹³

Abbreviations: COVID-19, Coronavirus; SA, South Africa; SARS-CoV-2, Severe Acute Respiratory Syndrome Coronavirus; WIL, Work Integrated Learning; WHO, World Health Organization.

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<https://doi.org/10.1016/j.radi.2021.10.018>

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In response to the pandemic, a university in Johannesburg announced that the academic calendar would resume online given the nature of the pandemic.¹⁴ This situation made unprecedented demands on both students and staff members.¹⁵ Etheredge¹⁶ states that the training of diagnostic radiography students is achieved through work-integrated learning (WIL), which requires them to be registered at an academic institution and have placed in an accredited training hospital. Therefore, pre-COVID-19 student learning generally took place in lecture halls (contact learning) and the relevant clinical diagnostic radiography departments.¹⁷

Online teaching and learning platforms were anticipated to facilitate access to quality higher education and expand access to knowledge.¹⁸ However, a study conducted by Mpungose¹⁹ shows that only a few students had access to the online learning platform. This hindered their transition from contact learning to remote learning. The pandemic has highlighted the devastating digital literacy divide in SA.²⁰ Within higher education, digital literacy is an essential skill which students are required to display and utilise to view digital information across various digital technologies.²¹ Le Grange²² suggests that newer technologies that promote tangible growth and results within online teaching and learning be implemented due to the notably vast digital divide faced within SA.

In SA, the pandemic has accelerated the urgent need for lecturers and students to be skilled in online teaching and learning, coupled with long-standing challenges of tuition affordability, perceived exclusivity and issues of access and transformation.²³ In support, Cleophas²⁴ highlights that South Africans entered the COVID-19 lockdown with diverse financial positions, and therefore lecturers should be cognisant of the pre-existing cultural classification. Some students were able to access online learning platforms from the start of the national lockdown, and many were dependent on the government for smartphones, tablets, or laptops and free data.²⁰ The emergence of this disease has influenced change in the higher education system in SA. Therefore, perceptions of the impact of initiatives such as online teaching and learning will yield significant data for teaching and learning practice. This research explored the experiences of undergraduate diagnostic radiography students of online teaching and learning during the COVID-19 lockdown period.

Methods

The study was conducted in Gauteng, one of the provinces in SA, at a comprehensive university. Comprehensive universities are those universities that emerged from the merger of universities and technikons. These universities integrate training that technical and traditional universities provide.²⁵

A qualitative, exploratory, descriptive design was employed. This design enabled the researchers to conduct a naturalistic inquiry, allowing them to attach meaning to the individual perceptions of the participants concerning a particular context in their lives.²⁶ The researchers explored the interpretive phenomenon through communication with the participants. The central question asked was: “How did you experience the COVID-19 lockdown period as undergraduate diagnostic radiography students?” An interview guide with open-ended and probing questions (Table 1) was used to elicit a detailed understanding of the individual perceptions of the students' online teaching and learning experiences during the COVID-19 lockdown period.

Purposive sampling was used in this study and respondents who could provide information relating to the objectives of the study were consciously selected.^{27,28} One-on-one online interviews were conducted via Microsoft Teams due to the COVID-19 regulations

between June and July 2020. The interviews were transcribed verbatim. Permission was sought from the participants through an information letter and consent form shared online via Blackboard, which is a learning environment and learning management system.²⁹ Fourteen (n = 14) undergraduate diagnostic radiography students ranging from second to fourth year of study were interviewed. Students in their first year of study were excluded because of their minimum exposure to conventional and online teaching and learning in higher education. All interviews were recorded and did not exceed an hour. Transcription of all recorded data was done before data analysis.

Ethics

Ethical clearance for the study was received from the Research Ethics Committee of the University of Johannesburg. Participants' names were not documented during the data collection; only the demographic data were documented.

Data analysis

Through sequencing and frequency, certain themes were identified in the data.³⁰ The data collected were subjected to content analysis, according to Bengtsson,³¹ which included decontextualisation, recontextualisation, categorisation and compilation.

Trustworthiness was maintained through four indicators as identified by Lincoln and Guba (1985)³² and suggested by several authors: credibility, transferability, dependability and confirmability.^{33–35} To ensure credibility, the researchers asked the participants to consider their honest opinion regarding online teaching and learning. The researchers also applied reflexivity during data transcription of the interviews. An audit trail of all the data collected was done to ensure dependability. Therefore, the researchers took notes of the interview details. Transferability was maintained through a description of the research setting, the study participants and the research processes followed, to enable similar research to be repeated in a different research setting. To ensure confirmability, the interpretations were scrutinised by both researchers, who acted as independent coders. Direct verbatim quotes from the participants are shared in the results.

Results

A total of fourteen participants were interviewed. Data saturation was reached by the eleventh participant, but three more participants were interviewed to confirm data validity. Demographic details of the participants were recorded, including gender, age, ethnicity, race and level of study. Ten participants in the study were female (71%) and four (29%) were male. The participants' ages ranged from 20 to 33 years. The participants comprised three second-year students (21%), four third-year students (29%) and seven fourth-year students (50%). The findings are discussed in Table 2 below under the themes that emerged.

Conceptualisation of online teaching and learning

Analyses of participants' narratives resulted in two main themes: (1) Maintaining balance in the new 'normal' and (2) Enablers for an inclusive learning environment (Table 2). First, the themes are introduced, then subthemes are substantiated by verbatim quotes from participants. The content analysis that was used on transcripts elicited key quotes that were identified from the data obtained during the interviews with students.

Table 1
Open-ended and probing questions.

Question 1	How did you feel when you heard you were going completely online? <ul style="list-style-type: none"> • Please explain why you would describe online teaching and learning as such.
Question 2	How would you describe online teaching and learning during lockdown? <ul style="list-style-type: none"> • Elaborate on the challenges of working with online teaching and learning methods.
Question 3	Would you describe online teaching and learning as a feasible method for all students? <ul style="list-style-type: none"> • Did you have access to all your teaching and learning modules? • Would you say the necessary assistance was offered by the university?

Table 2
Summary of emerged themes.

Theme	Subtheme
Maintaining balance in the new 'normal'	<ul style="list-style-type: none"> • Loss of the sense of purpose. • Change in pattern of learning. • Other responsibilities.
Enablers for an inclusive learning environment	<ul style="list-style-type: none"> • Availability of necessary resources. • Student motivation • Facilitated learning • Lecturer support

THEME 1: maintaining balance in the new 'normal'

This theme concerns questions 1 and 2 (Table 1). Three sub-themes were identified by participants: loss of sense of purpose, changes in the pattern of learning and other responsibilities.

Subtheme 1: loss of sense of purpose

Some participants expressed concerns relating to the emergence of COVID-19. They identified the challenges that they faced and anxiety they experienced due to the change from contact learning to online teaching and learning, coupled with clinical responsibilities as per WIL.

“It was stressful. At first, we worked a bit through it so that made it worse cause it was something I did not expect, and we have not faced a pandemic before, so it was new to everyone. At the same time, we were worried about work and campus and are going to graduate are we going to finish this year. How is it going to happen? Are we going to go to campus?” (Participant 7)

“Everything stopped I became lost, and I did not know what to do. I did not know what is happening at school (referring to campus). Everything was just harder at the beginning” (Participant 12)

“I am dealing with a lot of anxiety because there is no end in sight, so I feel very stressed out, I feel I am kind of thrown into the deep end.” (Participant 1)

“ ... My experience has been bad. Sometimes we had no electricity for 5 days due to cable theft. And I needed to study and prepare for exams. My performance has dropped ... ” (Participant 2)

Participant 8 had challenges with network connectivity and also expressed concern for peers.

“When it comes to attending lectures that is also where I had a problem, where I stay, I have network connectivity issues. Fortunately, most lectures were recorded so I could use the nightshift data to catch up.” (Participant 8)

“Umm ... Not all students have devices. It is a disadvantage to those students that don't have devices as well as network issues. In some places the connectivity is bad. Some students will not be able to attend because the signal is bad.” (Participant 8)

Subtheme 2: changes in the pattern of learning

Participants believed that contact learning was more beneficial than online teaching and learning as it can be accessed by all students. Students also felt they were unable to interact adequately with the lecturer through online teaching and learning.

“The online teaching and learning, a lot of the time was wasted on us getting used to it. Well online teaching and learning is not as real. We do not learn. I would much rather be on campus.” (Participant 12)

“ ... Certain students are not familiar with how to use a computer and they don't have access to a lot of things that will allow them to support online learning.” (Participant 5)

“ ... not being able to watch my lectures on time, this means you cannot ask any questions you just have to watch the recorded version afterwards. And some lecturers were not recording their sessions.” (Participant 1)

“Not all students have access to internet or network coverage and devices. Only part of the students has access to the online learning I think it's unfair to those students that don't have it.” (Participant 13)

Subtheme 3: other responsibilities

Some participants revealed that they were at their family residence during the lockdown period, which contributed to an imbalance in their learning.

“I am from the village. So, staying in a village. You must get up early and cook for everyone Babysit and take care of everyone at night everyone is sleeping You are also tired cause you were busy with Online learning and babysitting. Being at res (campus residence) is peace of mind because at home you are limited.” (Participant 12)

“At home, it is difficult to study or do your work, they don't take online learning seriously they take it as if you are lazy. You have to first do the house chores and can only study at night when everyone is asleep, and you are tired.” (Participant 2)

Dube³⁶ points out that the South African government encouraged online teaching and learning during COVID-19, but that this method does not consider the students that are originally from rural areas where issues with internet connectivity and incompatible devices put them at a disadvantage. A study by Baloran³⁷ documented how students revealed that they were resistant to the introduction of online teaching and learning because of the technology involved, coupled with a lack of finances. The overall findings of the current study reveal that the participants believed that all students should be provided with equal opportunities to transition to online teaching and learning. Dube³⁶ is further of the view that online teaching and learning discriminates against underprivileged students, whereas students from urban areas benefit. Recordings should be made available, especially for those students that cannot attend online lectures or that need further clarity on parts of the lecture.³⁸ Furthermore, poor network bandwidth is experienced in neglected geographical areas and population groups, especially in rural areas and among poor populations.³⁹

THEME 2: enablers for an inclusive learning environment

This theme is concerned with question 3 in Table 1. The data analysis resulted in four subthemes: availability of necessary resources, student motivation, facilitated learning and lecturer support.

Subtheme 1: availability of necessary resources

Most participants mentioned resources that they deemed necessary to assist in making online teaching and learning feasible for all students. The participants felt that they had different privileges regarding resources to facilitate their online teaching and learning.

“... I would not say it is a feasible method for all students as I did say in the beginning, I am a bit fortunate as I have a laptop which I can use some people may not have the same resources. But for me, I do think it is feasible because I do have my laptop and the data, I prefer it.” (Participant 1)

“... not, all students are equipped as others when it comes to internet depends on the person some might be shy over online lectures compared to contact lectures where we can see you.” (Participant 14)

Subtheme 2: student motivation

Participants revealed that a shortage of the necessary resources, coupled with a lack of computer skills, resulted in a lack of motivation towards learning online.

“I had to study and do everything by myself no motivation, no self-motivation and difficult to work at home as the family do not understand and support.” (Participant 2)

“One of the things I know I struggled with is not having physical interactions with the lecturer uhm ... sitting with the lecturer and trying to figure something out if I am struggling with something. It's been a bit difficult having to email lecturers back and forth because sometimes a loss in communication that way.” (Participant 4)

Subtheme 3: facilitated learning

Participants provided reasons for their preference for contact learning as they strongly felt that it is more reliable and encouraging.

“I prefer more contact lessons because you can engage with the content better than when you study at home.” (Participant 5)

“One more thing I think also being in a class environment is more conducive to learning than being at home in my bedroom because I am distracted by so many things you know I want to take my phone out and watch Netflix on the side. It is a bit of a distraction to be at home at the same time. Once you're in class in a lecture you know you have to focus in front of a lecturer.” (Participant 1)

“Well online learning is not as real. We don't learn. I would much rather be on campus.” (Participant 12)

Subtheme 4: lecturer support

In contrast, some participants provided positive responses regarding lecturer support during the transition. They also expressed how they were aware of the efforts made by the lecturers during this time.

“The university has been preparing for it, so they were ready. Some lecturers had been using it here and there. I wasn't used to it, so I had to learn and now I am used to it, but I miss going to campus.” (Participant 3)

“My lecturers are so supportive; they are there for us. I have such great lecturers.” (Participant 11)

“Seeing the amount of work that lecturers put in.” (Participant 12)

“I think all lectures tried their best.” (Participant 13)

After the responses were analysed, it was clear that the learning environment needs to be enabled for all students. Immediate action needs to be taken to make online teaching and learning feasible, especially for underprivileged students who need assistance with access to this new innovation and to benefit from it.⁴⁰ Literature shows that students are not used to the online teaching and learning method, resulting in a pessimistic response. This is due to the increased responsibility that students must carry regarding their learning.^{41,42} Some of the participants seemed to despair about their limited computer literacy. Even though online teaching and learning seem to be successful in providing learners with access to high-quality learning, most universities need to concentrate on ensuring that this method does not further exacerbate the existing inequalities regarding access and quality of learning.⁴² Mahmood³⁸ suggests that a structured lecture plan, use of videos and audio for lessons, applicable software installation and technical support are necessary for facilitating online learning. In contrast to the negative perceptions of the introduction of online teaching and learning, some students appreciated and recognised the attempts by lecturers to ease the transition. A report by Ligami⁴³ sheds light on humanising teaching and learning. Cited in this report, Gachago states that, “Online teaching is not just transferring information but [about] creating a relationship. It is crucial to realise that students are isolated. One of the biggest challenges that have caused a lot of conversation is the lack of trust between the students and lecturers.”

Discussion

This study aimed to determine students' experiences of online teaching and learning and their acceptance of this process during the COVID-19 lockdown. Online teaching and learning are emergent new methods to maintain continuity of medical education during the COVID-19 pandemic as a result of universities being shut down.³ The results have shown that students in Gauteng, SA, need interventions to foster feasible online teaching and learning. Students cited challenges with connectivity and data costs as the main reasons for their inability to access most online lectures. Several authors have shown that unavailability of data,^{4,5} coupled with constant bouts of loadshedding, result in connectivity issues.⁴⁴

A study by Bawa¹⁵ shows that online teaching and learning are more ineffective regarding academic success than contact learning. The current study shows that some students were not comfortable with this method of learning due to the challenges of not being tech-savvy or not having suitable or compatible devices. Similarly, Mishra, Gupta and Shree⁴ reveal that some students struggled to concentrate during online lectures as they were not familiar with learning through their devices. Furthermore, another study shows that the unavailability of devices to ensure all students equal opportunity to access online teaching and learning may affect students attending scheduled lectures.^{10,37}

The results of the current study also show that the participants expressed feelings of anxiety and a constant sense of being overworked within their clinical practices. Additionally, Rafati, Nouhi, Sabzevari and Dehghan-Nayeri⁴⁵ mention issues with clinical schedules and students being overwhelmed by duties within the clinical setting.

The numerous challenges raised by the participants in the current study accentuate the necessity to attend to all student needs. Moreover, there is a lack of knowledge on how the various universities are coping within the new work setting. This requires considerable attention and research to identify the factors that may be contributing to this interference in online teaching and learning. Some 300 academics in SA presented a motion opposing university management teams which maintained that 2020 yielded favourable outcomes.⁴³ These academics further suggested that the ignorance of management regarding the effects of COVID-19 restrictions will result in negative implications for higher education.

Limitations

The study was confined to only one institution of higher education within Gauteng, SA. As such the study was unique to this specific context. In future, more institutions could be included. Furthermore, during interviews, the participants could not switch on their cameras due to data constraints.

Recommendations

All requirements are to be established before online teaching is initiated. Moreover, online teaching and learning programmes must highlight the importance of continuity in education. Constant structural support to the participants from family and lecturers to maintain development and a positive attitude towards online teaching and learning.

Conclusion

The results reveal that students' experiences of online teaching and learning are subject to the availability or not of various resources. Difficulties mentioned are data, network coverage, load-shedding and being able to attend lectures while still being expected to be at their respective clinical departments. In line with the literature, the participants indicated their apathy due to the above difficulties but remained hopeful that things will return to normal and that contact learning will in fact return. The COVID-19 pandemic has negatively impacted the participants due to the current digital divide, thereby adversely affecting their academic performance. Participants also alluded to heightened precursors due to working with COVID-19-positive patients and the increased number of clinical hours while being expected to maintain their academic stature. This research has found that constant communication with students is key to integrating the enforced new method of online teaching and learning. "In other words, we need physical distancing, not social distancing."⁴³ Both lecturers and students require continual support and skills development during the transition from contact to online teaching and learning to counteract incidences such as the current pandemic. As a crucial positive step towards online teaching and learning, sustainable teaching management should be employed in programmes to avoid detrimental effects on students' WIL.

Conflict of interest statement

None.

Acknowledgements

The authors wish to thank all the participants who contributed to the study. This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

References

1. World Health Organization. *WHO Director-General's opening remarks at the media briefing on COVID-19 – 11 March 2020*. <https://www.who.int/director-general/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19--11-march-2020>. [Accessed 19 January 2021].
2. Remuzzi A, Remuzzi G. COVID-19 and Italy: what next? *Lancet* 2020;**395**(10231):1225–8. [https://doi.org/10.1016/S0140-6736\(20\)30627-9](https://doi.org/10.1016/S0140-6736(20)30627-9). [Accessed 12 January 2021].
3. Al-Balas M, Al-Balas HI, Jader HM, Obeidat K, Al-Balas H, Aborajoo EA, et al. Distance learning in clinical medical education amid COVID-19 pandemic in Jordan: current situation, challenges, and perspectives. *BMC Med Educ* 2020;**20**(341):1–7. <https://doi.org/10.1186/s12909-020-02257-4>. [Accessed 5 February 2021].
4. Mishra L, Gupta T, Shree A. Online teaching-learning in higher education during lockdown period of COVID-19 pandemic. *Int J Educ Res* 2020;(100012): 1. <https://doi.org/10.1016/j.ijedro.2020.100012>. [Accessed 1 November 2020].
5. Muthuprasad T, Aiswarya S, Aditya KS, Jha GK. *Students' perception and preference for online education in India during COVID-19 pandemic*. *Social Sciences and Humanities Open Access*; 2020. <https://ssrn.com/abstract=3596056> or <https://doi.org/10.2139/ssrn.3596056>. [Accessed 18 August 2020].
6. Wadood A, Mamun M, Rafi A, Islam K, Mohd S, Lee LL, et al. Survey on knowledge, attitude, perception and practice among university students during COVID-19 pandemic. *J Sci Med* 2020;**3**:67–79. <https://doi.org/10.28991/Sci-Med-2021-03-SI-9>. [Accessed 12 August 2021].
7. Bao W. *COVID-19 and online teaching in higher education: A case study of Peking University*, 2; 2020. p. 113–5. <https://doi.org/10.1002/hbe2.191.2>. [Accessed 14 November 2020].
8. Khoza SB, Biyela AT. Decolonising technological pedagogical content knowledge of first-year mathematics students. *Educ Inf Technol* 2020;**25**:2665–79. <https://doi.org/10.1007/s10639-019-10084-4>. [Accessed 12 January 2021].
9. Sobuwa Y. *Universities cancelling in-person classes due to coronavirus*. *Sowetan Live*; 2020. <https://www.sowetanlive.co.za/news/south-africa/2020-03-16-universities-cancelling-in-person-classes-due-to-coronavirus/>. [Accessed 18 January 2021].
10. Ferri F, Grifoni P, Guzzo T. Online learning and emergency remote teaching: opportunities and challenges in emergency situations. *Societies* 2020;**10**(4):86. <https://doi.org/10.3390/soc10040086>. [Accessed 12 September 2021].
11. Maatuk AM, Elberkawi EK, Aljawarneh S, Rashaideh H, Alharbi H. The COVID-19 pandemic and e-learning: challenges and opportunities from the perspective of students and instructors. *J Comput High Educ* 2021. <https://doi.org/10.1007/s12528-021-09274-2>. [Accessed 28 June 2021].
12. Kumar A, Sarkar M, Davis E, Morphet J, Maloney S, Ilic D, et al. Impact of the COVID-19 pandemic on teaching and learning in health professional education: a mixed methods study protocol. *BioMed Central Med Educ* 2021;**21**(439):1–7. <https://doi.org/10.1186/s12909-021-02871-w>. [Accessed 8 October 2021].
13. Bediang G, Stoll B, Geissbuhler A, Klohn AM, Stuckelberger A, Nko'o S, et al. Computer literacy and e-learning perception in Cameroon: the case of younede faculty of medicine and biomedical sciences. *BMC Med Educ* 2013;**13**(57):1–8. <http://www.biomedcentral.com/1472-6920/13/57>. [Accessed 20 June 2020].
14. Parekh A, Sinha S. *Teaching remotely*. University of Johannesburg; 2020. <https://www.uj.ac.za/coronavirus/Pages/Teaching-remotely.aspx>. [Accessed 18 January 2021].
15. Bawa P. *Learning in the age of SARS-COV-2: a quantitative study of learners' performance in the age of emergency remote teaching*, 1; 2020. <https://doi.org/10.1016/j.caeo.2020.100016>. 100016. [Accessed 15 December 2020].
16. Etheredge H. *Rethinking responsibility in radiography: some ethical issues in South Africa*. *SA J Radiol* 2011;**15**:10–3.
17. HPCSA. *Guidelines for the evaluation and accreditation of higher education institutions and clinical training facilities*. 2019. https://www.hpcsa.co.za/Uploads/RCT/Accreditation/Guidelines_for_the_evaluations_of_HEI%20-%20Radiography_and_Clinical_Technology_Jan_2019.pdf. [Accessed 4 October 2021].
18. De Moura VF, De Souza CA, Viana AB. The use of massive open online courses and the functional value perceived by students. *Comput Educ* 2021;(104077): 16. <https://doi.org/10.1016/j.compedu.2020.104077>. [Accessed 7 December 2020].
19. Mpungose CB. Emergent transition from face to face to online learning in a South African university in the context of the Coronavirus pandemic. *Humanities and Social Sciences Communications* 2020;**7**(113):1–9. <https://doi.org/10.1057/s41599-020-00603-x>. [Accessed 6 February 2021].
20. Hanekom P. *Covid-19 exposes South Africa's digital literacy divide*. *Mail & Guardian*; 2020. <https://mg.co.za/opinion/2020-09-08-covid-19-exposes-south-africa-digital-literacy-divide/>. [Accessed 25 November 2020].
21. Chan BSK, Churchill D, Chiu TKF. Digital literacy learning in higher education through digital storytelling approach. *J Int Educ Res* 2017;**13**(1):1–13. <https://doi.org/10.19030/jier.v13i1.9907>. [Accessed 15 June 2021].

22. Le Grange L. *Covid-19 pandemic and the prospects of education in South Africa*. Prospects; 2020. <https://doi.org/10.1007/s11125-020-09514-w>. [Accessed 2 February 2021].
23. Lues R, Padayachee A, De Jager H. *Universities of technology in the post-COVID-19 landscape*. Africa Edition. University world news; 2020. <https://www.universityworldnews.com/post.php?story=20200713153430109>. [Accessed 18 August 2020].
24. Cleophas F. *Covid-19 pandemic highlights challenges of online teaching and learning*. Mail & Guardian; 2020. <https://mg.co.za/education/2020-08-06-covid-19-pandemic-highlights-challenges-of-online-teaching-and-learning/>. [Accessed 15 December 2020].
25. Department of Education. *Creating comprehensive universities in South Africa: a concept document*. 2004. <https://www.dhet.gov.za/Management/Support/Creating/Comprehensive/Universities/in/South/Africa/A/oncept/document.pdf>. [Accessed 4 October 2021].
26. Pelzang R, Hutchinson AM. Patient safety issues and concerns in Bhutan's health-care system: a qualitative exploratory descriptive study. *BMJ Open* 2018;**8**:e022788. <https://bmjopen.bmj.com/content/bmjopen/8/7/e022788.full.pdf>. [Accessed 7 October 2021].
27. Burns N, Grove SK. *Understanding nursing research: building an evidence-based practice*. 5th ed. Missouri: Elsevier Saunders; 2011.
28. Edmonds WA, Kennedy TD. *An applied reference guide to research designs: quantitative, qualitative and mixed methods*. Thousand Oaks, California: Sage; 2013.
29. Blackboard Incorporated. *Learning management system (LMS) and software*. 2021. <https://www.blackboard.com/teaching-learning/learning-management>. [Accessed 15 June 2021].
30. Miles MB, Huberman AM, Saladana J. *Qualitative data analysis: a methods sourcebook*. 3rd ed. Los Angeles: Sage; 2014.
31. Bengtsson M. How to plan and perform a qualitative study using content analysis. *Nursing Plus Open* 2016;**2**:8–14. <https://doi.org/10.1016/j.npls.2016.01.001>. [Accessed 19 May 2020].
32. Lincoln YS, Guba EG. *Naturalistic inquiry*. Newbury Park, Ca: Sage Publications; 1985.
33. Kumar R. *Research methodology: a step by step for beginners*. 3rd ed. Los Angeles: Sage; 2011.
34. Holloway I, Galvin K. *Qualitative research in nursing and healthcare*. England: Wiley Blackwell; 2017.
35. Korstjens I, Moser A. Series: practical guidance to qualitative research. Part 4: trustworthiness and publishing. *Eur J Gen Pract* 2018;**24**(1):120–4. <https://www.tandfonline.com/doi/full/10.1080/13814788.2017.1375092>. [Accessed 7 October 2021].
36. Dube B. Rural online learning in the context of COVID-19 in South Africa: evoking an inclusive education approach. *REMIE – Multidisciplinary J Educ Res* 2020;**10**(2):135–57. <https://doi.org/10.4471/remie.2020.5607>. [Accessed 6 February 2021].
37. Baloran ET. Knowledge, attitudes, anxiety, and coping strategies of students during COVID-19 pandemic. *J Loss Trauma* 2020;**25**(8):635–42. <https://doi.org/10.1080/15325024.2020.1769300>. [Accessed 20 June 2020].
38. Mahmood M. Instructional strategies for online teaching in COVID-19 pandemic. *Human Behav & Emerging Technol* 2020;**3**:199–203. <https://doi.org/10.1002/hbe2.218> \|o "10.1002/hbe2.218"10.1002/hbe2.218. [Accessed 18 September 2020].
39. OECD. *Strengthening online learning when schools are closed: the role of families and teachers in supporting students during the COVID-19 crisis*. Organisation for Economic Co-operation and Development, Paris, https://read.oecd-ilibrary.org/view/?ref=136_136615-o13x4bkowa&title=Strengthening-online-learning-when-schools-are-closed&_ga=2.35201057.1649871877.1625493291-1776805290.1625151415. [Accessed 22 May 2021].
40. Landa N, Zhou S, Marongwe N. Education in emergencies: lessons from COVID-19 in South Africa. *Int Rev Educ* 2020;**67**:167–83. <https://doi.org/10.1007/s11159-021-09903-z>. [Accessed 12 January 2021].
41. Coman C, Tîru GL, Mesesan-Schmitz L, Stanciu C, Bularca MC. Online teaching and learning in higher education during the Coronavirus pandemic: students' perspective. *Sustainability* 2020;**12**(24):10367. <https://doi.org/10.3390/su122410367>. [Accessed 15 June 2021].
42. OECD. *Learning remotely when schools close: how well are students and schools prepared? Insights from PISA*, Organisation for Economic Cooperation and Development, Paris, https://read.oecd-ilibrary.org/view/?ref=127_127063-iiwm328658&title=Learning-remotely-when-schools-close&_ga=2.35201057.1649871877.1625493291-1776805290.1625151415. [Accessed 22 May 2021].
43. Ligami C. *South Africa 'Humanise online teaching and learning'*. University World News (Africa edition); 2021. <https://www.universityworldnews.com/post.php?story=20210609201303562>. [Accessed 8 October 2021].
44. Laher AE, Van Aardt BJ, Craythorne AD, Van Welie M, Malinga DM, Madi S. 'Getting out of the dark': implications of load shedding on healthcare in South Africa and strategies to enhance preparedness. *S Afr Med J* 2019;**109**(12). <http://www.samj.org.za/index.php/samj/article/view/12786>. [Accessed 18 March 2021].
45. Rafati F, Nouhi E, Sabzevari S, Dehghan-Nayeri N. Coping strategies of nursing students for dealing with stress in clinical setting: a qualitative study. *Electron Physician* 2017;**9**(12):6120–8. <https://doi.org/10.19082/6120>. [Accessed 9 March 2020].