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One university different modes of delivery: An analysis of lecturers' teaching experiences in conducting ICT practical sessions at a rural Eastern Cape university during the COVID-19 pandemic

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Abstract
In this empirical paper, we analysed lecturers' teaching experiences in practical sessions in ICT during the COVID-19 pandemic at a rural university. The reason for writing this paper is to provide new insights into existing literature in that although there are articles on teaching under the COVID-19 pandemic, this paper specifically examines how teaching ICT practical lessons was undertaken remotely during the COVID-19 pandemic. A quantitative research methodology was utilised using closed-ended questionnaire as a data collection instrument. Sampling was done using a census sampling technique. The findings derived from this study were positive in that they revealed how a good majority of lecturers were able to use virtual learning environments for practical sessions in ICT lessons. The implications were that teaching ICT practical classes online could go on during the COVID-19 pandemic. The study concluded that the COVID-19 pandemic is a game-changer that should compel higher education institution to adjust to the new normal such as migrating from the traditional face-to-face classroom to the remote modes of teaching and learning. The study recommends that all lecturers at WSU be skilled in using practical ICT sessions for teaching all courses that require practical sessions.

Key words: Online learning, Virtual learning environment, Practical session, Information and Communication Technology (ICT)

Introduction

After the Corona virus was first being reported in Wuhan, China, in December 2019 (Brammer & Clark, 2020; Chen, et al., 2020; Marinoni, et al., 2020), the world, with all its advanced technologies, had no immediate way to prevent or stop the deadly novel COVID-19 pandemic (Dube & Moyo, 2021), resulting

in it being declared a pandemic by the World Health Organisation (WHO) (Sohrabi, et al. 2020). Following this declaration, the world saw the largest disruption which had not been seen in history (Zimmerman, 2020) in literally all spheres of life, including in all levels of education (Anifowoshe, et al., 2020; Djajadikerta, et al., 2021; Engzell, et al., 2021). Face-to-face classes were cancelled (Adu, et al., 2022; Bedrossian, 2021; Dube, et al., 2022) and Higher education institutions (HEIs) were closed (Norhunaini, et al., 2020; Soni, 2020; Toquero, 2020) whereby staying at home was made compulsory in order to maintain social distancing (Bao, 2020; Crawford, et al., 2020; Lim, 2020). Before conventional activities resumed (Kaur, 2020), learning and teaching (L&T) in HEIs was conducted in an emergency remote teaching via virtual learning environments (VLEs) (Konyana & Motalenyane, 2022; Moyo, et al., 2022; Shava, 2022) to ensure non-stop teaching and learning (Almazova, 2020). This study provides analysis of lecturers' teaching experiences in ICT practical session at a rural Eastern Cape university.

The rest of this paper is divided as follows: literature review, statement of the problem, research methodology, results and discussion, conclusion, recommendations, acknowledgements and references.

Literature Review

A study by Badaru and Adu (2022) reveals how a vast majority of South African universities run their classes using a variety of VLEs. With the existence of VLEs, the e-learning process is expected to continue and not have an impact on student understanding (Almarzooq, et al., 2020; Creţan & Light, 2020; Heyang & Martin, 2020). However, since Covid-19 has posed significant challenges, it has, at the same time, triggered a learning revolution and created space to reshape the *status quo* (Bedrossian, 2021; Holfrod & Morgan, 2020; Hove & Dube, 2021; Kandri, 2020; Razami & Ibrahim, 2021), making access to practical sessions in education a challenge (Soudien, et al., 2021). In study sectors such as computing, programme outcomes stress the importance of developing theoretical (content) and practical (processes) aspects (Gamage, et al., 2020). When developing the practical aspects, special emphasis is given to the activities that teach students experimental methods, how to synthesise observations and laboratory practices (Gamage, et al., 2020). As a result of offering courses via VLEs due to social distances (Best, 2020), limitations have been noted when it comes to practical sessions (Gamage, et al., 2020). When working in a laboratory setting, as noted by Gamage, et al. (2020), there is no hands-on exposure to operating the complicated instruments and machinery and to appreciate the subtleties of being immersed in such an environment. With South Africa's high inequality rates, high levels of poverty and high youth unemployment, the lack of access to quality education due to the COVID-19 pandemic has the potential to suppress Sustainable Development Goal 4 (SDG4) whose aim is to 'ensure inclusive and equitable quality education and promote lifelong learning opportunities for all' (United Nations, 2018).

Disruptions to the social order due to the coronavirus disease (COVID-19) are well documented in literatures (Adigun & Ndwandwe, 2022). The consequences of the global outbreak of COVID-19, including the switch from face-to-face classes to online and the acceleration of digitalisation, has substantially increased the number of publications focused on e-learning from various angles (Nikou & Maslov, 2021). Due to lack of substantive literature on the use of e-learning for practical sessions in ICT, there are still calls for more research focused on e-learning and blended modalities in higher education (HE) considering the expected growth for the coming years (Fernández-Batanero, et al., 2021). Thus, our initial impetus to embark on this study arose from our careers in lecturing during the COVID-19 pandemic since 2020 where we have discovered and acknowledged the magnitude and the daunting nature of lecturing inequalities in terms of mode of delivery amongst different modules. We have every expectation that many research papers will be published in the months and years ahead that will examine empirically many issues related to the COVID-19 pandemic. However, 'a problem shared is a problem halved' and such research papers will not meet the pressing need of lecturers to share recent research of L&T practical modules via VLEs. This study analyses lecturers' teaching experiences in practical session in ICT during the COVID-19 pandemic at a rural university. The study is a unique study and will make an original contribution because as stated earlier, an eclectic search reveals that a study of this nature has never been done at this level in the country. Last, the study provides valuable inclusive and comparative lessons and challenges faced by

academics in the field of ICT in dealing with this extraordinary circumstance, especially since these three courses require practical sessions.

The improvement of the quality of school education in the era of digitalisation is becoming an urgent global problem (Gaiduk et al., 2021; Hove and Dube, 2021; Omodan and Diko, 2021; Tsakeni, 2021; Wolhuter and Jacobs, 2021). As noted by Sangter, et al. (2020), the manner of operating HEIs remotely during the COVID-19 pandemic have varied and continue to vary around the world, and on individual, departmental and institutional level. While different delivery models of online L&T (e.g., blended learning, fully online, or virtual classroom) have been around for some time (Means, et al., 2014), not all universities globally have had sufficient infrastructure and support systems, and experiences, to deliver an online, especially a remote virtual classroom, model. More crucially, there had never been an extraordinary event before COVID-19 that forced universities globally to shift all of L&T processes to a digital model quickly on very short notice (Djajadikerta, et al., 2021). The study is set against the background that as a result of the COVID-19 pandemic, Walter Sisulu University (WSU), a rural-based university in the Eastern Cape province, South Africa, was forced to re-strategise its efforts towards teaching and learning to cater for its students, especially the first-year students, who were still being introduced to online modes of learning (Songca, et al., 2021). Much as Songca, et al. (2021) illustrate how prepared WSU was for remote leaning, in administering this remote type of learning, there were challenges from both lecturers and students with regard to learning by VLEs. While the former suffered from lack of knowledge and lack of some of technical skills (Grishchenko, 2020; Makura, 2022; Omodan, 2022), the latter experienced challenges such as failing to be interactive with modern digital platforms such as Blackboard, inadequate knowledge on how online learning works, failure to access the internet due to poor geographical locations, lack of laptops to support online learning (Masha, 2021).

As revealed by various authors (e.g., Bonk & Graham, 2006; Onete, et al., 2014; Huang, et al., 2020), learning by VLEs provides easier access to learning, promotes flexibility so that students can overcome space and time limitations and offers new potential for the teaching process to be focused on the learners' needs and possibilities, emphasizing different learning styles, including visual, auditory and kinesthetic learners (VAKS). Thus, the 2020 COVID-19 crisis has significantly accelerated the move toward the online environment, on an untested and unprecedented scale (Burgess & Sievertsen, 2020). Further, the COVID-19 pandemic caused several socio-economic interruptions that further widened structural inequalities (Engzell, et al., 2021; Ozili, 2020). These included, among others, improper teaching methods.

Thus, the root cause of the increased risk of students from rural areas falling behind in education during a pandemic can be traced to the lack of access to alternative learning platforms and lack of access to ICT learning tools (UNICEF, 2020). The lack of access to ICT tools can be understood by exploring material access and mode of delivery challenges (Mishra, et al., 2020). Drawing from this background, in this study we analyse lecturers' teaching experiences in practical session in ICT during the COVID-19 pandemic at a rural university. WSU was chosen due to its location in a remote rural area where internet connectivity and mode of delivery challenges are often experienced.

Recent developments have prompted universities around the world to shift towards online education, and evolutions in ICT have contributed to the emergence of new and innovative education methods for students (Kauppi, et al., 2020). Learning via VLEs provides easier access to learning, promotes flexibility so that students can overcome space and time limitations and offers new potential for the teaching process to be focused on the learners' needs and possibilities, emphasizing different learning styles (Huang, et al., 2020). In this context, the 2020 COVID-19 crisis has significantly accelerated the move toward the online environment, on an untested and unprecedented scale (Burgess & Sievertsen, 2020). To date, measures of social distancing and school closing impacted the educational system around the world, and tremendous effort was put in over a very short period (Bao, 2020; Lim, 2020; QS, 2020). This section reviews the literature of this paper under the following sub-headings: Structural problems of an online-only world; Challenges of Online Delivery; E-readiness ICT classroom; and How it is done.

Structural Problems of an Online-Only World

Pre-COVID-19, the nature of HE in teaching ICT appears to have been predominately 'traditional' in the sense that ICT education was dominated by large classes and small group tutorials. It is our opinion that a listing of every suggestion made by the plethora of authors regarding online teaching would consume hundreds of pages, more pages than this article allows. Nearly all of the contributions concentrate on the issues, challenges and opportunities of moving from a structural perspective. It is, perhaps, surprising that so few dwell on the issue of teaching ICT practical sessions during the COVID-19 pandemic.

The digital revolution has changed the way ICT teachers are expected to deliver their lessons in their respective classrooms (Skhephe, et al., 2020). Furthermore, in the 21 century a lot of information is now available via technology than any one person could ever hope to acquire. In this study literature on the use of technological skills in ICT classroom has been reviewed under the separate sub-headings. As ponied by Oliveira (2015), for ICT classrooms to remain relevant, continuous changes and improvements are necessary in the subject area. What this means, is that learning and teaching processes must keep up with the technological innovations which ICT lecturers are adopting. Thus, for ICT learners to acquire the weights and potentials connected with heightened worldwide competition, a variety of basic skills is needed, often with the aid of technology. As technology use in ICT classrooms is now deemed to be as crucial, it permits continuous testing to determine whether learners have mastered the contents of the materials presented to them (Hammond, 2013).

Challenges of Online Delivery

During a COVID-19 pandemic, the use of VLE platforms could not be avoided (Moorhouse, 2020). A point to note, however, is that although online learning attempts to provide flexibility to study ubiquitously for both the instructors and learners (Abe, 2020), it is without its unending challenges (Norhunaini, 2020). Several factors become obstacles so that the application of e-learning becomes ineffective as a distance learning process (Chan & Ngai, 2012). Well-trained lecturers, the availability of ICT (Smith & Mitry, 2008; Xiangqian & Fuqing, 2012) and the level of difficulty of the course (Halawi, et al., 2009) are the main factors for the successful implementation of e-learning. Notably, the use of VLEs for lecturing under the COVID-19 pandemic is closely related to student understanding. However, how students understand certain lectures when practical things had to be done and displayed is a question that requires answers.

As highlight by Landrum (2020), the reality that technological infrastructure must be well equipped to ease learning via VLEs, it also can enhance students' ability to perform online classes and satisfy with perceived usefulness of learning via VLEs. However, the use of VLEs has its own share of problems. These include the enormous difficulty by many HEIs in using VLE platforms that cannot meet students' expectations (Saade, 2003), resulting in unexpected failure (Kilmurray, 2003) as well as in students being discontented, dissatisfied and displeased with their online learning experience (Bristow, et al., 2011).

Many of the articles reviewed on the topic of effective learning refer to the seven principles stated by Chickering and Gamson (1987): (1) Facilitating contact between student and faculty academic and non-academic staff; (2) Encouraging collaboration between students; (3) Encouraging student engagement and active learning; (4) Giving meaningful and timely feedback; (5) Emphasizing time on task; (6) Communicating high expectations and (7) Respecting diverse talents and ways of learning (Gorsky & Blau, 2009). These principles hold in the context of online education as well, and much of the discussion around the quality of the online education process revolve around these performance criteria. However, there are notable barriers, among them, lack of asynchronised communication for modules that require kinesthetic and practical sessions.

High level aims of experimental work in ICT curricula are developing experimental design, familiarising students with equipment techniques and materials and developing practical skills. The online delivery of laboratory work can be effectively designed to achieve most of these approaches except certain elements of hands-on, practical exercises. Teaching via VLEs demands reliable resources to get online and a computer, laptop, tablet or a smart phone at home. According to the National Center for Education Statistics (USA), only 87% of U.S. households own or use a computer at home and where only 77% had

access to the Internet (KewalRamani, et al., 2018). The opportunities to obtain collaborative learning experiences enhance the effectiveness of learning. As reported by Müller and Ferreira (2005), online labs allow students to work together as peers, applying their combined knowledge to the solution of a problem and to test and refine their understanding (Crawford, et al., 2020).

Müller and Ferreira (2005) further point out how the interactions among students provide opportunities to acquire various soft-skills, such as the ability to work in teams and to achieve objectives in co-operation with others and to integrate the know-how of others in order to accomplish a given task. Online delivery through a solely asynchronous mode at best hampers and at worst denies most of the above opportunities.

There is a high probability of graduating some of the COVID-19 cohort of students without adequate laboratory skills and practice; they may be at a long-term disadvantage, compared to those who studied "normally," when they move to another level of study or enter the labour market (Daniel, 2020). Therefore, it is important to review how universities are currently introducing lab-based practical experiments to students, how they were introduced through online delivery in the pre-COVID-19 period, and what approaches must be taken in the post-COVID-19 period, especially to achieve learning outcomes whilst maintaining a high-quality educational experience.

Lecturers in many HEIs note that student experience is made worthwhile by their presence of in campuses. ICT laboratories might well be viewed through the lens of one of these campus settings. ICT laboratories contribute substantially to the development of ICT personnel where the exogenous relationships formed with others teach the practical skills required in communication and teamwork. In a world where less face-to-face interaction is being actively encouraged, this poses a risk to students who may find it too easy to become even more disengaged with their peers and networks. Universities will have to continue to think carefully about how provision for practical sessions is delivered as this will ensure that student experience continues to be a major distinguishing feature and developmental benefit of university education. Effective university teachers will, in the future, alter their methods of instruction to support high quality learning and engagement that is enriching (Gamage, et al., 2020). The goal here is to seize the opportunity of reaping benefits, which include customised training, increasing engagement in learning, use of multimedia, acceleration of expertise through scenarios, and learning through digital games (Clark & Mayer, 2016). All of these have potential application in laboratory-based training.

As the plethora of challenges emerge in a post COVID-19 era, naturally many are looking to technology to provide large parts of the response and to feature heavily in the future of learning and teaching via VLEs. While some advocates view technology as the panacea that has enabled large portions of the developed world to work and learn remotely, we describe how solutions through the utilisation of cutting-edge virtual reality technology have been shown to be remarkably well-placed to help deliver remote sessions for ICT laboratories. The issue of access to the internet can be taken care of, even though it is noted that this issue, much as it is a human rights issue (Reglitz, 2020) is, however, far from equal across the with 19% of individuals in the least-developed countries accessing the internet (International Telecommunication Union, 2021). As the pandemic has brought into clear focus existent inequality, it goes to show how having materials and strategies for teaching via distance learning post COVID-19 is only the second half of the battle; the first is to ensure learners have the infrastructure to be able to access the content and practical sessions via the internet.

The use of VLE platforms cannot be avoided during a COVID-19 pandemic (Moorhouse, 2020). As affirmed by Goodchild and Speed (2019), the information technology era has transformed L&T processes and activities from the more conventional ways to more progressive education structures and approaches in many parts of the world. More recently, L&T has increasingly learning via VLEs, an aproach that emphasise new learning experience (Oke & Fernandes, 2020). Regardless of how well VLE platforms have been optimised, there are several factors that will become obstacles so that the application of e-learning becomes ineffective as a distance learning process (Chan & Ngai, 2012). Some of these factors that determine the success of online learning include the difficulty of the course (Halawi, et al., 2009), the availability of lecturers who have apt training in the use of VLEs and the successful implementation of VLEs for practical sessions (Xiangqian & Fuqing, 2012). It is our view that learning via VLEs has not been

felt equally by students because of the disparity students in ICT classes. Since the of VLEs for lecturing under the COVID-19 pandemic is closely related to student understanding, a question can be posed in terms of how students would understand certain lectures when practical things had to be done and to be displayed.

Were the Lecturers E-Ready? (ICT)

E-readiness ICT classroom

E-readiness classroom, aver Lloyd, et al. (2012), is one which is designed especially for the delivery and support of electronic learning systems (ELSs). Where such classrooms exist, the job of the lecturer is to instruct learners to work on their own, while they guide the learners throughout the session (Lloyd, et al., 2012). In such instances, teaching is supported by technology, often in the form of a connection to the internet. The e-readiness of an ICT classroom is determined on three levels (Keramati, et al., 2011): technical readiness, lifestyle readiness and pedagogical readiness. Technical readiness is where the focus is on the readiness of technology hardware, software, and a connection to the internet, as all these aspects support e-learning. In lifestyle readiness, the focus is on the facilitator and related challenges which may affect his/her satisfaction with an e-learning community, for instance his/her in/ability to adapt to change. Pedagogical readiness places the emphasis on the facilitator's understanding of technology, and his/her experience, confidence, and attitude. Sammak, et al. (2010) assert that pedagogical readiness pertains to perceptions regarding the electronic learning systems and evaluate whether lecturers have a predisposition to embrace new technology to accomplish class-related tasks. Holsapple and Lee-Post (2010) believe that in terms of pedagogical readiness, it is crucial to assess whether a facilitator prefers a chalk-and-talk approach to the optimal use of technology.

How it is done?

Endean and Braithwaite (2012) discuss a number of points to be considered when developing online experiments. The author states that it is important to offer virtual experiments while incorporating pictures/data of actual equipment, show good results from real experiments and to connect to real industrial processes. Crawford, et al. (2020) discusses the responses of HEIs in 20 different countries including China, USA, Germany, UK, Singapore, India and Hong Kong to COVID-19 and how academic programmes were conducted. A point to note is that even though the paper provides a comprehensive review, no particular information is provided for the delivery of practical sessions in laboratories except mentioning that in Hong Kong, laboratory work was suspended.

In the majority of studies described in the above section, laboratory classes are performed in real laboratory setups that would not be practical during a pandemic like COVID-19. However, virtual labs, remote control labs or video-based labs are good choices when students are not physically located on campus (Zhai, et al., 2012). For virtual labs, simulation tools and virtual reality are used. Remote laboratories allow the undertaking of experiments through the internet, whereas video-based activities provide a step-by-step overview of a real lab so that students can visualise the whole experimental process and its environment through a video. An example of the above is provided by Zhai, et al. (2012), albeit in electrical engineering. According to findings by Zhai, et al. (2012), the laboratory design they mention enable students to carry out experiments while incorporating autonomous, interactive and collaborative learning of electrical engineering experiments. Further, the article states the electrical online laboratory design breaks the space limitation for traditional experimental work and provides a collaborative learning environment where teachers and students can interact and perform laboratory experiments.

Goldberg and Dintzis (2006) discuss the steps to implement virtual microscopy via three levels. In the basic level students can be provided with digitised images from a light microscope; this approach is simple to deploy and inexpensive to implement but is limited in terms of functionality. In the intermediate level, a remote-control functionality could be incorporated with a light microscope. When fitted with an electronic stage and focusing controls, a user is able to control the microscope from an offsite location. The more advanced option is to provide slide scanning and virtual microscopy software. This is the most versatile

option, but it is an expensive solution as slides are digitised using a slide scanner, and the files are stored on a high-capacity server.

Although not related to ICT, Odeh, et al.'s (2015), example comes in handy for teaching practical sessions using VLEs. Odeh, et al., (2015) discusses a remote lab system named the Virtual Instrument Systems. In Reality, (VISIR) used in the Engineering Faculty at Al-Quds University in Jerusalem, Palestine. VISIR is a remote lab for designing, wiring, and measuring electronic circuits. The user has the ability to access the lab remotely at any location by using the internet. It comprises of a web-based user-interface using any web browser, measurement server, equipment server and switching matrix. The web interface enables the user to perform the same actions as if she/he is in a hands-on lab. The Measurement Server acts as a virtual instructor that controls the commands passing from the web interface to the equipment server to prevent hazardous circuit designs and to protect the instruments. The Equipment Server receives the commands from the Measurement Server to be executed on the real instruments. The Switching Matrix performs the connections between the components and instruments that the user has carried out in the web interface Odeh, et al. (2015).

Approximately 160 online experiments delivered as 'simulations', 'virtual experiments', or 'remote control experiments' offered at ECUST in Shanghai are listed by Endean and Braithwaite (2012). The list covers subjects such as computer networking, chemistry, physics, chemical engineering, machine principles, controls, electrical machines, electrical circuits, transducers, materials engineering, basic mechanical engineering, computer graphics, and monitoring technologies. A report by Lewis (2014) critically reviews the pedagogical benefits and pitfalls of the increased use of virtual laboratory tools across the Biological Sciences. According to the report, the performance in examinations revealed that the virtual laboratory tools were as equally effective as traditional laboratories in increasing student knowledge and understanding as they facilitate active, enquiry-based learning. The main pitfall of their use is that they do not provide hands-on experience of individual techniques or training in the use of individual items of equipment. Additionally, the report stresses the importance of integrating high-quality virtual laboratory tools with traditional laboratory sessions within curricula. For Adam (2009), online teaching and laboratory practices in the biosciences field, enquiry-based learning (EBL) is often more effective than traditional based learning. Some advantages in the EBL method are recognised as learning by discovery, interacting more effectively with peers and tutors and maintaining students' enthusiasm for laboratory work.

The nature of the teaching and learning processes changes with the use of e-technologies (Teo, 2011). Most online programmes are based on constructivist learning models, which presume that students are actively involved in the educational process by developing meaningful learning experiences and interacting with lecturers and peers to accumulate and create knowledge (Bangert, 2006). Multiple instructional methods need to be used to increase the effectiveness of the online educational process (Dixson, 2010) and to compensate for the lack of physical presence of both lecturers and students in the same space and time. In China, the first country which was severely affected by the COVID-19 outbreak, the decision to close universities but continue the process of teaching and learning led to a massive shift to online courses, supported by the government through the initiative called 'Disrupted Classes, Undisrupted Learning' (Huang, et al., 2020). In Singapore, a unified approach at university level helped ease the transition to online learning, by ensuring that the educational process continues with similar quality standards, by providing adequate technologies to instructors and students and by putting a strong emphasis on the learners and their needs (Lim, 2020). In Europe, the European Commission (2020) emphasises that 'COVID-19 is reviving the need to explore online learning and teaching opportunities'. South Africa followed suit but it is not clear how practical sessions were held during delivery of classes via VLEs. While there is an increased interest in understanding how universities responded to the pandemic (Bao, 2020; Greene, 2020; Lim, 2020), there are few studies reflecting on how the abrupt switch to the use of VLEs has been successful in terms of offering modules that require practical work (Burgess & Sievertsen, 2020). This leads to this study's statement of the problem.

Theoretical Framework

This study is grounded on the bricolage as a theoretical framework. This concept was first considered by the French anthropologist Claude Lévi-Strauss in 1967, as a part of his exploration of the nature of sense-making in society (Vanevenhoven, et al., 2011). It is a theory that uses all available knowledge, whether of immediate interest or outdated, within or outside of people, to solve a given problem (Louridas, 1999). We consider the theory to be relevant, because it advocates that people can construct something out of limited available resources or systems, to achieve new goals (Aagard, 20094). The bricolage theory allows the combining of resources, and the creation of systems for new purposes, which serve as the mechanism that drives the discovery of innovations in the form of new 'services' from existing resources (Duymedjian & Ruling, 2010), which is what this study is all about.

Statement of the Problem

The use of VLEs provides easier access to learning, promotes flexibility and offers new potential for the teaching process to be focused on the learners' needs and possibilities by emphasising different learning styles (Huang, et al., 2020). Due to the recent developments of the COVID-19 pandemic, universities around the world to shift towards online education, and evolutions ICT have contributed to the emergence of new and innovative education methods for students (Kauppi, et al., 2020). There are several factors that need to be present for the use of VLE in practical sessions to be effective.

There are some barriers to the use of VLEs, including lack of asynchronised communication for modules that require kinaesthetic and practical sessions. This is more so as Gamage, et al. (2020) reveal how sectors such as ICT requires programme outcomes that stress the importance of developing theoretical (content) and practical (processes) aspects. The absence of hands-on exposure to operating ICT equipment places serious limitations to students (Gamage, et al., 2020).

The use of VLEs has been seen in China and in Europe. South Africa followed suit by implementing this mode of delivery but it is not clear how practical sessions were held during delivery of classes via VLEs. Studies on remote learning from the students' side have focused mainly on infrastructure and connectivity challenges such as poor internet connectivity (Baykal et al., 2022; Razami & Ibrahim, 2021) and low bandwidth (Al-Balas, et al. 2020; Farooq, et al. 2020; Wan Hassan, et al. 2020); e-learning system support challenges such as lacking in suitable devices/technical equipment, variation of education platforms (Al-Balas, et al. 2020), accessibility, ease of use , technical support/help availability (Almaiah, et al. 2020; Wan Hassan, et al. 2020; Zulkefli, et al. 2020), social presence, teaching presence and cognitive presence (Zulkefli, et al. 2020) and technological competency and self-regulation challenges such as lack of ICT knowledge, low motivation (Wan Hassan, et al. 2020) and maintaining effective communication with peers (Zhang, et al. 2020).

From the lecturers' side, previous studies have focused on competency and operational challenges such as lack of proper/formal training, maintaining online learner's engagement/ involving student is challenging (Farooq et al. 2020), lecturers' isolation challenges such as working from, home, maintaining work-life balance (Farooq, et al. 2020), higher workload, difficulty in observing all students, assessment issues, lessons being more concentrated on volume and lecturer's self-regulation challenges such as learning difficulties, lack of time management skills, low motivation and feeling of loneliness in a video lesson (Rannastu-Avalos & Siiman 2020). Thus, studies on the use of VLEs for L&T exist. While there is an increased interest in understanding how universities responded to the pandemic (Bao, 2020; Greene, 2020; Lim, 2020), there are few studies reflecting on how the abrupt switch to the use of VLEs has been successful in terms of offering modules that require practical work (Burgess & Sievertsen, 2020). Given the absence of studies that focus on the use of practical work in ICT during L&T via VLEs, this study analyses lecturers' teaching experiences in practical session in ICT during the COVID-19 pandemic at a rural university. In light of this, the pertinent question arising is seen below.

Research question: *To what extent have lecturers succeeded in offering practical sessions in ICT classes during the COVID-19 pandemic?*

Methodology

This study engaged a non-experimental, explanatory study in which there was no manipulation (Fouché & Roestenburg, 2022; Pietersen & Maree, 2021; Ugwuanyi, 2022). We used an explanatory design to analyse lecturers' teaching experiences in practical session in ICT during the COVID-19 pandemic at a rural university. Since we utilised a quantitative research to familiarise with the problem under investigation (Halperin & Heath, 2020) by means of a fixed, predetermined research design and objective measures (Bartley & Hashemi, 2022; Bless, et al., 2020; Leedy & Ormrod, 2021), this study was hinged on a positivist research paradigm. Positivism is marked by uncovering objective and evidence-based truth (Bonache, 2021; Park, et al., 2020; van Aardt & Hirschohn, 2021) through well-described quasi-experiments (Park, et al., 2020) and studies human action through mathematical and logical reasoning (Saunders, et al., 2019) as well as through scientific methods (Govender, 2021; Li, et al., 2018; Sefotho, 2021).

Using some steps from a 17-step model that was adopted from Masha's (2020) study, we designed a structured questionnaire (Einola & Alvesson, 2021; Hambleton, 2021; Nayak & Singh, 2021) that was emailed to respondents (Du-Plooy-Cilliers & Cronje, 2019; Saunders, et al., 2019j; Zikmund, et al., 2019) to collect precise, quantitative, numerical data (Bertram & Christensen, 2021; Masha & Eze, 2022; Salami, 2022) on opinions and feelings (McNabb, 2018) about the effect of remote mode of delivery on students' comprehension of ICT modules in a selected HEI. The questions were designed using five-point Likert Scales anchored at 1 for strongly disagree and 5 for strongly agree so that the respondents' perceptions could be easily determined. The questionnaire measured both students' and lecturers' perception of the effect of remote mode of delivery of ICT modules during practical sessions. In terms of the aspects in the questionnaire they were all identified after reviewing recent studies and the original literature study was done prior to the development of the questionnaires (Charmaz, 2020; McGregor, 2019; Muzata, 2022). To determine the reliability of multiple-question Likert scale surveys, we used some selected category scales put forth Zikmund, et al. (2019) in the form of frequency.

Babbie (2021) states that a properly designed and executed questionnaire ought to achieve a response rate of at least 80 to 85%. The questionnaire used in this study measured reliable data in that dimensions of validity were enhanced through face validity whereby we gave the questionnaire to experts in the field to scrutinise. Afterwards, we used the comments, assistance and advice from experts to adjust the instrument so that it could be valid (de Klerk & van Wyk, 2022; Einola & Alvesson, 2021; Leedy & Ormrod, 2021). We benefitted from using questionnaires in that they allowed us to cover to collect large quantities of data as they covered the four sites of our institution (Du Plooy-Cilliers, 2019a; van der Walt, 2019; Walliman, 2018). They were also less time-consuming (du Plooy-Cilliers & Cronje, 2019; Johnson & Christensen, 2020; Nieuwenhuis 2021) and relatively economical (Kumar, 2020; Ling & Ling, 2019; Masha & Eze, 2022).

Sampling

Sampling encompassed the selection of 12 lecturers (Conlon, et al., 2020) where we utilised a census sampling technique to acquire data from every member of the targeted population (Chandra, 2020; Johnson & Christensen, 2020; Quinlan, et al., 2019) at the WSU, our quantitative research site (Babajide, 2022). The sampled respondents were both informative (Bertram & Christensen, 2021; Cash, et al., 2022; Leedy & Ormrod, 2021; Maxwell, 2021; Rudansky-Kloppers, 2021) and illuminative (Du Plooy-Cilliers, 2019; Salkind, 2019; Tsang, et al., 2019) about the topic of this study and were able to answer the research questions (Tiel, et al. 2019), thus making a useful contribution to the discussions on the phenomena under study.

Data Analysis

Data was analysed using the eight stages of data analysis proposed by Wild and Diggines (2015). After analysing data, we translated the raw data into some meaningful information and communicated the research results in the form of simple descriptive statistics (Jacobs, 2019; Leedy & Ormond, 2021; Pietersen & Maree, 2021) and by means of graphical representations such as bar charts (Dewis, 2018; Dörnyeli, 2018;

Saunders, Lewis & Wang, 2019) and numbers (Bertram & Christiansen, 2021) which afforded significant insights into the study (Wild & Diggines, 2015).

Ethical Considerations

After securing ethical clearance for this study, we secured informed consent from all the respondents before data collection commenced (Baumgardner-Zuzik, 2022; Bertram & Christiansen, 2021; Jones, 2022; Josephson & Smale, 2020; Kumar, 2020; Trochim, 2020; Wassenaar, 2021). We identified all risks and, through the principle of non-maleficence, did not harm the participants (Bartley & Hashemi, 2022; Cilliers & Viljoen, 2021; Hammersley, 2021; Hume & Baumgardner-Zuzik, 2022; Kipkemboi & Naanyu, 2022; Leedy & Ormrod, 2021; Wassenaar, 2021). Since we dealt with people's personal information, the Protection of Personal Information (POPI) (Act no 4 of 2013) required such information to be treated with respect and ethically (Coetzee, et al., 2019; Hirschsohn & Faasen, 2021; Raaff, et al., 2022). Still on the principle of non-maleficence, we assured all participants of their confidentiality and anonymity in the research study (Alrehaili & Mustaha, 2020; Babbie, 2021; Bartley & Hashemi, 2022; Bertram & Christiansen, 2021; Bouchrika, 2021; Elman, et al., 2020; Fouché & Chubb, 2022; Hoft, 2021; Jones, 2022).

Results and Discussion

Findings reveal that the majority of respondents are from the following age groups: 26-38% years (33.3%), 39-50% years (33.3%) and 51-65 years (33.3%). A small minority of respondents (11.1%) belong to the 18-25 years age group. This is depicted in Figure 1 below.

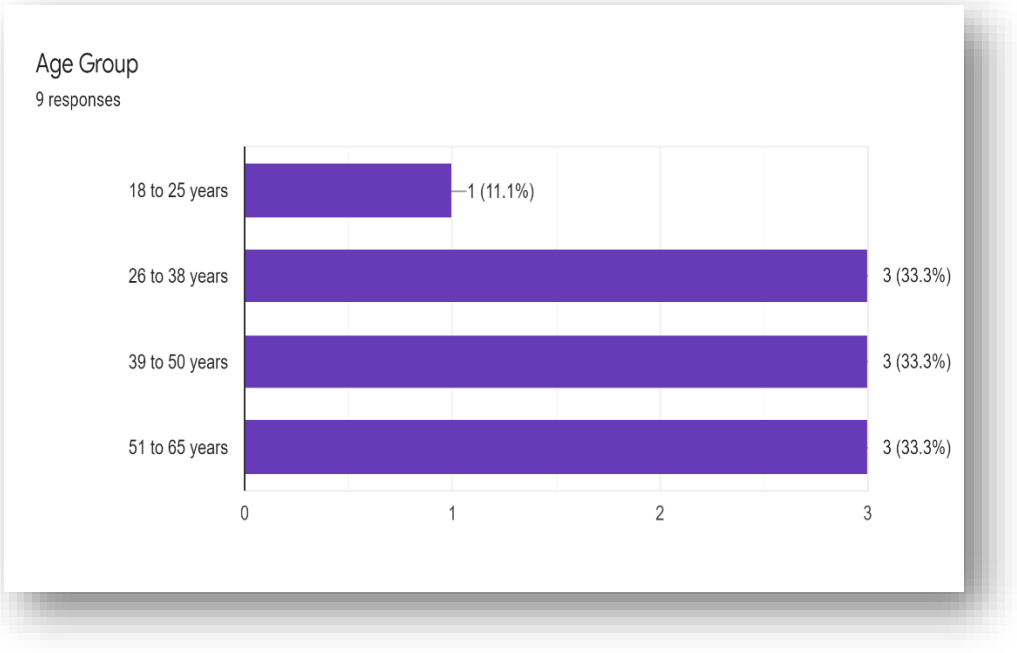

Figure 1: Age of respondents
Source: Prepared by the researchers

It is clear that age plays an important role in terms of delivering lectures via VLEs. Out of the five generations revealed in Table 1 below (Codrington & Grant-Marshall, 2014; Craig, 2014; Meister & Willyerd, 2010), millennials are the only generation that is techno savvy. Millennials have a high cyber literacy. Millenials go by various names, including, among others, Generation Y, Generation Y-ers, Y-ers (D'Amato & Herzfeldt, 2008; Lipkin & Perrymore, 2009; Ng, Lyons & Schweitzer, 2012; Noe, 2013 Joshi, et al., 2010) and the iGeneration (Codrington & Grant-Marshall, 2014; Joshi, et al., 2010). They are defined

as individuals born post-1980 but before 1989 or between 1980s and 20002 (Cennamo & Gardner, 2008) and their most defining experience has been the growth of the Internet and technology (Noe, 2013).

Table 1.
The five generations

Generation	Major influences	Broad traits	Defining invention
Traditionalists/Silent Generations/Veterans Born 1920s to 1940s	World War II, Cold War	Sacrifice, loyaly, discipline	Fax machine
Baby boomers Born 1940s to 1960s	Watergate, Women's rights	Competitive, hardwork, long hours	Personal computer
Generation X Born 1960s to 1980s	MTV, AIDS, Gulf War, Fall of Berlin Wall	Self-reliance, free agents, independence	Google and Facebook
Millenials/Generation Y Born 1980s to to 2000	Google, Facebook, Election of Obama	Cyberliteracy, tolerance, diversity, confidence	Google and Facebook
Generation 2020/iFacebook Born 2020 onwards	Social games, Great Recession	Mobility, media savvy, life on-line starting in pre-school, reading books on e-readers	Iphone apps

Source: Codrington and Grant-Marshall (2014), Craig (2014) and Mesiter and Willyerd (2010)

They (Generation Y-ers) learn as they go and when they need to, using technology and contacts (Haynes, 2015). Some learn through home schooling and at private colleges and actually learning about life and the world through TV and internet (Craig, 2014). Generation Y-ers are willing and not afraid to challenge the status quo and strives for an environment where creativity and independent thinking thrives (Robbins, et al., 2015). They are the highest users of mobile social networks such as Web 2.0, that is blogging, file sharing, location-based socialisation services, chat and so on (Craig, 2014). Hart (2013) eloquently describes Generation Y-ers as a group that has grown up in a world very different from the other generations, whose lives are saturated in technology, who are wired differently and have startling attitudinal differences and preferences. New research is showing that their brains are evolving due to the constant influences of technologies. This is the generation that does not write; they keyboard. This generation is very independent and techno savvy (Armor, 2005). According to Robbins, et al. (2015), this generation has lived much of their lives with ARMs, DVDs, cell phones, e-mail, texting, laptops, and the Internet. When they do not have information they need, they just simply enter a few keystrokes to get it. Having grown up with technology, Gen Ys tend to be totally comfortable with it. They're quite content to meet virtually to solve problems, while bewildered baby boomers expect important to be solved with an in-person meeting. Given the traits of Generation Y-ers, it is our opinion that this cohort of lecturers, although limited in number, could be influential in delivering practical ICT sessions via VLEs.

In terms of lecturers' teaching ICT practical session virtually, the results are depicted in Figure 2 below.

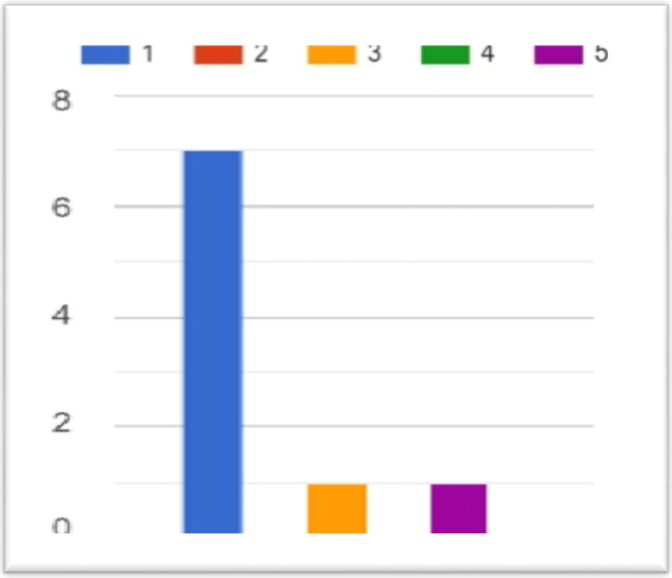

Figure 2: Lecturers teaching ICT practical sessions virtually
Source: Prepared by the researchers

Education is one of the key factors in building a good nation (Baiyere, et al., 2016) and universities are well-positioned to provide such. Universities, according to Kerr (1991), are established to fulfil the roles of research, community engagement, teaching and learning and to enhance development in strategic locations in the nation. They are established to foster a practical relationship between business owners, organisations and institutions of learning, to promote Work Integrated Learning (WIL) for students (Uleanya, et al., 2020). This is done through the curriculum and acceptable practices of both the institutions of learning such as universities and business organisations (Uleanya, et al., 2019). However, the function of teaching and learning in terms of its offering in HEIs changed dramatically after the Coronavirus disease 2019 (COVID-19), a highly contagious virus that is transmitted through human-to-human contact (Wang & Du, 2020).

According to Figure 2 above, WSU lecturers were able to teach teaching ICT practical session virtually, in programming modules through simulation software or virtual software. In most ICT classes, practical classes are performed in real ICT laboratory setups that would not be practical during a pandemic like COVID-19. However, virtual labs, remote control labs or video-based labs are good choices when students are not physically located on campus. For virtual labs, simulation tools and virtual reality are used. Remote laboratories allow the undertaking of experiments through the internet, whereas video-based activities provide a step-by-step overview of a real lab so that students can visualise the whole experimental process and its environment through a video.

The issue of simulations is also done in other countries. In Shanghai, approximately 160 online experiments delivered as 'simulations', 'virtual experiments', or 'remote control experiments' offered at ECUST in Shanghai are listed by Endean and Braithwaite (2012). The list covers subjects such as computer networking. The main pitfall of their use is that they do not provide hands-on experience of individual techniques or training in the use of individual items of equipment. For Adam (2009), online teaching and laboratory practices in the biosciences field, enquiry-based learning (EBL) is often more effective than traditional based. Some advantages in the EBL method are recognised as learning by discovery, interacting more effectively with peers and tutors and maintaining students' enthusiasm for laboratory work.

In terms of barriers experienced with the use of online mode of delivery in terms of lack of skills in effective delivery, Figure 3 shows that most lecturers (60%) do not have barriers in terms of lack of skills in effective delivery.

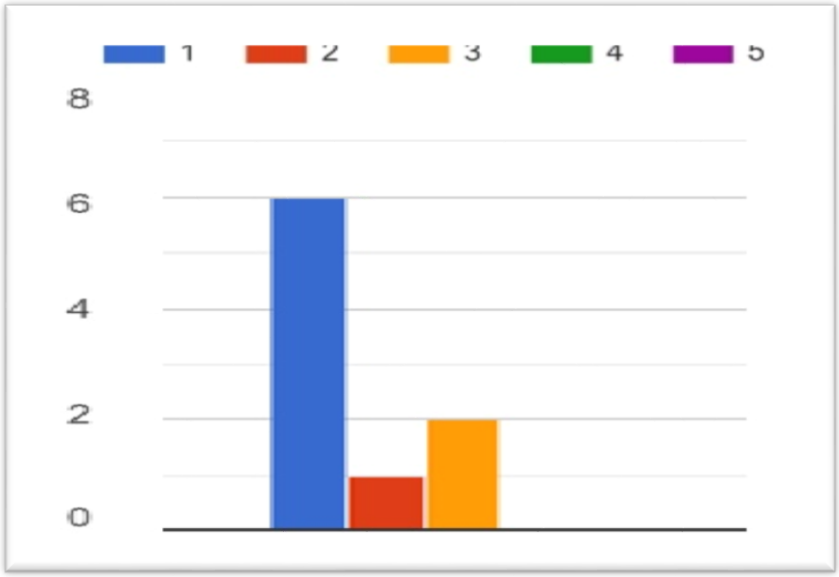

Figure 3: Barriers experienced with the use of online mode of delivery in terms of lack of skills in effective delivery
Source: Prepared by the researchers

There are some barriers to the use of VLEs, including lack of asynchronised communication for modules that require kinaesthetic and practical sessions. This is more so as Gamage, et al. (2020) reveal how sectors such as ICT requires programme outcomes that stress the importance of developing theoretical (content) and practical (processes) aspects. The absence of hands-on exposure to operating ICT equipment places serious limitations to students (Gamage, et al., 2020). Lack of knowledge of conducting practical ICT sessions via VLEs is a huge disadvantage for online education (Grishchenko, 2020; Makura, 2022; Omodan, 2022). As highlighted in previous studies (Baczek, et al., 2021; Elfirdoussi, et al., 2020; Grishchenko, 2020; Vasiliki, et al., 2021), technical skills are important in the teaching of ICT practical sessions.

While teaching practical ICT sessions via VLEs during this pandemic are not without some potential challenges, such as a lack of physical learner-teacher/learner-learner interaction, technical issues, distraction and time management, among others (Bedrossian, 2021; Eva et al., 2020), most HEIs have designed education systems within the framework of their own possibilities and capabilities. Some schools tried to teach their students by using content management systems such as Moodle as well as live video conferencing systems such as Zoom.

Conclusion

This study shows that lecturers at WSU were able to conduct ICT practical sessions using VLEs during the COVID-19 pandemic to a great degree. Due to the recent developments of the COVID-19 pandemic, universities around the world to shift towards online education, and evolutions ICT have contributed to the emergence of new and innovative education methods for students (Kauppi, et al., 2020). The use of VLEs provides easier access to learning, promotes flexibility and offers new potential for the teaching process to be focused on the learners' needs and possibilities by emphasising different learning styles (Huang, et al., 2020).

The increased rates at which schools, colleges, and universities shifted and are still shifting to online teaching and learning have become the principal learning portal (Foxcroft & Bosire, 2020). Several factors needed to be present for the use of VLE in practical sessions to be effective. One was skilled lecturers in ICT skills as the absence of hands-on exposure to operating ICT equipment places serious limitations to

students. Lack of knowledge of conducting practical ICT sessions via VLEs is also a huge disadvantage for online education,

We agree with Linden (2020) that the COVID-19 pandemic is regarded as a game-changer for compelling all national sectors, including higher education, to adjust to the new normal such as migrating from the traditional face-to-face classroom to the remote modes of teaching and learning. The COVID-19 pandemic caused the entire world to witness a mind-blowing increase in the use of online digital tools and several social media platforms (Perez, 2020; Waters & Hensley, 2020). It became a *Victor Ludorum* in the way the world had to forcefully switch overnight to some pedagogical approaches that are technologically based, for the continuity of education of the young ones, and as a panacea to the global crisis of the debilitating coronavirus pandemic (Dhawan, 2020). In South Africa, the 2020/2021 academic calendar begun amid the pandemic as educational institutions were confronted with the urgent need to improve their modes of online curriculums and course navigation, online examinations, increase student inclusion for remote learning and strengthen their capacity for ICT solutions in the time of crises (Vinas, 2020).

Recommendations

In South Africa, the 2020/2021 academic calendar begun amid the pandemic as educational institutions were confronted with the urgent need to improve their modes of online curriculums and course navigation, online examinations, increase student inclusion for remote learning and strengthen their capacity for ICT solutions in the time of crises (Vinas, 2020). The increased rates at which universities shifted and are still shifting teaching via VLEs have become the principal learning portal (Foxcroft & Bosire, 2020). South African HEIs saw the need to prioritise e-learning technologies that are considered relevant and useful for a seismic structural shift in HE (Mbhiza, 2021). Studies (Kang, 2021; Maske, 2020; Perez, 2020) have emerged on the digitalisation of education during the COVID-19 lockdown and the online platforms which have become the alternatives for teaching and learning during the COVID-19 pandemic. We therefore recommend that all lecturers at WSU be skilled in using practical ICT sessions for teaching all courses that require practical sessions.

Recommendation for Future Studies

This study focused on analysing the teaching experiences of ICT lecturers in ICT practical session at a rural Eastern Cape university. We recommend that future studies investigate the capabilities of lecturers across the entire university.

Acknowledgements

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