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E-Learning of the Timber Processing and Application Course at a South African University amidst the Covid-19 Pandemic



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ABSTRACT

The paper explored e-learning of a course, Timber Processing and Application at a University in KwaZulu-Natal Province, South Africa during the COVID-19 pandemic. The purpose was to understand the challenges that the participants encounter in studying their practical module online. A qualitative case study design located in the interpretivist paradigm was employed. The sample consisted of 15 participants, nine male and six female students. These participants were selected using purposive and convenience sampling techniques. Data for the study was generated through an open-ended electronic questionnaire designed on Google forms and was analysed using a thematic approach. The Technology Acceptance Model was employed as a framework to determine students' e-learning of Timber Processing and Application amid the COVID-19 pandemic. The study revealed diverse challenges to the e-learning method of Timber Processing and Application education. These include limited or no access to the internet, lack of internet data bundles, poor internet connectivity, preference for face-to-face learning, absence of practical activities in e-learning, unavailability of ICT learning infrastructure, difficulty in time management and self-discipline as well as lack of conducive learning environment. With these findings, the study contributes to the literature as it highlights the challenges associated with the e-learning of Timber Processing and Application (practical courses/modules) amidst the COVID-19 pandemic, as well as the right approach to the effective study of the course. Consequently, the study provides recommendations on how to tackle the challenges revealed in the research.

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INTRODUCTION

From January 3, 2020, to September 23, 2021, there have been 2,884,134 confirmed cases of COVID-19 with 86,216 deaths reported globally.¹ Africa shares from this with a total number of 5,650,962 confirmed cases of COVID-19, with 135,699 deaths. The first COVID-19 case in South Africa was reported on the 5th of March, 2020.² Accordingly, decisive action was taken by the government, on March 15, 2020, a national state of disaster was declared, and a nationwide lockdown was enforced on 27 March 2020 to avoid the first

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¹ World Health Organisation [WHO]. World Health Organisation Coronavirus Dashboard, 2021.<u>https://covid19.who.int/table</u>

² Jennifer Giandhari, Sureshnee Pillay, Eduan Wilkinson, Houriiyah Tegally, Ilya Sinayskiy, Maria Schuld, José Lourenço et al. "Early transmission of SARS-CoV-2 in South Africa: An epidemiological and phylogenetic report." *International Journal of Infectious Diseases* 103 (2021): 234-241. <u>https://doi.org/10.1016/j.ijid.2020.11.128</u>

wave overwhelming the health system.³ The national state of disaster declared on 15 March 2020 by the President of South Africa Cyril Ramaphosa contained partial travel bans, travel advisories, discouraging public transport, the closing of schools, and prohibiting gatherings of more than 100 persons. Globally, education institutions were all shut down.⁴ Consequently, all schools, including institutions of higher learning in South Africa were closed.⁵ However, on the 9th of April 2020, the lockdown was extended for another 14 days.

The lockdown implied that all academic institutions remained closed, therefore, the calendar for 2020 was affected. Accordingly, to cushion the impact of the lockdown on academic programmes, a call from the President requested for a transition from face-to-face (F2F, hereafter) to e-learning across all institutions. This was to contain the virus as well as limit its spread, through the observation of social distancing.⁶ These approaches brought the country to a crossroad, as both economic and social activities were halted, especially for educational institutions that execute F2F teaching and learning programmes. Consequently, in a bid to keep the academic window open and considering the unpredictable length of the COVID-19 pandemic, most educational institutions transitioned from the normal F2F to e-learning platforms, thereby replacing most of their theoretical lessons with online classes.⁷

E-learning in education is generally a term that describes distance learning that is executed online over the internet, not in a platform that permits F2F interaction.⁸ Also, e-learning is the application of diverse information and communication technologies (ICTs) that enable access to teaching and learning executed online.⁹ However, it was maintained that some challenges linked to the digital divide in the aspect of ICT usage exist within different countries in Africa in the migration from F2F to online learning during the lockdown caused by the COVID-19 pandemic.¹⁰ The issue of inequalities in access to ICTs infrastructure is an agelong challenge. This is also the case with South Africa, as access to ICT infrastructure particularly in education has been stalled due to the digital divide associated with diverse factors ranging from socio-economic, race, social class, gender, age, geographical area and educational background.¹¹ Imperatively, it is obvious that the COVID-19 pandemic has created room for higher education institutions in South Africa and other nations of the world to maximise e-learning activities with ICTs. However, institutions already planned to run F2F programmes find it difficult to adapt to the paradigm shift when compared with their contemporaries such as the Open University in South Africa, which was already running programmes online before the outbreak of the pandemic.

Timber Processing and Application is a course designed to be studied through a traditional F2F approach because it involves theory and workshop practice in the Department of Technology Education, at the university where the study was carried out. From studies conducted, digital inequality seems to exist between those who have access to computers and the internet, and these are variables that impede

³ David Mhlanga, and Tankiso Molo, "COVID-19 and the digital transformation of education: What are we learning on 4IR in South Africa?." *Education Sciences* 10, no. 7 (2020): 180. https://doi.org/10.3390/educsci10070180

⁴ Simon Burgess, and Hans Henrik Sievertsen, "Schools, skills, and learning: The impact of COVID-19 on education." *VoxEu.org* 1, no. 2 (2020). https://voxeu.org/print/65286

⁵ Goolam Mohamedbhai, COVID-19: What consequences for higher education? University World News. Date Accessed, August 04, 2020, https://www.universityworldnews.com/post.php?story=20200407064850279

⁶ Meganne N. Ferrel, and John J. Ryan. "The impact of COVID-19 on medical education." *Cureus* 12, no. 3 (2020).

⁷ Aleksander Aristovnik, Damijana Keržič, Dejan Ravšelj, Nina Tomaževič, and Lan Umek. "Impacts of the COVID-19 pandemic on life of higher education students: A global perspective." *Sustainability*, 12, no. 20 (2020): 8438. https://doi.org/10.3390/su12208438; William Dagogo Legg-Jack. "Readiness for the Fourth Industrial Revolution: Experiences of Students in Practical Courses During the COVID-19 Pandemic at a University in South Africa." In *Future of Work, Work-Family Satisfaction, and Employee Well-Being in the Fourth Industrial Revolution*, 12-29. IGI Global, 2021. https://doi.org/10.4018/978-1-7998-3347-5.ch002

⁸ Terry Anderson, "Theories for learning with emerging technologies." *Emergence and innovation in digital learning: Foundations and applications* 1 (2016): 35-50. https://doi.org/10.15215/aupress/9781771991490.01

⁹ Valentina Arkorful and Nelly Abaidoo. "The role of e-learning, advantages and disadvantages of its adoption in higher education." *International Journal of Instructional Technology and Distance Learning* 12, no. 1 (2015): 29-42.

¹⁰ Mohamedbhai, COVID-19: What consequences for higher education?

¹¹ Moeketsi Letseka, Matsephe Martha Letseka, and Victor Pitsoe. "The challenges of e-Learning in South Africa." *Trends in E-learning* 8 (2018): 121-138. https://doi.org/10.5772/intechopen.74843

the possibility of e-learning in countries such as South Africa.¹² Evidently, some developed countries have implemented measures that cater for the challenges of the digital divide with the provision of laptops and internet Wi-Fi for students.¹³ However, not much has been done to address the challenge students encounter accessing e-learning from home in the South African context.

Consequently, this study explores the challenges that hinder the e-learning of Timber Processing and Application at a South African University, in KwaZulu-Natal Province. Thus, the objective is to pinpoint the factors that impeded students' e-learning of Timber Processing and Application during the COVID-19 pandemic. To address this objective, the study adopted a qualitative case study design. Since the e-learning of Timber Processing and Application employs the use of ICTs, the Technology Acceptance Model (TAM) was adopted as a framework, this was to highlight factors that impeded students learning of the Module emanating from the study. The outcome of this study is significant to stakeholders within and outside higher education in South Africa and beyond, as it contributes to the body of existing knowledge in the following areas namely, the challenges associated with the e-learning of Timber Processing and Application (practical courses/modules) amidst the COVID-19 pandemic, as well as effective approach to the study of the course. The researcher wishes to mention that the details of the university where the research was carried out remain anonymous per the University's ethical guidelines.

The study is structured in the following sections namely, review of related literature, theoretical framework, methodology, results, discussion and conclusion.

LITERATURE REVIEW

E-Learning

E-learning entails those specific teaching and learning activities that are supported by electronic technologies such as TV, radio, CD-ROM, DVD, and cell phones among others facilitated by the internet.¹⁴ The concept of e-learning, distance learning, digital learning, m-learning, open learning, web-based learning, computer-mediated learning, blended learning has in common the ability to connect a computer through a network and learn from anywhere, at any time, with any rhythm and by any means.¹⁵

The advantage of e-learning is in its ability to make course content available online through the application of modern technological tools such as computers, laptops, mobile phones and others, on the following platforms namely institutional learning management systems, software applications, social media sites among others.¹⁶ Suggestively, access to course content anytime and anywhere by students is not limited

¹² Ana-Maria Bliuc, John Betts, Matteo Vergani, Muhammad Iqbal, and Kevin Dunn. "Collective identity changes in far-right online communities: The role of offline intergroup conflict." *New Media & Society* 21, no. 8 (2019): 1770-1786. https://doi.org/10.1177/1461444818797082

¹³ Helena Rodrigues, Filomena Almeida, Vanessa Figueiredo, and Sara L. Lopes. "Tracking e-learning through published papers: A systematic review." *Computers & Education* 136 (2019): 87-98. https://doi.org/10.1016/j.compedu.2019.03.007; Jack Schofield, The dangers of Wi-Fi radiation (2007) (updated). https://www.theguardian.com/technology/blog/2007/ may/21/thedangersof

¹⁴ James J. Duderstadt, Daniel Ewell Atkins, Douglas E. Van Houweling, and Daniel Van Houweling. *Higher education in the digital age: Technology issues and strategies for American colleges and universities*. (Connecticut: Greenwood Publishing Group, 2002); Basak Kumar, Sujit, Marguerite Wotto, and Paul Belanger. "E-learning, M-learning and D-learning: Conceptual definition and comparative analysis." *E-learning and Digital Media* 15, no. 4 (2018): 191-216. https://doi.org/10.1177/2042753018785180

¹⁵ Venera-Mihaela Cojocariu, Iulia Lazar, Valentin Nedeff, and Gabriel Lazar. "SWOT anlysis of e-learning educational services from the perspective of their beneficiaries." *Procedia-Social and Behavioral Sciences* 116 (2014): 1999-2003. https://doi.org/10.1016/j.sbspro.2014.01.510; Jasmine Paul and Felicia Jefferson, "A comparative analysis of student performance in an online vs. face-to-face environmental science course from 2009 to 2016." *Frontiers in Computer Science* (2019): 7. 1-9. https://doi.org/10.3389/fcomp.2019.00007

 ¹⁶ Alan Amory, "Education technology and hidden ideological contradictions." *Journal of Educational Technology & Society* 13, no. 1 (2010): 69-79. https://www.jstor.org/stable/10.2307/jeductechsoci.13.1.69; Simon Bhekimuzi Khoza.
"Lecturers' reflections on curricular spider web concepts transformation strategies." In E. N. Ivala & C. L. Scott (Eds.), *Transformation of Higher Education Institutions in Post-Apartheid South Africa (1ed.).* (New York: Routledge - Taylor & Francis Group, 2019): 15-26.

irrespective of any challenge such as the pandemic outbreak, provided the resources are available. This has been confirmed in several studies that e-learning offers access to course materials in an online environment, it is also time-saving as well as allows students the comfort to study at home.¹⁷

It has been argued that F2F learning cannot be replaced even in the face of technological revolution.¹⁸ Some scholars are of the view that blended learning offers a solution to the dichotomy that exists between F2F and e-learning, since it is a combination of both approaches, and with this method, students can access course materials based on their needs.¹⁹ However, there are compelling conditions that will tilt students' choice from F2F to online, such as violent protests and pandemics as occasioned by COVID-19 among others. Although in this study, it was reported that the effectiveness of e-learning was dependent on certain resources, its provision appeared to be the only solution.

E-learning draws on various resources, human and non-human to ensure its implementation, of which the provision of both has remained a challenge.²⁰ Human resource challenges include learners, educators, and content-related issues, whilst non-human challenges include the lack of access to all digital devices, internet, and Wi-Fi, the unavailability of proper digital tools, and no internet connections. Some of these challenges have been highlighted in studies within and outside Africa.

Several studies outside the African continent have highlighted the benefits and challenges associated with e-learning. These benefits include lack of the need to travel, time efficiency, and easy accessibility of course content, whilst the challenges are lack of interaction with peers, lack of practical activities, and the problem with internet connection.²¹ Significantly, the study also revealed that e-learning cannot be substituted for all fields, such as engineering, some of which require F2F interaction for an in-depth understanding²¹. Similarly, a study that reported students' decision to choose online learning over F2F during the disruption caused by COVID-19 did so based on flexibility and convenience, and the desire to opt for e-learning to cover grounds lost because of the pandemic.²² However, the study also highlighted that connectivity issues made it difficult for students in rural areas to participate in online classes, limited data, little or no F2F interaction, the intense requirement for self-discipline, lack of devices for online learning, and poor learning environment among others. Also, revealed in the study, a complete transition to online was not possible since most aspects of their agricultural courses entail practical exercise. However, several options that cater for practical lessons via online mode have been highlighted in the literature. These include remote access laboratories, video demonstrations, laboratory kits for home study and virtual computer simulations (virtual laboratories).²³ Remote access laboratories have been in existence since the 1990s to enable students and teachers to execute practical tasks using real substances and equipment via the internet, regardless of time and location.²⁴ Also, blended learning is considered another option as it offers a solution to the dichotomy

¹⁷ Giandhari, et al. "Early transmission of SARS-CoV-2 in South Africa, 234-241; Michał Bączek, Michalina Zagańczyk-Bączek, Monika Szpringer, Andrzej Jaroszyński, and Beata Wożakowska-Kapłon. "Students' perception of online learning during the COVID-19 pandemic: a survey study of Polish medical students." *Medicine* 100, no. 7 (2021). https://doi.org/10.1097/MD.00000000024821

¹⁸ Chunyang Liu, and Fei Long. "The discussion of traditional teaching and multimedia teaching approach in college English teaching." In *International Conference on Management, Education and Social Science*, (2014): 31-3; Anousha Nikoubakht and Alireza Kiamanesh. "The comparison of the effectiveness of computer-based education and traditional education on the numerical memory in students with mathematics disorder." *Journal of Psychologicalscience* 18, no. 73 (2019): 55-65. http://psychologicalscience.ir/article-1-82-en.html

¹⁹ Anderson, "Theories for learning with emerging technologies." 35-50.

²⁰ Shivangi Dhawan,. "Online learning: A panacea in the time of COVID-19 crisis." *Journal of educational technology* systems 49, no. 1 (2020): 5-22. https://doi.org/10.1177/0047239520934018

²¹ Vasile Gherheş, Claudia E. Stoian, Marcela Alina Fărcaşiu, and Miroslav Stanici. "E-learning vs. face-to-face learning: Analyzing students' preferences and behaviors." *Sustainability*, 13, no. 8 (2021): 4381. https://doi.org/10.3390/su13084381

²² T.S. Aiswarya Muthuprasad, K. S. Aditya, and Girish K. Jha. "Students' perception and preference for online education in India during COVID-19 pandemic." *Social Sciences & Humanities Open* 3, no. 1 (2021): 100101. https://doi.org/10.1016/j.ssaho.2020.100101

²³ Kennepohl, Dietmar. "Remote control teaching laboratories and practicals." *Accessible Elements* (2010): 167.

²⁴ Kennepohl, Dietmar. "Remote control teaching laboratories and practicals." *Accessible Elements* (2010): 167; Ku, Harry, Tony Ahfock, and T. Yusaf. "Remote access laboratories in Australia and Europe." *European Journal of Engineering Education* 36, no. 3 (2011): 253-268. https://doi.org/10.1080/03043797.2011.578244

that exists between face-to-face and e-learning.²⁵ A study reported that the blended learning approach has the potential to increase students' engagement and participation and offer them the ability for students to view a demonstration of hands-on skills before face-to-face lab time which could have a positive effect on reducing the challenges they encounter in an online class.²⁶

Within countries in Africa, similar challenges associated with online learning during the COVID-19 pandemic have been reported in such countries as Ghana,²⁷ Egypt,²⁸ Nigeria,²⁹ and South Africa.³⁰ In South Africa, one major contributor to the challenges encountered by participants in online learning is the issue of the digital divide. Globally, the issue of the digital divide is seen as an inhibitor to the use of educational technology.³¹ These authors argue that the digital divide is a real phenomenon that has already gained ground in developed nations, but is worse in developing countries, not only in terms of internet access but in such areas as attitudes, skills as well as the type of use and outcomes. It is on that basis that this study explores factors that impact students' e-learning of Timber Processing and Application with the view to propose pathways that ensure smooth e-learning of the module.

THEORETICAL FRAMEWORK

The study, factors that hinder the e-learning of Timber Processing and Application, is framed by Davis' work, the Technology Acceptance Model (TAM, hereafter).³² The choice of this framework is based on two constructs namely Perceived usefulness (PU, hereafter) and Perceived ease of use (PEoU, hereafter). Perceived usefulness is defined as the degree to which a person believes the usage of a particular system or technology would enhance his or her job performance. On the other hand, the perceived ease of use is associated with the effort attached with the use of that system. That is, the use of such technology or system is free of effort. The philosophical principles that established TAM have a strong basis in the use of ICT. Several scholars in their use of TAM have provided empirical evidence on the relationship that exists between usefulness, ease of use and the technology itself.³³

Two variables in TAM are significant in the adoption of technology in learning namely internal and external. Accordingly, the internal variables in the model describe that the attitude of the learner on the use of modern technology is explained by the perceived ease of use and the perceived usefulness of that technology. TAM supports the impact of the perceived usefulness of e-learning technology on the acceptance of e-learning systems by students to pursue online learning. External variables are related to other aspects that influence learners' acceptance of e-learning systems in teaching and learning and these are expected to

²⁵ Anderson, Terry. "Theories for learning with emerging technologies." *Emergence and innovation in digital learning: Foundations and applications* 1 (2016): 35-50. https://doi.org/10.15215/aupress/9781771991490.01; Bates, A. W. "Teaching in a digital age. Guidelines for designing teaching and learning for a digital age. Tony Bates Associates Ltd." (2018); Graham Charles R *Blended learning systems. The handbook of blended learning: global perspectives, local designs.* Wiley imprint, San Fransisco (2006).

²⁶ Volansky, Kerry. Physical Therapist Educators' Perceptions of the Benefits and Challenges to Teach "Hands-On" Skills In A Blended Environment." *Quarterly Review of Distance Education* 20, no. 3 (2019): 11-29,52. https://www.proquest.com/ scholarly-journals/physical-therapist-educators-perceptions-benefits/docview/2375711266/se-2?accountid=36534.

²⁷ C.C. Owusu-Fordjour, C. K. Koomson, and D. Hanson. "The impact of Covid-19 on learning-the perspective of the Ghanaian student." *European Journal of Education Studies* (2020). https://doi.org/doi:10.5281/zenodo.3753586

²⁸ Ahmed M. El-Sherbini, Mohamed A. Aboul-Dahab, Mohamed Mostafa Fouad, and Mohamed F. Abdelkader. "Distance learning during Covid-19: Lessons learned and Case studies from Egypt." In 2021 IEEE Global Engineering Education Conference (EDUCON), 1743-1748. IEEE, 2021.

²⁹ Folasade Esther Jimola, and Graceful Onovughe Ofodu. "Sustaining Learning during COVID-19 Seismic Shift: The Need to Develop Flexible Pedagogy." *Interdisciplinary Journal of Education Research* 3, no. 1 (2021): 14-26.

³⁰ David Mhlanga, "Industry 4.0: The challenges associated with the digital transformation of education in South Africa." *The Impacts of Digital Transformation* (2020): 13.

³¹ Alexander JAM Van Deursen, and Jan AGM Van Dijk. "The first-level digital divide shifts from inequalities in physical access to inequalities in material access." *New Media & Society* 21, no. 2 (2019): 354-375. https://doi.org/10.1177/1461444818797082

³² Fred D. Davis, "Perceived usefulness, perceived ease of use, and user acceptance of information technology." *MIS Quarterly* (1989): 319-340.

³³ Dennis A. Adams, R. Ryan Nelson, and Peter A. Todd. "Perceived usefulness, ease of use, and usage of information technology: A replication." *MIS quarterly* (1992): 227-247.

impact the intentions of learning adoption through ease of use and usefulness.³⁴ The existence of empirical evidence suggests that user behaviour is the determinant of the theoretical significance of PU and PEoU of TAM.³⁵ This implies that user behaviour is influenced by external variables which are linked to individual differences, characteristics of the system, social influences and facilitating conditions. Evidence from empirical findings highlights the connection that exists between the two basic constructs namely, PU and PEoU, in diverse applications.³⁶

The choice of TAM in this study is premised on the factors that impact on students' e-learning of Timber Processing and Application course during the COVID-19 pandemic. The study involves students who migrated from F2F to an online platform in the learning of their module because of the lockdown caused by the COVID-19 pandemic.

METHODOLOGY

A qualitative case study approach was employed, and the study was located within the interpretive paradigm. This is because qualitative research employs multiple foci that involve how things are done and the outcome that follows.³⁷ Qualitative research is interpretative in nature and employs a naturalistic approach to its subject matter.³⁸ The implication is that qualitative researchers study things in their natural settings, with an attempt to make sense of, or interpret, phenomena in terms of the meanings people ascribe to them. Qualitative research involves the studied use and collection of a variety of empirical materials – case studies, personal experiences, introspective life stories, interviews, observations , history , interactions , and visual texts – that describe routine and problematic moments and meanings in individual lives.

Timber Processing and Application is amongst the three components studied in Technology Education Module alongside Plastic, Clay and Fibre. Therefore, the sample for the study consisted of 15 participants of the selected module. Six females and nine males were purposively selected from the group studying Timber Processing and Application at the time of the research. Before the outbreak of COVID-19, the participants of this study were attending F2F lectures and then migrated to e-learning of the module because of the pandemic. The data collection was executed within a month, specifically in April, 2020.

Before data collection, ethical consideration was given full attention. The University Ethics Research and Ethics committee permitted the conduct of the study through the issuance of ethical clearance. The research Protocol Reference Number issued is HSS/1070/018. Participation in the study was based on participants' consent, and the purpose of the study was made known to them. Besides, in line with confidentiality and anonymity, the names of all participants that took part in the research are not mentioned.

Data for the study was generated through opened-ended online questionnaires designed using Google forms. The questionnaire items included questions on the impact of online teaching and learning of practical courses, the availability of the required facilities and the hindrances to this type of learning during the pandemic considering students' current location. The inclusion of these items on the questionnaire was to achieve the study validity.³⁹ Credibility in the study was achieved through the triangulation of multiple sources, as data was generated from level 300 and 400 students in the Natural, Physical, Biological Sciences offering Timber Processing and Application.⁴⁰ The questionnaires were disseminated through emails and

³⁴ Venu Madhav Sunkara, and Rajasekhara Rao Kurra. "An analysis of learner satisfaction and needs on e-learning systems." *International Journal of Computational Intelligence Research* 13, no. 3 (2017): 433-444.

³⁵ Davis, "Perceived usefulness, perceived ease of use, and user acceptance of information technology." 319-340.

³⁶ Oluwole Durodolu, "Technology Acceptance Model as a predictor of using information system'to acquire information literacy skills." *Library Philosophy & Practice* (2016); Mulugeta Hayelom Kalayou, Berhanu Fikadie Endehabtu, and Binyam Tilahun. "The applicability of the modified technology acceptance model (TAM) on the sustainable adoption of eHealth systems in resource-limited settings." *Journal of Multidisciplinary Healthcare* 13 (2020): 1827.

³⁷ Patrik Aspers, and Ugo Corte. "What is qualitative in qualitative research." *Qualitative sociology* 42, no. 2 (2019): 139-160. https://doi.org/10.1007/s11133-019-9413-7

³⁸ Norman K Denzen and Yvonna S. Lincoln, "The Sage handbook of qualitative research." (3rd ed.) (Carlifornia: Sage Publications Ltd. 2005).

³⁹ L. Leung, "Validity, reliability, and generalizability in qualitative research. J Fam Med Prim Care. 4 (2015); 324.

⁴⁰ Lisa A. Guion, David C. Diehl, and Debra McDonald. "Triangulation: Establishing The Validity Of Qualitative Studies: FCS6014/FY394, Rev. 8/2011." *Edis* 2011, no. 8 (2011): 3-3.

WhatsApp messages. The approach was deemed appropriate because of the COVID-19 restriction which demanded social distancing. The questionnaires were emailed to all 211 students studying Timber Processing and Application, Plastic as well as Clay and Fibre. Amongst this, a third of the population was studying Timber Processing and Application at the time the research was conducted, and only 38 students responded. From the number of responses received, the data that addressed the objective of the study was compiled and analysed.

The data collected via Google forms was analysed thematically.⁴¹ The process follows familiarisation with the data, generating codes, generating themes, reviewing the themes, defining and naming themes, and subsequently reporting. A table was designed where data reflecting similar content were tabulated and coded; thereafter, themes were generated from the coded data; this was followed by a review of the themes. Then, defining and naming for final reporting.

RESULTS

This section presents the following six themes that emerged from the analyses of data generated namely, internet-related issues, preference for face-to-face learning, absence of practical activities in e-learning, unavailability of ICT learning infrastructure, difficulty in time management and self-discipline as well as lack of conducive learning environment. These themes are presented and analysed below.

Internet-related issues

Findings from the analysis of data generated from the participants revealed internet-related issues namely, accessibility to the internet, data bundle and poor network as challenges to their participation in e-learning. Six participants alluded to this, as an inhibition to their participation. This was confirmed in the comments of the following students.

The only thing I have is a laptop without an internet connection; Studying online will be hard for persons that lack internet access and laptop, so only time will tell how sustainable these approaches are; I want to come back to my school wifi, I miss it so much; No full-time internet accessit is difficult to consistently have internet access; ...I am unable to connect to my internet due to lack of wifi.

On the other hand, three participants narrated their experiences as it relates to the data bundle required for internet connectivity, as expressed below;

"We need to be provided with data. The university has tried but not all of us have the sim card that the university data requires, I can't change a sim card because MTN network doesn't function very well in my area"....data depletion is quick, so that has been a problem ""I am unable to connect to my internet due to lack of data". "I think the issue is of data connection because currently, the data prices in South Africa is too expensive so it is really a problem to browse through the internet to do some research. Even to watch videos in the quest for more knowledge "...money for enough data, data costs are high.

Considering the challenge associated with the poor internet connection, a participant articulates that:

"My area is a rural area, so the network is always a problem since there are no towers around.... Not well sustainable because we will fail due to our environment. And network in our location is truly bad."

From the analyses of the excerpts above, it is indicative that lack of internet access, data bundle and poor network constitutes a major challenge to Timber Processing and Application students' participation in e-learning. According to the six participants that commented on the lack of internet access, the sustainability of e-learning depends on the availability of internet connection, and this seems not possible studying from home. One of the participants also noted the provision of data by the University and complained about the

⁴¹ Virginia Braun, and Victoria Clarke. "Using Thematic Analysis In Psychology." *Qualitative Research In Psychology* 3, no. 2 (2006): 77-101. https://doi.org/10.1191/1478088706qp063oa

ineffectiveness of such services as provided by MTN in their location, and this might have also affected participation in e-learning. Also, participants were vociferous on lack of data as a hindrance to e-learning of Timber Processing and Application. It was revealed that data depletes fast, its cost in South Africa is exorbitant, as a result, students are unable to access relevant resources to support their learning. Poor internet network which was revealed as a problem was attributed to the rural environment and the absence of cell phone towers (telecommunication masts), which led to the participants' conclusion that e-learning is not sustainable and will result in students' failure.

Preference for Face-to-face learning

Some participants who narrated their experience in the study of Timber Processing and Application expressed their preference for F2F learning when compared to e-learning mode as shown in the excerpts below.

"from time to time I depend on my lecturers for clarifications ...without practical's, it might affect my understanding of some concepts in the module... face-to-face classes are important for easy comprehension, the performance of practicals will be difficult without the needed materials, this will also affect group task, and this is helpful in sharing information; Group tasks can't be accomplished in the absence of face-to-face class as it makes communication hard. This is in all aspects of all modules".

Findings from the analyses of the comment in the excerpt above reveal students' preference for F2F learning when compared to e-learning. Several reasons are attributed to this preference. As revealed, F2F learning gives room first, for the performance of practical, and this also simplifies the understanding of some concepts which is difficult in e-learning. The study also revealed that carrying out practical tasks on e-learning is not possible due to the absence of the relevant requirements, which is not necessarily the same with F2F learning. Furthermore, the study found that F2F learning gives room for group tasks which creates avenues for easy interaction.

Absence of practical activities in e-learning

One of the participants who commented expressed her view on the absence of practical activities during their participation in e-learning. This is expressed in the comment below.

"As a science teacher (prospective), you need to be able to teach laboratory skills. Which we as student teachers are now not being taught. We need to be equipped with hands-on lab skills so that when we teach, we know exactly what we are talking about."

From the analysis of the comment above, it can be seen from the participant's perspective that practical tasks were not possible to execute because of the e-learning approach adopted during the pandemic. According to the participant, this aspect of the module is very important because it gives its recipient the practical foundation and knowledge required of a science teacher.

Unavailability of ICT and other learning infrastructure

From the analysis of data generated on participants perspectives, it was revealed that, participation in remote learning is only possible based on the availability of the necessary ICT learning gadgets. These, they expressed in the comments below.

"Well, since everyone in my family is in the house, each person wants to make use of the laptop, so I don't have sufficient time to concentrate on my studies, I share the laptop with others at home, so availability is a worry."

"I don't have a laptop or a phone that functions well enough for me to participate. Learning will be a challenge as we come from various households facing different challenges... Insufficient resources and audio devices. I have impaired hearing. Earphones, a laptop and other audio devices are a necessity." "No laptop, I only have my cell phone and it has space problems, especially when downloading content and typing is almost impossible. There is a smartphone that I will use, and my neighbour is willing to lend me a laptop in times of need." "I don't have many facilities/resources to engage in such."

"The fact is that I don't own the required facilities such as a laptop or quality access to an internet connection to complete specific tasks at a given time.

Findings from the excerpts above reveal that the availability of ICT learning gadgets constitutes a hindrance to participating in e-learning. According to one participant, there is only one laptop at home, and since everyone wants to use it, this becomes a 'survival of the fittest game', thereby making it difficult to have access to the laptop when needed. Consequently, this impacts the student's study since it brings about a lack of focus. A participant also lamented on lack of a functional laptop or phone to participate in e-learning, and this could be attributed to the challenges at home that impeded the participant's effective participation, but then status at home is a major factor. The participant further stated the need for other resources, his comments revealed his disability and as such the need for audio devices that will facilitate his participation in e-learning. However, two participants share similar views on being in possession of cell phones with which they took part in remote learning. From the third participant's encounter whilst downloading bigger files due to insufficient space. Typing efficiently was also a challenge faced by the respondents.

Difficulty in time management and self-discipline

Some participants expressed concern about how difficult it was to manage their time as well self-discipline participating in e-learning. This they expressed in the comments below.

"It really difficult to manage your own time, especially at home because you also have to do some chores and thinking that there is no modules timetable at all to know that you have attended a class."

".... Sometimes I fail to comply with the time I allocate for studying. Chaos and lack of discipline to the time frame for studying."

"One must have learning discipline which I still don't have."

From participants' comment above, it is highlighted that time management and self-discipline are challenges when it comes to participating in e-learning. According to the first participant, there is a conflict of interest when it comes to juggling between academic and domestic activities as expressed in her comment above. A participant also highlighted time management as a challenge. Lack of discipline and chaos are cited as the major reasons why there is improper use of time. On the act of discipline, it was articulated that one must have learning discipline if the person is to participate in e-learning.

Lack of Conducive Learning Environments

One participant expressed her view on the poor environmental condition which inhibits effective participation in e-learning. This is expressed in her comment below.

"...no encouraging atmosphere for study, privacy, no space to study, inability to focus, stress and anxiety.

Findings from the analysis of the comment above reveal that most learning environments especially at home, are not conducive for e-learning. The student attributed this to a lack of privacy, which probably leads to a lack of concentration, stress and anxiety.

DISCUSSION OF FINDINGS

This section presents the discussion of findings emanating from students on variables that affect their transition from F2F to e-learning of Timber Processing and Application amid the COVID-19 pandemic. These findings are discussed below.

Theme 1: Internet-related issues.

The study found that limited or no access to the internet, lack of data bundles and poor internet connection constituted challenges to students' participation in e-learning of Timber Processing and Application.

Limited or no access to the internet has been reported as a challenge by many scholars.⁴² The research found that lack of internet access constitutes a challenge to online learning.⁴³ This is consistent with a study that revealed that access to the internet plays a major role in the achievement of e-learning and that this cannot be achieved if students have limited or no access. Besides, another revelation in agreement with this result reported that the efficiency of e-learning services is reduced because of low or limited internet provision.⁴⁴ The study found that e-learning was hampered due to a lack of internet data. This corroborates a study that found that lack of internet data contributed to science and technology students' inability to take part in remote learning during the lockdown.⁴⁵ The study also found that data cost is very expensive. This is consistent with another research which revealed that internet service required to connect e-learning platforms necessitates a lot of data. Also, the cost to purchase data bundles is too high which might be difficult for both students and lecturers. Also found in the study was poor internet connectivity as a challenge to e-learning. This result complemented another study that reported poor internet service among other challenges, as part of the glitches to effective online learning of students in the Philippines.⁴⁶ Poor internet connectivity is said to be one of the major hindrances to e-learning. This agrees with a finding which highlighted that unstable internet connectivity impacted negatively on students' e-learning experience in Jordan.⁴⁷ According to the study, students from rural remote communities are faced with this kind of challenge.

Theme 2: Preference for face-to-face learning

The study found that the preference of participants favoured F2F when compared to e-learning. Firstly, F2F learning offers clarity and an easy understanding of concepts. This finding is in line with another result which revealed that students having contact with the teacher promotes learning and enhances understanding of concepts taught.⁴⁸ Secondly, the results show that the e-learning environment lacks that physical interaction inherent in F2F learning. Also, this is consistent with another study which revealed that students preferred F2F learning when compared to e-learning because the interaction in F2F learning is one activity students cannot do away with because they love to work together with their peers.⁴⁹ According to the TAM, the perceived usefulness of technology is influenced by the perceived ease of use. In respect of these findings, the perceived ease of use of e-learning when compared to F2F is negative because of the difficulties the understanding of concepts taught as well as the lack of physical interaction between peers.⁵⁰

⁴² I.A. Adeoye, A. F. Adanikin, and Ariyo Adanikin. "COVID-19 and E-learning: Nigeria Tertiary Education System Experience." *International Journal of Research and Innovation in Applied Science (IJRIAS)* 5 no 5, (2020).

⁴³ Cedric B. Mpungose,"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* 7, no. 1 (2020): 1-9. https://doi.org/10.1057/s41599-020-00603-x

⁴⁴ Zhang Guoli, and Liu Wanjun. "The applied research of cloud computing platform architecture in the E-Learning area." In 2010 The 2nd International Conference on Computer and Automation Engineering (ICCAE), 3, (2010): 356-359. https://doi.org/10.1109/ICCAE.2010.5451399

⁴⁵ Legg-Jack, "Readiness for the Fourth Industrial Revolution." Add page number.

⁴⁶ Jessie S. Barrot, Ian I. Llenares, and Leo S. Del Rosario. "Students' online learning challenges during the pandemic and how they cope with them: The case of the Philippines." *Education and Information Technologies* 26, no. 6 (2021): 7321-7338.

⁴⁷ Anas Ratib Alsoud and Ahmad Ali Harasis. "The impact of covid-19 pandemic on student's e-learning experience in Jordan." *Journal of Theoretical and Applied Electronic Commerce Research* 16, no. 5 (2021): 1404-1414.

⁴⁸ Owusu-Fordjour, Koomson and Hanson. "The impact of Covid-19 on learning-the perspective of the Ghanaian student."

⁴⁹ Gherheş, Stoian, Fărcașiu, and Stanici, E-learning vs. face-to-face learning, 4381.

⁵⁰ Davis, "Perceived usefulness, perceived ease of use, and user acceptance of information technology." 319-340.

Theme 3: Absence of practical activities in e-learning

The study revealed the absence of practical activities in e-learning. According to the findings in this study, science teachers should be equipped with hands-on skills needed to teach the subject, but this they have missed because of the e-learning approach. This finding agrees with the result of another research, a similar revelation was made in their study for agricultural students in India, it was highlighted that conducting practical activities via online learning is difficult.⁵¹ According to them, there is a need for a blended approach to cater for all aspects of learning. In addition, it was reported that e-learning is not suitable for all subjects, especially those with demonstrative practice.⁵² According to the TAM framework, it is suggestive that the Perceived usefulness of e-learning is uncertain since it does not allow for practical activities. TAM further remarked that people tend to either use technology or not based on their belief that it will help them to perform their job. This follows the advantage technology offers in terms of the affordance to achieve the purpose or goal of a given task. Hence, the perceived usefulness of e-learning in the study of the practical aspect of Timber Processing and Application is negative, as such their adoption of this type of education is not conceivable.

Theme 4: Unavailability of ICT and other learning infrastructure

One peculiar area that has hampered the effectiveness of e-learning is the unavailability of the needed ICT and other learning infrastructure.⁵³ The research found that some students of Timber Processing and Application lack the needed learning infrastructure in the transition from F2F to e-learning. This is corroborated by the study that signposted lack of sufficient personal equipment, such as personal computers and electronic devices, laptops, and smartphones hinder online learning.⁵⁴ Similarly, other studies revealed that lack of ICT infrastructure constitutes part of the challenges that affected medical students' choice of online learning during the lockdown.⁵⁵ It was also found in the study that provision needs to be made for students with disabilities to ensure their effective participation.

Theme 5: Difficulty in time management and self-discipline

Time management is very crucial in planning online programmes.⁵⁶ As revealed, participants in the study had the difficulty in managing their time. This agrees with another study which revealed that students who study at home find it difficult to manage their time.⁵⁷ They concluded that the ability to keep to time schedule affected online learning outcomes. The study also found that self-discipline is necessary to stay with e-learning. In agreement with this, a scholar cautioned that maximizing the benefits of online learning demands the inculcation of critical values such as self-discipline and self-direction.⁵⁸

⁵¹ Muthuprasad, Aditya and Jha. "Students' perception and preference for online education in India during COVID-19 pandemic." 100101.

⁵² Krishna Regmi, and Linda Jones. "A systematic review of the factors-enablers and barriers-affecting e-learning in health sciences education." *BMC medical education* 20, no. 1 (2020): 1-18. https://doi.org/10.1186/s12909-020-02007-6

⁵³ Shivcharan Kumar, "Awareness, benefits and challenges of e-learning among the students of Kurukshetra University] Kurukshetra: A study." International Journal of Information Dissemination and Technology 8, no. 4 (2018): 227-230. https://doi.org/10.5958/2249-5576.2018.00048.1

⁵⁴ Robert Kananga Mukuna, and Peter J.O Aloka. "Exploring Educators' Challenges of Online Learning in Covid-19 at a Rural School, South Africa." International Journal of Learning, Teaching and Educational Research 19, no. 10 (2020): 134-149. https://doi.org/10.26803/ijlter.19.10.8

⁵⁵ Marwa Mohamed Zalat, Mona Sami Hamed, and Sarah Abdelhalim Bolbol. "The experiences, challenges, and acceptance of e-learning as a tool for teaching during the COVID-19 pandemic among university medical staff." PLoS One 16, no. 3 (2021): e0248758. https://doi.org/10.1371/journal.pone.0248758 ; Dagogo William Legg-Jack, Digitalisation of Teaching and Learning in Nigeria amid COVID-19 Pandemic: Challenges and Lessons for Education 4.0 And 4IR. *Ponte International Journal of Sciences and Research*, (2021): 77(10/1). https://doi.org/10.21506/j.ponte.2021.10.10

⁵⁶ Alsoud and Harasis. "The impact of covid-19 pandemic on student's e-learning experience in Jordan, 1404-1414.

⁵⁷ Mila Sari and Trias Megayanti. "Time Management During Covid-19 Pandemic." In 6th UPI International Conference on TVET 2020 (TVET 2020), Atlantis Press, (2021):36-39., https://doi.org/10.2991/assehr.k.210203.082

⁵⁸ R. Hickey, "Disadvantages to consider about online education. Retrieved September 14, 2015," (5).

Theme 6: Lack of conducive learning environment

It is a fact from an empirical point of view that the academic performance of university students was affected by the environmental conditions, to which they were exposed at home during the COVID-19 pandemic.⁵⁹ Participants in the study lamented on the lack of conducive space to study. This is corroborated by another study that reported similar challenges as it revealed that environmental condition hinders effective online learning.⁶⁰ The lack of space led to the inability to concentrate resulting in stress and anxiety. This result is supported by another study which found that the lack of physical space conducive for learning contributes to the poor mental condition of online participants.⁶¹ Consequently, it was argued that, despite the expectation that e-learning increases educational opportunities for all students irrespective of background and socioeconomic status, there are still challenges associated with this type of education.⁶² It is in this regard that Dhawan concludes that students without a conducive working space will be disadvantaged.⁶³

CONCLUSION AND RECOMMENDATIONS

The study explored the e-learning of Timber Processing and Application during the COVID-19 pandemic. The objective was to identify variables that hinder the adoption of e-learning for the study of Timber Processing and Application. This objective was addressed through a review of related literature on e-learning. Technology Acceptance Model was employed as a theoretical framework, whilst a qualitative case study design was applied in data generation and analysis. The results highlighted limited/no access to the internet, lack of internet data bundles, poor internet connectivity, preference for face-to-face learning, absence of practical activities in e-learning, unavailability of ICT learning infrastructure, difficulty in time management and self-discipline as well as lack of conducive learning environment as challenges to the smooth e-learning of the Timber Processing and Application course. From the above challenges, the study concludes that the e-learning of Timber Processing and Application during the COVID-19 pandemic was marred with diverse challenges.

Furthermore, the study also concludes that e-learning approach alone cannot cater for the learning of Timber Processing and Application but to complement the face-to-face appraoch since the module involves practical activities. From the findings, the study recommends that all stakeholders within the Department of Higher Education and Training, Government, and Civil Society Organisations should collaborate to ensure the increased investment to cater for such challenges as highlighted above. Also, there is need to make provision for blended or hybrid learning approach which is a combination of face-to-face and e-learning methods to ensure the effective learning of the module because of the theoretical and practical component. Furthermore, the study recommends that students should be introduced and trained in the use of various online platforms for educational purposes so as to cater for learning in times of disruptions such as the COVID-19 pandemic.

⁵⁹ Arturo Realyvásquez-Vargas, Aidé Aracely Maldonado-Macías, Karina Cecilia Arredondo-Soto, Yolanda Baez-Lopez, Teresa Carrillo-Gutiérrez, and Guadalupe Hernández-Escobedo. "The impact of environmental factors on academic performance of university students taking online classes during the COVID-19 Pandemic in Mexico." *Sustainability* 12, no. 21 (2020): 9194. https://doi.org/10.3390/su12219194

⁶⁰ Caroline M Aziony and Abyshey Nhedzi. "The Digital Divide and Higher Education Challenge with Emergency Online Learning: Analysis of Tweets in the Wake of the COVID-19 Lockdown." *Turkish Online Journal of Distance Education* 22, no. 4 (2021): 164-182. https://doi.org/10.17718/tojde.1002822

⁶¹ Ronnie E.Baticulon, Jinno Jenkin Sy, Nicole Rose I. Alberto, Maria Beatriz C. Baron, Robert Earl C. Mabulay, Lloyd Gabriel T. Rizada, Christl Jan S. Tiu, Charlie A. Clarion, and John Carlo B. Reyes. "Barriers to online learning in the time of COVID-19: A National Survey Of Medical Students In The Philippines." *Medical science educator* 31, no. 2 (2021): 615-626. https://doi.org/10.1007/s40670-021-01231-z

⁶² Andre Matthias Müller, Charlene Goh, Li Zhen Lim, and Xiaoli Gao. "Covid-19 Emergency Elearning And Beyond: Experiences And Perspectives Of University Educators." *Education Sciences* 11, no. 1 (2021): 19. https://doi.org/10.3390/educsci11010019

⁶³ Dhawan,. "Online learning: A panacea in the time of COVID-19 crisis." 5-22.

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