A CRITICAL ASSESSMENT OF THE IMPACT OF COVID-19 PANDEMIC ON CONSTRUCTION EDUCATION, TEACHING AND LEARNING IN SOUTH AFRICA

BY

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ABSTRACT

The emergence of the global pandemic Coronavirus (COVID-19) disease was confirmed by the National Institute for Communicable Diseases (NICD) on the 5th of March 2020. Across the world, the outbreak of the COVID-19 has challenged the education system such that academic institutions have been struggling with ways of delivering education safely and affordably to prevent the spread of the virus. This stimulated the need for higher education institutions to fully adopt the online learning approach in teaching and learning (T&L).

Unfortunately, the sudden shift from the traditional approach of teaching to an online mode of teaching and learning has given rise to new problems due to the unpreparedness of society to face sudden change. This study aims to examine the impacts that the new online teaching and learning methods have on students with a view to proffering possible measures of improving the teaching and learning in this era of digital platform among the construction management and quantity surveying students in South Africa tertiary education institutions. The study adopted a mixed research method approach using a questionnaire for quantitative and semi-structured interview instruments for the qualitative aspect of the research. A total of seventy-seven (77) questionnaires were obtained from construction students within the Construction Management Quantity Surveying department at the Durban University of Technology. The target participants for this study. In addition, six (6) academic staff were interviewed to get the qualitative data for the study. Both quantitative and qualitative data were collected simultaneously but were analysed separately. The quantitative data from the questionnaire were analysed through descriptive and exploratory factor analysis utilising Statistical Package for the Social Sciences (SPSS) version 28. While the qualitative data from the semi-structured interview were analysed thematically.

The overall findings of this study showed that changing from face-to-face to online learning during the pandemic had a major impact on students' performance. The key findings from quantitative results indicated that the transition from face-to-face to online has resulted in various challenges or setbacks such as technical problems associated with internet connectivity, lack of skills training, psychological setbacks associated with mental health, social setbacks and infrastructure support. This study discovered these challenges are crucial towards the academic performance of students and the successful implementation of online learning. Furthermore, the results of the qualitative analysis concluded that class attendance, internet connections, lack of technical skills and lack of infrastructure support are key challenges facing the delivery of online learning during the pandemic and the academic performance of the students. These findings were in line with findings of quantitative analysis. Other challenges that contributed to poor performance are, that students were isolated, and they couldn't collaborate. The study also revealed lack of proper devices for online learning such as laptops and cell phones affected students and the delivery of online learning. The findings of this study also highlighted measures that can be implemented to improve online T&L during the COVID-19 pandemic. From the findings of this study, it was evident that there is a need for proper training in skills on how to use online platforms. Other measures included: the provision of infrastructure support such as computers, laptops and enough data provision of counselling for students and academic staff to maintain the state of mental health, introduction of learning management systems such as blended learning, distance learning and massive open online courses. Globally higher education institutions have demonstrated resilience in response to the COVID-19 pandemic. Therefore, this study recommends that online learning should be promoted by the government and university policymakers thus this will help to enhance the practice among students and academics also working towards the Industrial Revolution. This will be achieved through assuring that.

The competence skills required by students and lecturers to utilise the technological functions of online learning, the provision of infrastructure support, quality assurance and different learning management systems such as blended learning are being prioritised

Keywords: COVID-19, Teaching, Learning, Online, Student

DECLARATION

I, SOHUMA PINDILE confirm that every element presented in this research work is the result of my individual work and no outside help was sought or obtained. This research has not been submitted anywhere else before for any academic qualification. In addition, it shows what I personally think and may not be the same as the Durban University of Technology's standpoint.

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DEDICATION

This research thesis is highly dedicated to my parents, my late father, Golden Gunguza Sohuma, my late mother, Cynthia Vuyelwa Nobuntu, sisters, Nolukholo, Busisiwe, and Noluvo. Lastly to my beloved friend Andiswa Yolanda Jalubane

The Almighty God, Bless Us All!

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My inspirational biblical scripture in Jeremiah 29:11: **“For I know the plans I have for you," declares the LORD, "plans to prosper you and not to harm you, plans to give you hope and a future.”** kept me going until 26th year of living and loving.

I am grateful and acknowledge God for granting me the resilience to persist in this research undertaking. I want to express my sincere gratitude to the Higher Being who created me, who has been my source of guidance and support, and who has consistently shown me unmatched love and assistance when I needed it the most. Thank you, Almighty God.

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To Sohuma family, thank you for their prayers and support through this journey. To all colleagues, friends, and loved ones are too numerous to mention that have significantly contributed towards the successful completion of this research thesis.

I thank you all.

LIST OF PUBLICATIONS

Modupe Celcilia, Mewomo and Pindile Sohuma (2022). *E-Learning Challenges Faced by Construction Management Students in South African institutions during COVID-19 Pandemic.* 16th Built Environment Conference Johannesburg 2022 (ASOCSA). 27th -28 September 2022

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LIST OF ABBREVIATIONS

ICT-Information and Communication Technologies

CMQS- Construction Management and Quantity Surveying

HOD- Head of Department

OL- Online Learning

LMS-Learning Management System

COVID-19- Corona Virus

WB-World Bank

HE- Higher Education

SSI- Semi-Structured Interviews

RO- Research Objective

BL-Blended Learning

MOOC -Massive Open Online Courses

T&L – Teaching and Learning

DUT- Durban University of Technology

KZN- KwaZulu Natal

IoT- Internet of Things

SPSS- Statistical Package for the Social Sciences

EBE- Engineering and Built Environment

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

This dissertation assesses the critical impact of COVID-19 on construction education T&L. This chapter specifically presents the background information, problem statement, aim of the study, research questions, objectives, motivation, and justification for this study. It is anticipated that upon the completion of this chapter, the reader will understand what the study is about.

1.2 BACKGROUND STUDY

Traditionally before the advent of COVID-19 pandemic, construction education has been content-based, hands-on, design-oriented, and concentrated on the development of critical thinking or problem-solving abilities (Bourne, Harris and Mayadas 2005). Various methodologies, including active constructivism, project and problem-based learning, flipped classrooms, and project and problem-based learning, have improved higher education in the built environment (Bishop and Verleger 2013; Lima, Andersson and Saalman 2017).

Over the last decade, online education has established itself as a significant tool for higher education institutions. Despite the benefits of online education, it is often faced with scepticism and opposition from both educators and students (Vivolo 2016). Converting a traditional learning to an online format takes time and needs substantial work from the university stakeholders, as well as expertise with the resources available (Asgari *et al.* 2021). According to Meng, Hua and Bian (2020), traditional learning is known as in-person education and is the approach of conducting T&L activities in physical classrooms provided by educational institutions, where teachers and students have direct interaction.

In the study conducted by (Mpungose 2020), it was stated that face-to-face learning is often viewed as traditional since it overlooks the students' individual experiences.

The COVID-19 pandemic has drastically altered the methods in which higher education (HE) institutions presently provide education. Students and lecturers from all study disciplines and levels were required to immediately convert to online learning teaching methods and evaluation in accordance with national lockdown regulations (Lockee 2021). According to (Benson 2002; Conrad 2002; Carliner 2004) online learning is described as access to learning experiences via the utilisation of some technological tools and advancements such as the internet, wireless networks, mobile phones, and other means of communication (Ratheeswari 2018). This abrupt change from the traditional approach of T&L to online learning posed a significant challenge, disruption, and disturbance to work-life balance and wellbeing, with many students and staff in the built environment education sector as they were feeling particularly isolated and detached from their peers and colleagues with whom they worked and socialised on a daily basis prior to the pandemic (Gülbahar and Adnan 2020; Abbasnejad, Soltani and Wong 2023). The virus that started in Wuhan, China quickly spread and affected many countries around the world (Tang *et al.* 2020). The Coronavirus pandemic has had an influence on the education system by causing an emergency shift from conventional classroom to remote learning, and now online learning has been found to be prevalent tool or widespread instrument to COVID-19 pandemic and with the technological advancements and the Internet, educational institutions are modifying their learning strategies in order to fulfil the needs of users in offering an ideal T&L environment (Carter Jr *et al.* 2020). Since online learning promotes the idea of lifelong learning and information is becoming more important, society and educational institutions must take seriously.

1.3 PROBLEM STATEMENT

The outbreak of the COVID-19 pandemic had a tremendous impact on the institutions of higher learning globally. As a result of the pandemic, many institutions of higher learning across the globe were forced to radically transform their mode of operation in a short period of time (Mtshweni, 2022). The South African institutions of higher learning were a no exception. In the study of Mpungose (2020), the author asserts that South African universities have been forced to transit from face-to-face to online learning (e-learning) because of the COVID -19. This has posed serious challenges on T&L in the university.

Jantjies, (2020) states that South African online challenges are driven by lack of access to hardware, understanding digital means of communication, and internet affordability. Durban University of Technology students specifically stated that the lockdown has affected them academically since I had to go back home they faced the issues of not having access of communicating with their supervisor or lecturers on how to continue with course content and research due to network issues at home. Students also highlighted lack of hardware infrastructure is also affecting them. Hence these factors are negatively contributing to two country's best chances at development and equality, this being access to quality education and access to employment opportunities. According to Joshi (2021) feels that the opportunity provided by COVID-19 can be embraced by South African education officials and policymakers to introduce new learning modes, such as online learning, to strengthen their education systems. This allows them to deal with present disturbances, recover from them, and plan for future problems. However, we cannot ignore the various challenges faced by students to transition to online learning. Aguilera-Hermida (2020), states that it is important to consider students' challenges and their preferences; these will assist in forming strategies that will help should some other such

waves or disasters can occur in the future. The purpose of this study was to critically asses the impacts of Covid-19 pandemic in construction education teaching and learning. In this regard, the gaps in the current education system were identified and likely scenarios were explored based on the current education system in order to better inform the policymakers and key stakeholders in the academic industry on the role and effect of online learning. The specific problem to be investigated in this research study concerns challenges and measures to improve construction education during the pandemic. Therefore, the research seeks to answer the following question:

1.4 RESEARCH QUESTION

1.4.1 What are the setbacks of online T&L on construction education and construction student performance?

1.4.2 What measures can be taken in improving the T&L in this era of COVID-19 on construction education in the case of CMQS students?

1.5 RESEARCH OBJECTIVE

1.5.1 To assess the setbacks of online T&L towards Construction Education that affect student academic performance.

1.5.2 To proffer measures in improving the T&L on construction education in this era of digital platform.

1.6 AIMS AND OBJECTIVES OF THE STUDY

This study aims in examining the impacts of Covid-19 pandemic on construction education, teaching and learning. Also suggest possible proffering measures of improving the teaching and learning for construction education in this era of digital platform in South African tertiary education institutions.

1.7 SIGNIFICANCE OF THE STUDY

The study provided detailed information on the impacts of the COVID-19 Pandemic on the construction education and offers management of tertiary institutions an understanding of the extent of the problem and provides an essential step to mitigate it.

1.8 SCOPE OF THE STUDY

This study was conducted at the Durban University of Technology. This was conducted in the Faculty of Engineering and Built Environment (EBE) under the department of Construction Management and Quantity Surveying (CMQS) in Durban.

1.9 LIMITATION OF THE STUDY

This study was limited to the Durban University of Technology, the department of Construction Management and Quantity Surveying students and lecturers.

1.10 DELIMITATION OF THE STUDY

This research study was conducted on second to fourth year students, and nine full-time lecturers employed in the department of Construction Management and Quantity Surveying. Other departments were not included in the study as the focus of the study is to assess the impact of COVID-19 on online T&L in the department of Construction Management and Quantity Surveying (CMQS)

1.11 RESEARCH METHODOLOGY

The methodology used in this study is mixed method approach. Questionnaires were used to gather the required information from students and interviews were also used to gather the required information from lectures in the department of CMQS. Permission from DUT's research office and

from the Head of Department (CMQS) was obtained prior to administrating questionnaires to students and conducting interviews with lectures. The primary data was obtained from both the students and lecturers, the data was captured and analysed. Both quantitative and qualitative data were collected simultaneously but were analysed separately. The quantitative data from the questionnaire were analysed through descriptive and exploratory factor analysis methods utilising Statistical Package for the Social Sciences (SPSS) version 28. While the qualitative data from the semi-structured interview were analysed thematically.

1.12 OUTLINE OF THE STUDY

1.12.1 Chapter One: Introduction

This chapter one contains the introduction of the research study which includes the background, the research problem, its aims, outlines the significance of the study, limitations and delimitations of the study. It briefly states the methodology used.

1.12.2 Chapter Two

The chapter two of this research provides a comprehensive review of literature from various sources such as journals, book, conference proceedings or conference papers and online research. The literature review section is organised based on the study's research questions.

1.12.3 Research methodology

This part of research chapter provides an overview of the design and implementation of the research. This passage offers a thorough examination of the various research instruments used, research design, the methods used for data collection, and the research approach for data analysis, chosen research

technique and the methodology for selecting the population and sample and the interpretation of the findings.

1.12.4 Data collection and analysis

The data collection section of the research study is dedicated to reporting the results and analysing the gathered information. in addition, the study's research questions are answered.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

In this chapter, the literature relating to this study was reviewed. Definition and evolution of the online T&L over the years will first be reviewed, followed by a general review of COVID-19 in relation to education. The advantages, challenges, significance and application of online learning during COVID-19 and the student performance were also be reviewed in this chapter.

2.2 EDUCATION SYSTEM BEFORE THE ADVENT OF COVID-19

The traditional education environment which has been functional for decades, had been refined to as close to perfect as it can get with many approaches, styles and philosophies adapted to suit the needs of the student and the task at hand (Meyer and Norman 2020). The built environment education has been improved in recent years as technological advancements have enabled multiple course curriculum delivery options for many higher education institutions globally. According to (Amirault 2015), using technology to deliver curriculum poses a variety of challenges, including: the quality of the deliverables, the security risks faced by the student, the cost of completing the program. Naturally, both lecturers and students face many challenges as online technology platforms have now become a popular and necessary means of delivering courses. Therefore, there is a need to strengthen systems that adapt to learning needs. Moreover, it is important to achieve the main goals before the modern education system becomes a reality (Kagermann 2014).

2.3 TRENDS OF ONLINE TEACHING AND LEARNING

Youth have never known a world without computers and cell phones for communication. As a result, this generation anticipates engaging in all aspects of life through media, spending most of the time online and using computers. Oranburg (2020), defines online learning as a technology-based design method for distributing, tracking, and managing courses over the Internet. Considering the above-mentioned aspects, this type of online learning can be seen as a natural evolution of the concept of distance education.

2.3.1 Multimedia learning

Multimedia learning is the use of many media types, which include text (alphabetic or numeric), symbols, graphics, photos, audio, video, and animations, frequently with the use of technology, to increase comprehension or memorisation. It assists lecturers, students, and the entire educational system in redesigning their curriculum for interactive and rich media learning. It also contributes to a strong communication process as well as reinforcing and innovative methods of learning and teaching. This methodology is popular because it motivates students and provides them with numerous ways to express their thoughts and ideas(Guan, Song and Li 2018).

2.3.2 Technology-enhanced learning

Technology-enhanced learning refers to the educational process that is facilitated through the utilisation of various technological mediums, including but not limited to the internet, computers, and video conferencing. This modality of learning brings advantages to both the instructor as well as the learner. From the perspective of the provider, there exist notable cost savings associated with enhanced performance and other strategic benefits. The paradigm affords learners with prompt feedback that is tailored to their individual needs, reusable instructional resources, and a captivating

learning milieu. Technology-enhanced learning has the capability to overcome limitations related to physical location, temporal constraints, and specific situations. This opportunity affords the student the liberty to select from a range of options concerning time, location, and preferred learning modality. The subject matter comprises a broad spectrum of offerings, spanning from rudimentary electronic curricula to immersive, technologically advanced, multimedia-infused, and collaboratively driven online courses (Shen and Ho 2020).

2.3.3 Computer-Based Instruction

The use of computers in education is a result of the significant progress made in communication and information technology. It offers a conducive educational setting for students. Computer-Based Instruction enhances student engagement and enthusiasm. The emergence of computer-based techniques can be attributed to the production and utilisation of multimedia elements such as audio-visual materials and animation. Computer-Based Instruction entails the utilisation of computers for the purpose of teaching and engaging in learning activities. It serves as an additional resource to traditional classroom teaching, inspiring students and creating a captivating and stimulating learning atmosphere. Numerous software applications have been created for Computer-Based Instruction with the intention of addressing course difficulties and circumventing the limitations of memory-based learning systems. It serves as an educational aid and helps students to generate tables and carry out calculations.

2.4 OVERVIEW OF ONLINE LEARNING IN HIGHER EDUCATION DURING THE PANDEMIC

Traditional and online learning are distinguishable based on prominent sources of information, assessment methods, and the standard of educational delivery. In conventional educational settings,

students rely exclusively on instructors who serve as their primary information providers and evaluators. The competence and expertise of these instructors greatly influence the quality of education received by students. Assessment in the context of online learning is facilitated through the utilisation of tools and systems, enabling students to access information contained within diverse documents uploaded onto the platform. Furthermore, the effectiveness of educational outcomes is contingent upon the proficiency and training of teachers in technological skills, alongside their pedagogical approach.

The T&L processes in higher education institutions have been altered due to the coronavirus pandemic, leading to changes in interactions between lecturers and students. Due to the pandemic, universities were compelled to shift all student interactions to an online platform (Coman *et al.* 2020). Many governments took action to halt the spread of the virus and guarantee the continuation of education, resulting in universities worldwide embracing online learning (Ali 2020). Modern educational technologies, in addition to their associated models and practices, have become crucial elements of the T&L process and have seen significant advancements in the higher education sector (Okoye *et al.* 2022). The introduction of digital technology in higher education institutions is not a new occurrence, but the recent global lockdowns due to COVID-19 have significantly accelerated the process of digitalisation in universities. As a result, universities are now compelled to offer online programs on a much wider scale. According to Lee (2017:33) and Kumar *et al.* (2019:17) the current form of online education started in the 1990s with the advent of the Internet and World Wide Web and continued to develop, as information and communication technologies (ICT) advanced and became more sophisticated. Szopiński and Bachnik (2022), was of the view that online learning is not just a temporary trend affecting universities, but a rapidly growing norm in the field of education. According to the author, online education is becoming more prevalent due to changing student

demographics and heightened competition in the education industry. Online education comes with distinct challenges that differentiate it from traditional in-person learning.

To succeed in this environment, both educators and students must undergo adequate preparation, training, and maintain consistent planning (Szopiński and Bachnik 2022).

2.5 IMPLEMENTATION OF ONLINE TEACHING-LEARNING IN HIGHER EDUCATION INSTITUTIONS DURING COVID-19

The education sector was greatly affected by the worldwide spread of COVID-19, leading to a significant crisis. Multiple countries implemented online education initiatives in response to the unprecedented disruption in the field of education (Bozkurt *et al.* 2020; Jena 2020; Muthuprasad *et al.* 2021). At the onset of the COVID-19 outbreak, the South African government promptly implemented a range of immediate measures to ensure societal coherence. The Ministry of Education, led by Blade Nzimande, introduced an emergency policy initiative in the field of education to transition from traditional in-person teaching methods to online education. In March 2020, the Ministry of Education suggested that universities should be shut down but emphasised the importance of continuing T&L activities without any interruption (Ministry of Education, 2020a). According to the statement released by Minister of Education the department has partnered up with department of Science and Innovation to compile documentation that will support the implementation and promotion of online T&L during the pandemic in line with policies of the department.

As online education has grown, its quality has attracted the attention of researchers. Machusky and Herbert-Berger (2022); Zhu, Liu and Hong (2022) pointed out the challenges of online education compared with traditional education amid the COVID-19 widespread, counting the failure to communicate face-to-face and increased individual obligation.

2.6 BARRIERS OF ONLINE LEARNING IMPLEMENTATION IN SOUTH AFRICA

2.6.1 Infrastructure support

The World Bank (2020:8), highlighted that several universities, including those with strong academic performance, might face challenges in swiftly implementing effective online education for all students during the current COVID-19 era. The rapid progress of technology frequently surpasses the capacity of decision-makers to stay updated on the expenses and infrastructure needed to support its growth. It is crucial to understand that successful online learning necessitates appropriate ICT support such as infrastructure, tools, and support systems for hardware and software. Without any hesitation, the integration of (ICT in educational programs is advancing swiftly. According to Machusky *et al*. (2022), the provision of infrastructure support for universities is a multifaceted matter. The devices need to have the capability to accommodate online educational platforms. Furthermore, it is imperative that the teachers and the students are situated in areas capable of providing the necessary bandwidth for these activities. The situation becomes more complex when institutions transition to a completely online learning format, requiring lectures to exclusively teach in remote locations. Infrastructure must have the capability to facilitate numerous, possibly hundreds of simultaneous videoconferencing sessions.

2.6.2 Staff Readiness

Willingness to embrace change is an important prerequisite for a successful technology integration, as it gives students the opportunity to learn and apply the skills needed in the 21st century (Landa, Zhu and Sesabo 2021). Since ICT in education is constantly changing, numerous institutions of higher learning around the world have discussed and implemented ICT to enhance education. This is due to the fact that technology serves as a catalyst and helps staff members prepare and deliver lessons

(Hofer, Nistor and Scheibenzuber 2021). Educational institutions may possess the required ICT equipment, but they face other obstacles like insufficient time for lesson preparation and inadequate curriculum design (Vrasidas 2015; Ali 2018b). The authors emphasise that simply having access to resources is not enough to ensure the successful implementation of ICT. The authors argued that other supportive factors, such as staff motivation, are necessary for this purpose.

2.6.3 Student Accessibility

According to Ali (2020), states that it is acknowledged that students have a strong affiliation with ICT. A study conducted by (Jesse 2015; Ali 2018a), was of the view that most students have the ability to use their smartphones for making phone calls, sending text messages, and accessing social media. Hoq (2020), further stated that it is not appropriate to expose students and teachers to vast online repositories without proper guidance during the COVID-19 pandemic lockdown. This is because even if they are technically proficient, they may lack the necessary theoretical knowledge for a specific profession. Basar *et al.* (2021), highlighted that the lack of fast, affordable, and reliable internet connections hinders online education, particularly for individuals residing in rural areas and underprivileged communities. Students who are unable to access online content through smartphones are unable to benefit from online learning because a significant amount of the content is not accessible.

2.6.4 Lack of ICT and Pedagogical Skills

Insufficient ICT skills among online tutors present a challenge to the effective implementation of online learning, as highlighted by (Al Mulhim 2014; Kundu and Bej 2021). According to Kibuku, Ochieng and Wausi (2020) the absence of technical abilities in online learning and the inability of online classes or tutors to create effective content are significant obstacles to the successful

implementation of online education in universities. Furthermore it was noted that even when online classes or e-tutors receive training, the emphasis is primarily on mastering the technical aspects of the system rather than on the more difficult task of receiving proper pedagogical training for online learning.

2.6.5 Financial Constraints and Sustainability Issues

According to (Ionescu *et al.* 2020), state that the affordability of online learning poses a significant obstacle for its implementation and delivery in developing countries. The authors noted that numerous universities in developing countries struggle to keep up with technological advancements due to the high expenses associated with establishing and sustaining a reliable ICT infrastructure. However, Aristovnik *et al.* (2020), was of the view that adopting and utilising ICT to a significant extent can greatly improve the quality of education, instruction, and academic inquiry and also it can assists universities in accomplishing their academic and administrative goals. Furthermore stated that utilisation of more advanced ICT systems in universities comes with the drawback of heightened expenses, particularly for institutions operating with limited financial resources. A recent study conducted by Kibuku, Ochieng and Wausi (2020), revealed that key areas requiring immediate attention included various cost obstacles such as initial expenses, ongoing maintenance, training expenses, e-content development costs, and bandwidth charges. The authors highlighted that issue of cost becomes more complicated due to the constant advancements in technology and their fluctuating expenses, making it challenging for institutions to stay updated with these changes.

2.7 ADVANTAGES OF ONLINE LEARNING IN HIGHER EDUCATION INSTITUTIONS DURING COVID-19

Lei and So (2021), states that the utilisation of online learning in education, especially in higher education, during the current COVID-19 pandemic offers numerous advantages. Due to its many benefits, online learning is regarded as one of the most effective educational solutions currently available. Numerous studies have yielded positive outcomes and gains through the implementation of online learning technologies in educational institutions. Considering the factors of time and location, online learning offers a great deal of flexibility such that all students are fortunate enough to have the ability to select the location and time that best caters to their needs (Dhawan 2020; Huang *et al.* 2020). Online learning increases the efficiency of knowledge and skills by providing easy access to large amounts of information. Using discussion forums, you can create opportunities for interaction among students. In doing so, online learning helps to remove barriers to participation, such as fear of talking to other students. Furthermore online learning motivates students to interact with others, exchange and respect different perspectives also it facilitates communication and improves the relationships that support learning (Hassan, Mirza and Hussain 2020). Below are some of the advantages of online learning.

2.7.1 Flexibility

Ghoshal (2020), posit that most people who choose online education have other commitments and prefer this form of learning because it gives them control over how they spend their time on their various tasks. Al Rawashdeh *et al.* (2021), argues that with online learning, you can follow many flexible learning methods for classes with much less travel. In addition, students gain a deeper understanding of knowledge through interactive video-based classroom activities in this way the students quickly react to the activity. According to (DE 2020) states that the introduction of e-learning

gives educational institutions and their students a lot of freedom regarding when and where to transmit or receive information for educational purposes.

2.7.2 Reduces Costs

Zaki (2022), argues that the cost of online learning is significantly less expensive for any given program than the cost of a normal campus learning. According to Arkorful and Abaidoo (2015), in their study they highlighted that because there are no travel expenses are incurred by the students in online learning is deemed to be economical. Additionally, it saves money because it provides learning opportunities for as many students as possible without requiring many buildings.

2.7.3 Save time

In a study by Alodwan (2021), states that online learning saves time there is no time wasted waiting for transportation or commuting to and from the campus, with study materials on your desk and online resources on your computer, a distance learning program brings the classroom directly where you are. In addition, Mukhtar *et al.* (2020), argues that online learning allows for self-pacing, as students can learn at their own speed using the asynchronous method, whether that's quickly or more slowly. Distance learning is an alternative for students with limited availability and can be completed from the comfort of their own homes (Arkorful and Abaidoo 2015).

2.7.4 Enhanced time management skill

Dung (2020), states that although online learning offers the advantage of allowing students to complete their school work at their own convenience, it is still important for students to effectively manage their time in order to meet the deadlines. Online learning train students to enhance their time management skills as they are solely responsible for participating in the course, rather than just

attending class on a specific day and time (Mitchell and Delgado 2014). Consequently, students not only acquire knowledge from the coursework, but they also enhance their time management abilities.

2.7.5 Access to high quality expects and resources

Iordache (2023), points out that online learning provides access to recognised experts in your field and quality resources that can help deepen your understanding of the course and develop professional skills. In addition, the author stated that attending online offers the following: meeting the industry experts; access to high quality learning content; special guests and online conferences and access to global resources. Through online learning, students can learn from recognised experts and access quality educational resources regardless of their geographic location. Access to experts and resources helps enrich the learning and develop knowledge and skills in ways that traditional education can limit (Geith and Vignare 2008).

2.8 PERFORMANCE OF STUDENTS ON ONLINE TEACHING & LEARNING DURING COVID-19

Online learning has become an essential component of success in higher education, as it significantly improves the quality of both T&L (Ngwane and Khumalo 2019). In addition, there is a direct correlation between the utilisation of educational technology, students' level of involvement and achievement in their desired learning outcomes. South African students encounter various challenges such as differing backgrounds, languages, and racial divisions, which in turn encompass both economic privilege and poverty. In a study conducted by (Motala and Menon 2022), the author suggested that implementing teaching strategies can be challenging, and it can be difficult to understand the issues that learners face, especially in large class settings. Consequently, learners from disadvantaged backgrounds may experience delays in their education. Many institutions have

recognised online learning as an effective tool, in line with global standards, which can enhance and improve the quality of T&L (Thomas and Omotoke, 2015). In addition, the authors believe there is a necessity to allocate resources towards ICT to educate students on its use in their everyday tasks, improve their access to educational resources and information, and bridge the gap between secondary and tertiary education.

2.8.1 The role of computer skills on student performance in online learning

According to Bawaneh (2021), certain individuals possess superior skills in utilising online learning technologies to facilitate their learning. The readiness of individuals seems to be a crucial factor to consider when designing educational online learning applications. According to Deng and Sun (2022), the divide in technological knowledge and access among students is influenced by their familiarity and availability of computer technology. This proficiency is often linked to individuals in urban areas and from higher economic backgrounds.

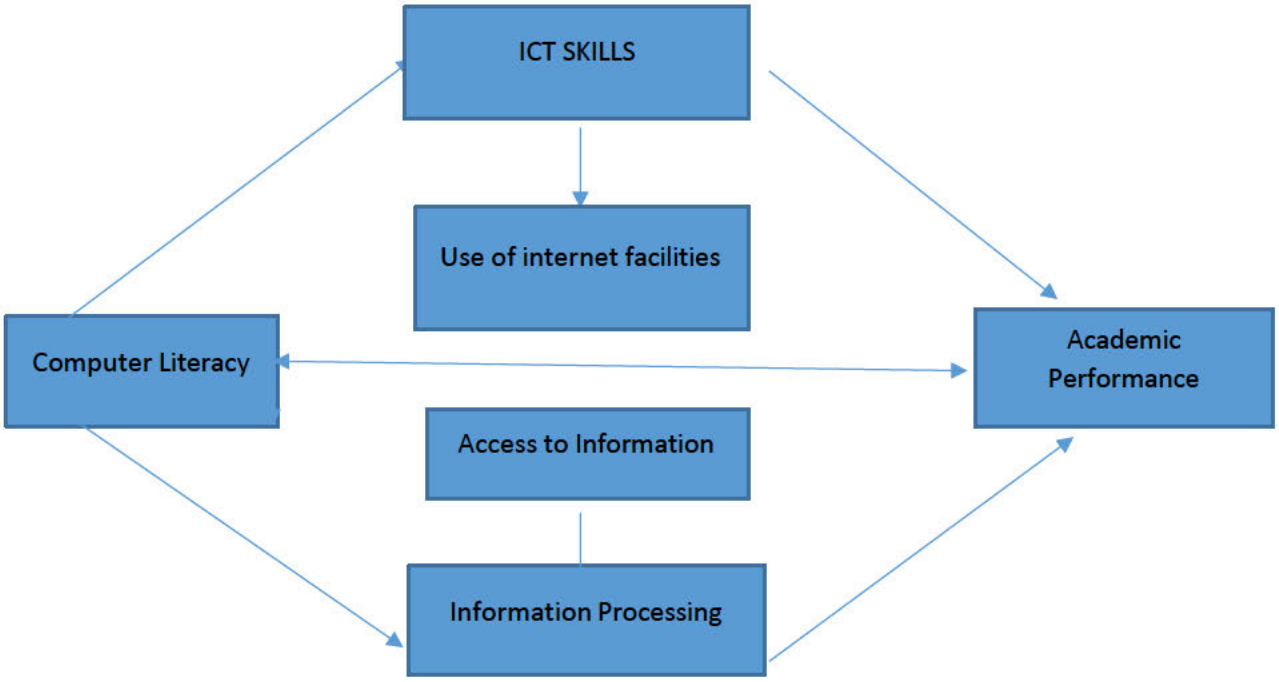

Figure 2.1 Process of computer literacy Source: (Li and Lee 2016)

The computer model above suggests that having knowledge and skills in computer usage is crucial for achieving good academic results. The acquisition of ICT skills leads to increased ease in using internet facilities through consistent practice. Therefore, individuals become more efficient and can obtain and analyse information. As a result, when this information is relevant and usable, students have the potential to enhance their academic performance (Li and Lee 2016).

2.9 FACTORS CONTRIBUTING TO POOR PERFORMANCE DURING COVID-19 ON ONLINE LEARNING

The problems facing South African society, including higher education institutions, are likely to continue. Existing social and economic inequalities between vulnerable and marginalised groups have been exacerbated by the pandemic, but also pose new challenges in terms of social, academic and psychological adjustment. These issues are currently under consideration but require a comprehensive and multi-pronged approach by higher education stakeholders, including student counselling.

2.9.1 Pressure from teaching and learning transformation

The abrupt transition to remote education in response to the global outbreak of COVID-19 presented notable difficulties and disturbances for both students and educators (Blankenship and Jones 2021).The shift to online learning presents a unique and unprecedented situation for students, educators, and the higher education system as a whole (Mazlan *et al.* 2021). According to Cheong *et al.* (2020), due to the pandemic students and lecturers have been forced to accept the usage of a new approach of learning within short period of time. Furthermore, (Tsai *et al.* 2020; Mazlan *et al.* 2021) state that for an effective transition to online T&L the following should be prioritised: computer skills, hardware and software support, and a proper internet connection are essential for both students and lectures. Similarly, Pokhrel and Chhetri (2021) assert the necessity of computer literacy and

experience for both students and teachers in order to effectively employ appropriate teaching methods that are pertinent to the subject matter. The COVID-19 pandemic has indubitably posed challenges for students and educators globally amid this expeditious shift.

2.9.2 Psychological Well-Being

According to Garris and Fleck (2022), the lack of emotional support and social interactions which are contrarily related to the mental health of the students will have the dreadful consequences on the academic performance of students. The mental well-being of students during the COVID-19 crisis has a high impact on their academic performance, often resulting in the expression of traumatic distress. The extensive spread of COVID-19 has led to worries among students about the effectiveness of the online education platform. This highlights the increasing importance of self-directed learning, leading to concerns about both physical and mental well-being, which ultimately impact students' future careers and achievements. However, the student workload has increased due to the emotional difficulties they are facing, such as anxiety, depression, and stress. This has resulted in a decline in their ability to perform well academically (George and Thomas 2021).

2.9.3 Digital Inaccessibility

Magomedov, Khaliev and Khubolov (2020), state that previously, virtual learning was mainly dependent on the power of technological infrastructure, such as internet access, and poor connectivity resulted in access to online activities being denied. This reliance on online learning has presented institutions, academic faculty, and students with unprecedented challenges. However, the pandemic negative impact has resulted in technological inaccessibility being one of the challenges faced by the users (i.e. educators and students).

2.9.1 Work-Life Conflict (Social and Family Life)

The speedy evolution of COVID-19 pandemic has affected students' academic lives (Aucejoa *et al.* 2020). The continued existence of this disease has harmed the educational sector, resulting in the temporary closure of higher education institutes. In the same vein, the COVID-19 pandemic has significantly reduced academic engagement, leading to negative effects on students' social lives, particularly those from disadvantaged backgrounds who have been disproportionately affected by severe socio-economic consequences. Peacock and Cowan (2019), the research have it that studying and having a good balance between work and personal life makes people feel like they belong and helps them connect with others in a positive way. It also improves how well students do in a new learning environment. The COVID-19 crisis has caused problems for students in terms of balancing work and personal life and having difficulty socializing. This has led to issues with academic honesty and students feeling sad about not being able to learn in an interactive environment (Joshi *et al.* 2022). Indeed, the pandemic has disrupted students' social connections with their families and friends, inevitably affecting their academic performance (Cao *et al.* 2020).

2.9.1 Absenteeism

Absenteeism is defined by Fahmi (2023) as a lack of physical presence at work when there is a social expectation for that individual to be there. Absenteeism is a common problem that affects all organisations, from business to education, albeit it varies depending on the situation. Jena 2020; Alibudbud (2021), argues that absenteeism is the time when a student is not in class during working hours. A growing body of research on school absenteeism focuses on the impact of instructional time lost due to absences while schools are open. Unlike the school shutdown caused by COVID-19, which compelled every student to miss class, not every student is absent during a typical school year. A

student may miss school for a variety of reasons, including a lack of dependable transportation and the necessity to care for family members.

2.10 CHALLENGES FACED BY STUDENTS ON E-LEARNING

Alenezi *et al.* (2023), highlights the numerous challenges that students encounter pertaining the use and success of online learning within the academic environment. Authors argue that the ongoing discussion regarding the challenges in this area includes learning styles and culture, technical challenge, lack of infrastructure resources, students skills and characteristics and time management challenges.

2.10.1 Learning styles and culture

Sywelem *et al.* (2012) stated that everyone has their own learning style and cultural influences. Those who use their own learning style and are taught to take into account the cultural aspects of the individual perform better academically. Islam, Beer and Slack (2015) added that understanding students and their learning styles is desirable to achieve the best learning outcomes. Sywelem *et al.* (2012) describe how ambiguous the learning styles of online students are. Furthermore this influences the way students develop learning materials, and that some students prefer to learn through dialogue and others through visual presentations. Still others state that they prefer listening to instruments and writing notes. This challenge affects learning outcomes and causes serious problems in understanding students' learning styles in e-learning environments.

2.10.2 Technical challenge

According to Aboagye, Yawson and Appiah (2021),a fast and reliable internet connection is crucial for effective online T&L. Due to the transition from traditional in-person education to virtual learning, students and professors were compelled to maintain a constant connection to the internet. As a result,

the lack of connectivity poses a significant obstacle to both T&L during the COVID-19 pandemic lockdown, possibly rendering them unachievable..(Kamysbayeva *et al.* 2021) also emphasised that the availability of fast and reliable internet connection is a major concern to universities and author further stated that the internet connection is one of the major critical challenge for reliable for online learning. Demuyakor (2020), states that technical challenge for online learning can be attributed to lack of internet data.

2.10.3 Lack of infrastructure resources

Azorín (2020), highlights that one of the challenges faced by students in online education is the limited availability of fast internet connections and necessary electronic devices. Insufficient infrastructure or resources at home may pose challenges for students in their ability to learn online. Consequently, parents now face increased responsibility of acquiring laptops and IT devices for their children to enable remote studying (Sahu 2020). In remote regions without access to electricity, students might face challenges in staying connected as they lack the necessary power to charge their online learning devices, like laptops. Kerres (2020) states that a significant level of worry among academics and students regarding the insufficient availability of resources for online instruction and education can be challenging.

2.10.4 Students' skills and characteristics

According to Aboagye, Yawson and Appiah (2021) factors including students intelligence, motivation and computer skills are more crucial to the effectiveness of online learning and the use of digital platforms. The authors further stated that not all students are good with computer experience as this can be one of factors intermediating the students in using computers. If the student's capacity is at most intermediate, then training for the student should be arranged. Proper training is needed

because the burden of training will fall on overburdened academics. Kamysbayeva *et al.* (2021) backs this approach, claiming that teachers lack the necessary skills to be effective and productive with online students.

2.11 MEASURES IN IMPROVING THE ONLINE TEACHING AND LEARNING

As universities and other educational institutions continue to close on a massive scale and many countries around the world move to distance learning, a key issue for policymakers and decision-makers is the availability of new online education, how to manage and measure learning and to minimize the impact of COVID-19 on education. Online learning involves the use of technology and digital media to provide, support, and enhance teaching, learning, testing, and assessment (Moule 2007). It can include a wide range of activities from using technology to support 'blend' learning (a combination of traditional and online learning) to learning delivered entirely. Universities have adopted different strategies to reach students efficiently, which include:

2.11.1 Learning Management Systems (LMS

Alzahrani and Seth (2021), states that learning management systems are primarily utilized in online educational applications. The integration of Information and Communication Technology (ICT) is vital for universities that provide distance learning programs. Universities have devised strategies to seamlessly incorporate ICT throughout the learning process, equipping students with relevant knowledge and skills that align with the needs of present and future society.(Mukhtar *et al.* 2020) Further stated that numerous universities have displayed significant interest in determining the most effective methods for delivering online course content, involving learners, and evaluating assessments. As a result of the pandemic, there has been a shift in focus towards online education and

more investment has been made in this area by institutions. Learning management systems refer to internet-based software used for the dissemination, monitoring, and administration of courses (Huang *et al.* 2020). The authors further stated that numerous digital platforms, such as Google Classroom, Blackboard, Moodle, and Edmodo, are available for use during the current era of COVID-19.

2.11.2 Provision of digital skills

According to Narenji, Tizhoosh and Mostafavi (2021), Students require a wide range of competencies to flourish in digital settings due to the current COVID-19 Pandemic, the move from traditional learning to e-learning, and the utilisation of e-learning as a genuinely student-centred approach. In other words, it is normal for designers of online learning systems to pay attention to learner demands and define the necessary skills and abilities. According to (Zhao *et al.* 2021; Cisneros-Barahona *et al.* 2023)Students should have certain competencies such as content production, ethics, problem-solving, and technological skills. Narenji *et al.* (2021) Students should have certain characteristics, such as leadership skills, flexibility and adaptability, critical thinking, technical knowledge, communication, emotional intelligence, creativity, and innovation. The authors also highlighted that digital technology changed the way student learn and created more learning opportunities. Therefore, students who take online courses need digital and socioemotional skills. In addition, resilience is now identified as a mechanism for helping students adjust to current and future crises. Torun (2020) identified e-learning as a predictor of academic progress during the COVID-19 Pandemic. Computer self-efficacy, internet self-efficacy, online self-efficacy, self-learning, learner control, and motivation for online learning are all required skills and abilities for students. Pham and Tran (2020) identified a set of abilities students would need to participate actively and effectively in online classes, such as computer skills, communication skills, inventiveness, and creativity.

2.11.3 Distance education

According to Simonson (2022) distance learning refers to a formal education system where learners and instructors are physically separated, but connected through interactive telecommunications. This definition is further supported by (Rizaldi and Fatimah 2020), emphasising that distance learning involves pursuing education without any in-person interaction between the teacher and the learner. The author further pointed that distance learning is also a major contributor to higher education, it is considered a means to enhance accessibility, engagement, and fairness. It provides opportunities for a wide range of students, including mature students and those who cannot attend traditional universities, to receive education that would otherwise be unavailable to them. The integration of media and information and communications technologies has brought about changes in the enhancement of new educational tools (Vlachopoulos 2011). The use of technology, such as telephones, audio and video media, audio conferencing, videoconferencing, simulated person-to-person interaction, and learning management systems, added personal touch to the T&L experience.

2.11.4 Massive Open Online Courses

According to Aljarrah, Ababneh and Cavus (2020), Massive Open Online Courses (MOOC) is a fast-developing educational model that is gaining popularity in higher education. MOOC is a technological innovation that is offering virtual educational opportunities to anyone who wants to participate in a massive grouping of students collaborating and producing content on a variety of platforms that include learning management systems, social media and websites. However (Safri, Mohi and Hanafiah 2020) stated that universities should prioritize the utilisation of MOOC as the primary online learning platform, as it effectively engages students in their lessons and enhances their learning experience. MOOC offers benefits to course instructors by providing a self-directed learning environment that allows students to learn with minimal guidance. Additionally, the utilisation of a

smartphone allows for the functioning of MOOCs, eliminating any justification for students' inability to obtain educational opportunities. Essentially, through MOOC, students and instructors have the means to maintain communication and keep in touch. It is unfortunate if the lecturer fails to seize this opportunity.

2.11.5 Blended Learning

Blended learning is the educational approach that combines traditional learning with online learning with the incorporation of the Internet of Things (IoT) (Karma, Darma and Santiana 2021; Siripipatthanakul *et al.* 2023). Internet of Things based blended learning is regarded as the best new normal solution for all the universities students and educational stakeholders during the pandemic. According Siripipatthanakul *et al.* (2022) to blended learning is preferable to pure online learning due to its numerous benefits it provides to students such as fostering a sense of belonging or community. Furthermore stated that blended learning can be seen as an effective alternative of distance learning in terms of student learning experience, student to student interaction, and student-lecture interaction.

2.11.6 Online course design

Course design is one of the most important factors affecting the final outcome of the course (Eom and Ashill 2016). Experts use a systematic design process, backward design, consideration of learner requirements, and designer-learner interaction during the design process to increase student acceptance and satisfactory outcomes (Abbasnejad, Soltani and Wong 2023). In addition, dynamic presentations, simulations, conceptual discussions and laboratory tutorials are effective tools to improve online course design (Juan *et al.* 2011). Faculty and regular interaction (teacher-student and student-student) and interpersonal communication can facilitate the course design process and strengthen student satisfaction and commitment to studies (Eom and Ashill 2016; Jaggars and Xu

2016). Other facilitation strategies can be considered when designing a productive online course, namely assessment and comprehensive feedback on assignments, course organization, instructor responses to student questions, and the inclusion of visual material, self-study materials, and in-class activities (Hosler and Arend 2012).

CHAPTER 3

RESEARCH METHODOLOGY

3.1 INTRODUCTION

This section outlines the research methodology, including the chosen approaches and design. It also covers the target population, sample size, sample frame, and methods of data collection such as questionnaires and interviews. Additionally, it discusses data analysis techniques, as well as concerns regarding reliability and validity.

3.2 METHODOLOGICAL RESEARCH APPROACHES

3.2.1 Quantitative Research

According to Struwig 2001; Leedy and Ormrod (2019), quantitative research design is a commonly employed methodology that utilizes techniques and measurements to generate quantifiable or discrete values. The authors also highlighted that quantitative research is defined as research involving numeric values and measurement, with a focus on frequencies and statistics and also as the approach that yields quantitative information that can be summarised through statistical analysis. (Struwig 2001) identified the following quantitative research characteristics: Analysing factors according to the predictions made by a theoretical framework, discovering connections (causal links) among constructs informally, results from a research study are frequently extrapolated beyond the boundaries of the specific sample used ,replicating a study helps determine the level of applicability of the findings to different contexts and the main focus of the empirical investigation is on the individual.

3.2.2 Qualitative

Creswell (2014), states that qualitative research primarily aims to investigate and comprehend the significance given to a social or human issue by an individual or a group of people. Qualitative research originated from anthropological, sociological, humanistic, and evaluative disciplines throughout history. Qualitative research, according to (Leedy and Ormrod 2015) concentrates on phenomena that take place in natural settings in the "real world". Studying those phenomena in all their complexity is a component of qualitative research. Furthermore Mohajan (2018), supported this by stating that this approach enables the researcher to gain understanding of problems by examining their specific circumstances and the interpretations given to them by individuals. Since it acknowledges the complexity of the issue under study and attempts to present it in all its facets, qualitative research is rarely straightforward. Its main goal is to use the opinions and experiences of participants to create meaning, purpose, or reality (Merriam and Tisdell 2015).

3.2.3 Mixed method

A mixed method research approach refers to a research study that integrates qualitative and quantitative research methods and data. According to Johnson, Onwuegbuzie and Turner (2007) the mixed method approach combines qualitative and quantitative research methods in order to achieve broad and deep knowledge and corroboration. On the other hand (Creswell 2014), further explains that quantitative research involves closed-ended questions with predetermined answers, while qualitative research involves open-ended questions with no predetermined answers. This method was created with the belief that both qualitative and quantitative designs have imperfections, so blending them together will enhance each other's strengths while mitigating their respective weaknesses.

After carefully analyzing and critically evaluating the research topic, considering the specific nature of the problem being investigated, it is concluded that the most appropriate approach for this design is the mixed method research method.

3.3 RESEARCH DESIGN AND APPROACH EMPLOYED IN THIS STUDY

The research design according to Creswell (2014), it encompasses a thorough strategy that establishes a connection between conceptual research issues and practical research. It involves determining the necessary data, gathering and analysing it using specified methods, and effectively addressing the research questions posed by the researcher. Akhtar (2016) states that the goal of research design is to ensure that the investigation is appropriate to the research question and to control variance. The current study used mixed method to assess the impact of COVID-19 on construction education, teaching and learning. Quantitative research methods enabled the researcher to establish students' point of view on the topic, while on the other hand, however the qualitative phase of the research was used to assess lectures on online T&L during the pandemic. Questionnaire was used to collect the data and they were disseminated to students from the department of CMQS at DUT on the other hand qualitative data was collected by means of interview protocol disseminated to lectures in the department of CMQS at DUT. The main aim was to gain insight of both research methodologies, so that the weaknesses of one would be compensated by the strengths of the other. It is critical for this study to gain insights into the information needs and information-seeking patterns of CMQS lecturers on the use of online learning in COVID-19 time, as well as their preferences for improving online T&L, to guide the design and implementation of an appropriate online teaching service for both lectures and students. Mixed methodology was deemed appropriate for gaining these insights. DUT was chosen because of the total number of students registered for the degree program was high than

the Mangosuthu University of Technology (MUT) registered for their National Diploma, also MUT doesn't offer the Honours program hence DUT was found suitable for this study.

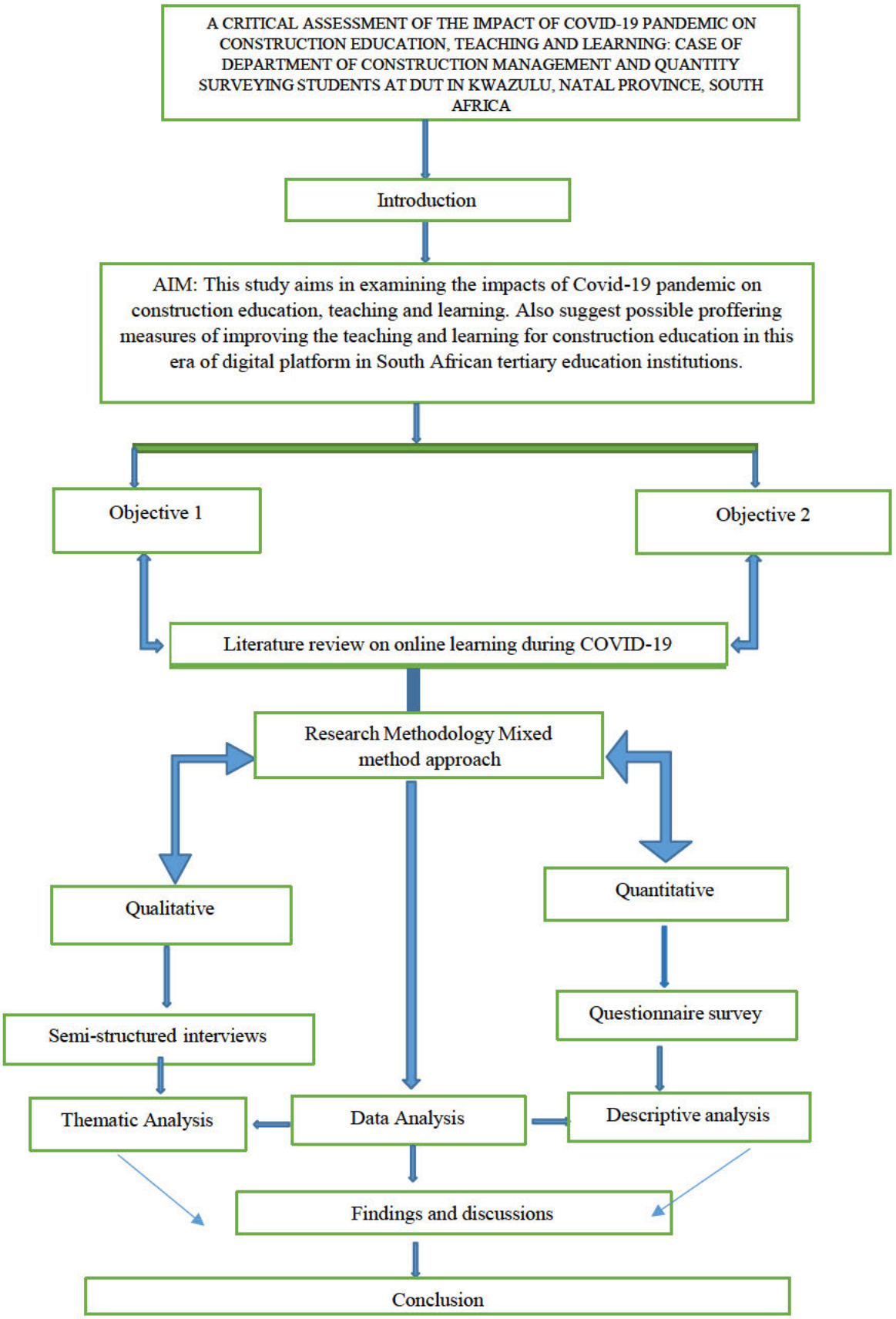

Figure 3.1 Research flow chart

3.4 RESEARCH STRATEGY

Research strategy is defined by Saunders (2014) as the approach the researcher plans to take in order to address the research questions. A framework for comprehending the research is provided by the research strategy. The research objectives, research questions, research philosophy, and the time and resources available for the study are all factors that influence the choice of research approach (Saunders, Lewis and Thornhill 2007).

3.4.1 Research strategy employed under this study.

The combination approach of both semi structured interviews and questionnaire survey was deemed appropriate for accomplishing the research objectives of the study. Both qualitative and quantitative data collection methods were used in two stages. A survey was conducted in the first part of the study using document analysis to gather relevant information about the challenges and solutions to address these challenges of online learning during the COVID-19 pandemic. This helped to shed light on the study's main question and its sub-questions. In the second stage of the study, the information was triangulated (cross-checked) using input from participants in semi-structured interviews.

3.5 TRIANGULATION

The researcher employed a triangulation approach, gathering different types of data on the same subject to enhance analysis and interpretation. The opportunity is provided to combine both quantitative and qualitative data to generate a comprehensive analysis of the research issue. In this method, it is common for the researcher to gather both data types simultaneously and subsequently combine the information in the analysis of the final outcomes. This design seeks to investigate and clarify any contradictions or inconsistent results. Figure 3.2 illustrates the triangulation method.

Figure 3.2 Triangulation mixed method design: Adopted from (Creswell and Clark 2017)

3.6 POPULATION OF THE STUDY

The study population, according to Blumberg, Cooper and Schindler (2014) is the total set of people or objects that researchers are interested in using as a basis for generalizing findings, it typically varies with its characteristics. (Hair *et al.* 2011) further stated it is the entire collection of items or components that are pertinent to a research study because they contain the data that the research study is intended to gather. According to Sekaran and Bougie (2016), for research to be effective, the population of the study must be precisely specified in order to obtain a representative sample size that can be generalized. The researcher decided to use students and lecturers from the department of CMQS at the Durban University of Technology, the students and lectures were chosen because they are found to be one of the pillars of construction industry in South Africa, so it is important to assess the impact of new T&L during the pandemic on them as DUT is one of the universities producing built environment graduates in KZN. The department of CMQS consist of 34 second years, 38 third years and 28 fourth years registered students for Bachelor of Built Environment from Second year to Fourth year and 9 Lectures.

Leedy and Ormrod (2015) puts forward that investigators should try to capitalize on the sample size and offers the following recommendations for selecting a sample size: For small population with fewer than 100 people of other units, there is little point in sampling or surveying the entire population, if the population size is around 500, 50% of the population should be sampled. If the population size is around 1500, 20% should be sampled. Based on the above, the entire population of 109 were taken as sample size for this research. See Table 3.1 below illustrates the sample size of this study.

Table 3.1Sample Population

S/N	Students	Population	Department of CMQS
1	Second Year	34	Durban University of Technology
2	Third Year	38	Durban University of Technology
3	Fourth Year	28	Durban University of Technology
4	Lecturers	9	Durban University of Technology
	Total	**109**	

Source: Author's Field Survey (2023)

3.7 SAMPLING TECHNIQUE

Taherdoost (2016), states that sampling technique is the process of selecting a group of individuals from a population to represent the population. Nardi (2018) support this by saying to determine how much data is required and to comprehend how data is collected within a population, the sampling methodology is the most efficient method. There are two types of sampling technique namely probability and non-probability sampling. Probability sampling technique involves random sampling

method while non-probability method is based on the researcher's decision which might involve sampling biases (Acharya *et al.* 2013).

In quantitative approach the probability sampling it gives an individual the elements in the targeted population an even chance and a non-zero chance of being selected for the study. Thus, the study employed random sampling for quantitative approach. The random sampling method is a method where the researcher randomly selects subset of participants from a population (Bhardwaj 2019). On the other hand, for qualitative approach the study used purposive sampling. According to Creswell and Clark (2011) purposive sampling is a form of nom-probability sampling where the research intentionally selects the participants who have experience to the phenomenon being explored in a study. In this study the researcher purposively selected the CMQS lecturers with a teaching identity at the university because they were best prepared to share their lived experience during COVID-19 pandemic.

3.8 SAMPLE FRAME

A sample is a section or subset of a study population chosen to examine a sampling process (Taherdoost 2016). Since the study is about the impact of COVID-19 on construction, education, T&L in Durban University of Technology, the targeted respondents involved in the data gathering will be only second year to fourth year students CMQS department. The samples consist of one hundred (100) students who are in second year to fourth year and Nine (9) lecturers in the department of CMQS at DUT. From the responses that were collected a total number of seventy-seven was obtained from the field survey and six (6) of the responses were obtained from the semi-structured interviews. Table 3.2 illustrate the sample size.

Table 3.2 Sample Responses

S/N	Professions	Population	CMQS students
1	Second Year	31	Durban University of Technology
2	Third Year	28	Durban University of Technology
3	Fourth Year	18	Durban University of Technology
4	Lecturers	6	Durban University of Technology
	Total	**83**	

Source: Author's Field Survey (2023)

3.9 METHOD OF DATA COLLECTION

The primary and secondary data sources were both included in this study because data can be generated from both types of sources (Sekaran and Bougie 2016). The information acquired from existing literature sources served as the basis for the secondary data. To fulfil the study's aims, the researcher had to collect information from both primary and secondary sources. Secondary data was gathered utilising reputable web sources like Science Direct, Scopus, Google Scholar, and pertinent university documents. While primary data was gathered via questionnaires and distributed via Google Forms to DUT students and structured interviews were conducted with lecturers in the department of CMQS via Microsoft teams. The information provided by respondents was compiled and utilised to create the primary data for this study. The questionnaire and interview protocol were designed in such a way that the study respondents could understand them clearly. The questionnaire was shared among the students in the CMQS department to gather information and the interview protocols were used to elicit information from the lecturers. The Letter of Information and the Informed Consent Form were part of the information given to the participants. Participants were required to read the informed

consent form and confirm their voluntary participation because the questionnaires were distributed electronically. The questionnaire was designed in such a way that participants could not access the questions without first confirming that they had been fully informed about the research and were aware that their participation was entirely voluntary.

3.10 RESEARCH INSTRUMENT

3.10.1 Questionnaire design

Due to the nature of the study, Appendix C was one of the tools used. According to Nardi (2018), questionnaire is the most commonly used instrument or technique in survey research to collect descriptive data from a sample group because respondents have the advantage of providing data and information directly from the source. To ensure that quantitative data was adequately captured, the questionnaire was mostly made up of closed-ended questions. (Carini *et al.* 2003) According to studies, conducting surveys online is an effective and efficient way of gathering data. According to studies, the rate of response to web surveys is comparable to that of paper surveys and a survey questionnaire is a primary data collection method that consists of a series of questions with multiple response options designed to gather information from participants. The research tool used in this study to get data from the students was a questionnaire. The survey questionnaire was created to collect data on a critical assessment of the impact of the COVID-19 pandemic on construction education, T&L to achieve the goals outlined above. The survey is split into three parts: the first part section -A collects data based on demographics of respondents, section-B the second part responds to questions for objectives 1 and section-C respond to questions of objective 2. (Please kindly see the attached appendix C)

3.10.2 Interview Protocol

According to a study conducted by Edwards and Holland (2013) an interview is described as a form of communication where the person conducting the interview asks the participants questions to gather detailed information and gain insight into their thoughts, beliefs, perspectives, and opinions. This view is supported by another study conducted by (Bless, Higson-Smith and Kagee 2006), which emphasizes that interviews involve direct interaction with participants who are requested to provide responses to questions related to the research issue. Smart paraphrase: The qualitative research can make use of various interview protocols such as unstructured, semi-structured, or structured formats. This study employed semi-structured interviews to collect personal experiences of participants regarding online learning during the COVID-19 pandemic. Semi-structured interviews proved to be highly beneficial for this research as it aimed to answer the research questions for this study. Section-A of the interview protocol addressed the biographical information for the interviewees and section-B of the interview protocol addressed technical information. (Refer to Appendix E)

3.10.3 ADMINISTRATION OF THE QUESTIONNAIRE WITH STUDENTS

The administration of the questionnaire was done through online distribution using google forms and collection was tracked through respondents on google forms. The letter of information was part of the information provided to the participants. Out of one hundred students seventy-seven responded and twenty-three did not. The questionnaire took between 15 and 20 minutes to complete.

3.10.4 ADMINISTRATION OF THE INTERVIEWS WITH LECTURES

A mutually convenient schedule was identified for both the interviewer and the designated lecturer. The lecturers were sent a letter providing them with information regarding the study's purpose and emphasizing the importance of their contribution to the study's conclusion. The researcher provided

each lecturer with both the information letter (Appendix D) and a copy of the interview protocol guide (Appendix E). At the start of the interview, the interviewer was given permission to record it and reassured about the confidential nature of the conversation. Out of nine lecturers six have responded and three did not respond.

3.11 ASSURANCE OF CONFIDENTIALITY AND ANONYMITY

The collected data was processed anonymously in accordance with study ethics rules. The survey results were exclusively utilized for research purposes. There were no existing or predicted risks to any of the research participants in this study. As an ethical commitment that considers the rights of the participants, the researcher accepted the obligation to safeguard the participants. The researcher prioritised maintaining an elevated level of secrecy and anonymity. Personal information about research participants, such as names, ID numbers, and mobile phone numbers, was not necessary. The questionnaire lacked sensitive biographical items that may have been used to identify the individuals. Access to private personal data is not required throughout the data collecting procedure. Participation in the study was entirely voluntary**.**

3.12 DATA ANALYSIS METHODS

Data analysis involves examining the collected data and the research questions designed to fulfill the study's purpose. Data analysis consists of identifying patterns and themes within data, then drawing conclusions based on that information.

3.12.1 Analysis of quantitative data

The quantitative data was analysed using Statistical Package for the Social Science (SPSS), adopting both descriptive and inferential statistics in the interpretation of the results. The common descriptive statistics to be employed were frequency, mean, and standard deviation. The respondents background

was analysed using the frequency distribution, the mean scores and standard deviation were used to estimate the variables empirical relative's weights. The exploratory factor analysis was used to reduce the variables for easy analysis and interpretation of results. Also, the exploratory analysis produced the significance of variables and their groupings.

3.12.1 Mean Item Score (MIS)

According to the study conducted by Davey *et al.* (2007), the M.I.S. is calculated by dividing the total number of assessed variables that make up the Likert scale by the average of the study participants' five-point scores. The five point-Likert scale was converted into M.I.S for each factor presented in the research question. The principles were in relation to respondent's scores for selection criteria. The M.I.S of the index factor is the summation of the actual rating of the participants based on the five-point Likert scale. The M.I.S can be explained mathematically see the equation below.

$$Mean\ Score = \frac{1n1+2n2+3n3+4n4+5n5}{N}$$

Where, N = Total number of respondents

n1 = number of participants suggesting 1 on the Likert scale

n2 = number of participants suggesting 2 on the Likert scale

n3 = number of participants suggesting 3 on the Likert scale

n4 = number of participants suggesting 4 on the Likert scale

n5 = number of participants suggesting 5 on the Likert scale

3.12.2 Relative Importance Index

Eadie (2013), defines Relative Important Index (R.I.I.) as a method for analysing categorical data that employs a five-point Likert scale. It was also used in this study for the same purpose. Table 3.5 below shows the rating scales used.

Table 3.3 RII Significance

RII Range	Significance	Construct
$0.857 < RII \leq 1.0$	Extremely Significant	ES
$0.714 < RII \leq 0.857$	Very Significant	VS
$0.571 < RII \leq 0.714$	Significant	S
$0.428 < RII \leq 0.571$	Moderately Significant	MS
$0.286 < RII \leq 0.428$	Somewhat Significant	SS
$0.143 \leq RII \leq 0.286$	Not Significant	NS

Source: Kerner (2013)

3.12.3 Factor Analysis

Bandalos and Finney (2018), pointed out that factor analysis's primary objective is to minimize the number of variables to a manageable number of composite variables. According to (Beavers *et al.* 2013; Kline 2014) Factor analysis is a statistical technique that examines the relationship between variables in order to explain the common underlying dimensions that comprise variables in this study referred to as components. The principal's appropriateness was determined using Bartlett's test of sphericity, and Kaiser-Meyer-Olkin (KMO) was utilised for sampling adequacy Shrestha (2021).

3.12.1 Analysis of qualitative data

Qualitative analysis is the process of examining and understanding data without relying on numerical values, aiming to uncover hidden meanings and patterns of connections (Miles, Huberman and Saldaña 2018). Qualitative data analysis was performed via the transcriptions of the online interviews or telephone interviews and the study adopted content and thematic analysis to analyse the data. Content and thematic analysis is based on the examining data from recurring incidents of a kind,

which these instances are then systematically identified across the data set and grouped together by a coding system (Joffe 2012).

3.13 DATA TRIANGULATION

The process of triangulation was in line with this method of combining qualitative and quantitative data. The qualitative analysis findings were combined with the quantitative statistics to reach conclusions on the emerging themes.

3.14 VALIDITY AND RELIABILITY OF THE STUDY

This section presents the procedures adopted to measure the reliability and validity of this study. The methods of analysis are covered in the section below.

3.14.1 Cronbach's Alpha Coefficient

Reliability is the degree to which a measure produces results that are error-free and consistent. The Cronbach's Alpha test was used in this study to assess the reliability of the quantitative data and the internal consistency of the questionnaire results. The Cronbach's Alpha test was used to determine whether the measuring scales all measured the same construct reliability. Greater reliability is indicated by a Cronbach's rating between 0 and 1 (Metin and Korkman 2021). The results of the questionnaire reliability test using Cronbach's Alpha are displayed in Table 3.6. These results fall between the 0 and 1 range, indicating that the reliability test is acceptable.

Table 3.4 Cronbach's alpha

Category	Cronbach's Alpha
Challenges (Setbacks) to online learning during COVID-19	,930
Measures in improving the online T&L on construction education in this era of digital platform	,947

Source: Field Survey (2023)

The pilot study was conducted for both the online questionnaire and semi-structured interviews and the participants provided valuable feedback, thus removing ambiguity, language, grammar, duplication of questions, ensuring the instruments validity and reliability. According to Creswell (2014: 201), in qualitative methodology, terms such as trustworthiness, credibility, and dependability are more significant when determining the validity of an instrument for collecting data. The researcher utilised and applied these qualitative terms that were suggested when receiving feedback for the semi-structured interview protocol piloted with the expects. This ensured the researcher with the insight to revise, adjust and modify the semi-structured interview schedule to suit the purpose of the study. Therefore, to inspect, correct and measure the instruments in the data collection procedures increases reliability and validity, thereby assisting in improving the accuracy of the findings (Creswell 2014:201).

3.15 RESEARCH DATA MANAGEMENT PROCEDURE

The information obtained will be maintained on DUT's premises, kept secret, and protected with a strong password for five years, as per the authorised DUT data management information. The information will thereafter be deleted. Please refer to the details in the informational letter. (Appendix A). All information gathered from the survey questionnaires was examined by the researcher, who

then submitted the results as part of the dissertation. The participants have the right to discontinue participating in the study and receive the necessary standard of care if they want to do so.

3.16 INCLUSION AND EXCLUSION CRITERIA

Only students from the department of construction management and quantity surveying at DUT were included in this study. All other students from other departments were excluded from the study.

3.17 METHOD OF DATA PRESENTATION AND ANALYSE

The data for this study was presented through tables and graphs, and it was analyzed using suitable descriptive and inferential statistics. Inferential statistics make inferences about a population based on data sets, while descriptive statistics measure the characteristics of a study population in detail. The IBM SPSS Statistics 26 software, commonly known as the Statistical Package for Social Sciences, was utilised for data analysis. In this research, the outcomes that are influenced by other factors can be foreseen, whereas the factors themselves serve as indicator.

3.18 ETHICAL CONSIDERATIONS

During the interviews and administration of questionnaires, there was consistent adherence to ethical principles pertaining to informed consent. Prior to the dissemination of the questionnaire, the participants were provided with both the informed consent form and the letter of identification. The introductory section of the questionnaire prominently stated the objective of the survey and provided a guarantee of confidentiality to the respondents. Participants in the telephone interviews were informed in advance that their talks would be recorded using an audio recorder and that such recordings would only be used for research purposes. Individuals who participated in personal interviews were given a consent letter and a written declaration from the research institute, DUT, outlining the researcher's ethical stance as well as their commitment to maintaining the confidentiality

and welfare of all participants. The study's participants were assured that the confidentiality of the information they disclosed would be diligently upheld, precluding any utilisation that might compromise their anonymity.

3.19 CONCLUSION

This chapter has addressed the approach utilised in conducting this research. The beginning of the study entailed an explanation of its methodology, including the philosophical, approach, strategic, and timing aspects of the research, as well as the techniques and procedures employed, with the rationale behind each of these choices. This chapter provides a comprehensive examination of the findings obtained from the conducted research.

CHAPTER 4

DATA ANALYSIS AND PRESENTATION

4.1 INTRODUCTION

This chapter presents the analysis of the research findings. The chapter is divided in to two sections, namely survey questionnaire with the students and semi-structured interviews with lecturers to provide valid explanation of the problem. The survey questionnaire is divided into three sections, Section A describe the demographic or background information of the research respondents. Section B investigates the setbacks of online teaching and learning towards construction education that affects student performance. Section C analysed the possible measures to improve the T&L on construction education in this era of COVID-19 and digital platform. While the semi-structured interviews are divided into two sections, demographics and the findings from the interview survey.

4.2 BACKGROUND INFORMATION OF RESPONDENTS

The first section of the questionnaire presented the respondent's background information. The respondents' information includes gender and qualification level in the department.

4.2.1 Gender of the Participants

Figure 4.1 below shows that out of 77 participants from survey 57, 1% participants were male while 42, 9% were female. See table 4.1 below for further clarification.

Table 4.1 Gender of the participants

Gender	Frequency	Percent	Valid Percent	Cumulative Percent
Male	44	57.1	57.1	57.1
Female	33	42.9	42.9	100.0
Total	77	100.0	100.0	

Source: Author's Field Survey (2023)

4.2.2 Level of study of respondents

Figure 4.2 below revealed that 40, 3% were second year students, 36, 4% were third year students and 23, 4% were fourth year students.

Table 4.2 Level of study

Study level	Frequency	Percent	Valid Percent	Cumulative Percent
Second year	31	40,3	40,3	40,3
Third year	28	36,4	36,4	76,6
Fourth year	18	23,4	23,4	100,0
Total	77	100,0	100,0	

Source: Author's Field Survey (2023)

4.3 OBJECTIVE1: THE SETBACK OF ONLINE TEACHING AND LEARNING TOWARDS CONSTRUCTION EDUCATION THAT AFFECT STUDENT ACADEMIC PERFORMANCE

This section examines the setbacks of online T&L towards construction education that affect student academic performance at DUT, South Africa using descriptive method of analysis.

4.3.1 Descriptive Analysis: Setbacks of online teaching and learning towards construction education that affect student academic performance

This study uncovered twenty-one setbacks to online T&L in construction education that impact student academic performance. The most significant setbacks were identified by assessing the relative importance index (RII). The rating levels of the RII ranges from being “not significant” to “extremely significant” as presented in Table 4.3.

Table 4.3 RII significance

RII Range	Significance	Construct
$0.857 < RII \leq 1.0$	Extremely Significant	ES
$0.714 < RII \leq 0.857$	Very Significant	VS
$0.571 < RII \leq 0.714$	Significant	S
$0.428 < RII \leq 0.571$	Moderately Significant	MS
$0.286 < RII \leq 0.428$	Somewhat Significant	SS
$0.143 \leq RII \leq 0.286$	Not Significant	NS

Source: Kerner (2013)

Table 4.3 highlights six significant setbacks, while the remaining fifteen are deemed significant. This data underscores the relevance of these setbacks to students' online construction education. Therefore, employing techniques such as factor analysis is essential to improve the investigation of these variables' efficiency.

Table 4.4 Setbacks of online learning

Code	Setbacks	Mean	Std. Dev.	RII	Significance Level	Rank
SIOL9	Technical problem associated with internet connectivity	3.92	1.295	0.784	VS	1st
SIOL21	Less participation from and amongst the student	3.79	1.239	0.758	VS	2nd
SIOL5	Lack of physical consultation with lecturers	3.58	1.408	0.716	VS	3rd
SIOL10	Loss of interest due to online T&L	3.56	1.391	0.712	VS	4th
SIOL18	Difficulty in assimilating lessons online	3.56	1.094	0.712	VS	5th
SIOL15	Absence of physical workspaces	3.53	1.294	0.706	S	5th
SIOL17	Difficulties in adapting to new changes	3.49	1.334	0.698	S	7th
SIOL6	Difficulty to adopt & adjust to new T&L	3.48	1.242	0.696	S	8th
SIOL14	Absence of contact group discussion class	3.47	1.294	0.694	S	9th
SIOL3	Trial &error in the online assessment procedure	3.44	1.057	0.688	S	10th
SIOL11	Excessive workload	3.35	1.189	0.670	S	11th
SIOL16	inaccessibility &unaffordability of ICT gadgets	3.30	1.136	0.660	S	12th
SIOL7	Problem of technology adaptability	3.30	1.298	0.660	S	12th

Code	Setbacks	Mean	Std. Dev.	RII	Significance Level	Rank
SIOL20	Low productivity	3.27	1.221	0.654	S	14th
SIOL1	Anxiety from transitioning from face to face to online T&L	3.26	1.312	0.652	S	15th
SIOL2	Zero-self exploratory learning	3.16	1.077	0.632	S	16th
SIOL13	Lack of transparency in the method of assessment	3.10	1.021	0.620	S	17th
SIOL8	Difficulties in receiving detailed feedback on assessments	3.05	1.287	0.610	S	18th
SIOL12	Un-realistic deadline from the lecturers	3.03	1.235	0.606	S	19th
SIOL4	Inadequate measures to check plagiarism	2.94	1.228	0.588	S	20th
SIOL19	Late schedule of classes	2.87	1.218	0.574	S	21st

Source: Author's Field Survey (2023)

4.3.2 Assessment of Suitability and Adequacy for Factor Analysis (FA)

This study conducted factor analysis utilising the principal component analysis (PCA) extraction method on the 21 identified challenges associated with online T&L. Nonetheless, the sample size is one of numerous datasets on which factor analysis relies to determine data appropriateness and reliability. Various viewpoints on the sample size necessary for factor analysis have evolved. According to Winter *et al*. (2009), the sample size should be more than 50. (Carpenter 2018) was of the view that a range of respondent rates for the sample size to conduct PCA must appear as follows on Table 4.5

Table 4.5 Factor loadings

S/N	Value of Factor Loading	Response Rate
1.	0.75	50-59
2.	0.70	60-69
3.	0.65	70-99
4.	0.55	100-119
5.	0.50	120-149
6.	0.45	150-199
7.	0.40	200-249
8.	0.35	250-349
9.	0.30	350 and above

4.3.3 Data reliability and adequacy test: PCA

Before moving on to further in-depth analysis, a statistical reliability test on the obtained data is required. This will guarantee that accurate data is collected. The value of alpha must be higher than 0.70 or 0.60 in order to demonstrate the instrument's reliability (Taber 2018). The 21 variables included in the survey had an alpha value of.921 as a result. Consequently, the study's findings show great internal consistency, and the questionnaire utilised had a high level of dependability. To determine if a sample is enough for PCA, KMO and Bartlett's test of sphericity is frequently employed

(Krishnan 2010). The dataset is often adequate for factor analysis when Bartlett's sphericity test is significant (P 0.05) and the KMO index is more than 0.5 (Williams, Onsman and Brown 2010). The KMO test resulted in a value of 0.870 in this inquiry, however Bartlett's test produced a statistically significant result of (chi-square = 900.508, p = <, 001). The outcomes are therefore consistent with the application of PCA see the Table 4.6 below.

Table 4.6 KMO and Bartlett's test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.870
Bartlett's Test of Sphericity	Approx. Chi-Square	900.508
	df	210
	Sig.	<.001

4.3.4 Component Correlation Matrix

The selection between orthogonal and oblique rotation is made using the Component Correlation Matrix (CCM), which displays the statistical correlation between the retrieved components or factors. Table 4.7 below demonstrates the CCM results for this study's setbacks-related variables. The purpose of showing this table is to check which rotation is suitable for PCA. From the CCM table, it is required to look for any correlation between factors or components greater than .32 or less than -0.32. It was noted that from the components in the table below there are no components greater than 0.32 or less than -0.32. Therefore, orthogonal rotation was suitable for this study. NB: orthogonal rotation produces uncorrelated factors, and oblique rotation produce correlated factors.

Table 4.7 Component correlation matrix

Component	1	2	3	4	5
1	1,000	,002	-,002	,009	,020
2	,002	1,000	-,001	-,006	-,003
3	-,002	-,001	1,000	-,008	-,007
4	,009	-,006	-,008	1,000	-,009
5	,020	-,003	-,007	-,009	1,000

Extraction Method: Principal Component Analysis.
Rotation Method: Oblimin with Kaiser Normalization.

4.3.5 Communalities Table

Hair *et al.* (1998) proposed that a range of 20 to 50 variables is widely considered optimal for conducting factor analysis while studies like (Kim et al. 2016) have suggested that a smaller number of variables may also be applicable. To this end, the 21 variables employed in this study were considered sufficient. Table 4.8 below illustrates the communalities of the factors for the setbacks to online learning during COVID-19 in construction education were established to determine the extent to which the underlying factors account for the variance of the 21 factors. The table showed that the 21 variables had communalities greater than 0.4, with an average of 0.686 implying that the 21 variables measure the underlying factors. These findings confirm the data's adequacy for factor analysis, accounting for the number of variables, sample size, and communalities.

Table 4.8 Communalities of factors that affects online learning during COVID-19

Communalities	**Initial**	**Extraction**
Anxiety from transitioning from face to face to online T&L	1.000	**.721**
Zero-self exploratory learning	1.000	.480
Trial &error in the online assessment procedure	1.000	**.623**
Inadequate measures to check plagiarism	1.000	**.660**
Lack of physical consultation with lecturers	1.000	**.734**
Difficulty to adopt & adjust to new T&L	1.000	**.733**
Problem of technology adaptability	1.000	**.651**
Difficulties in receiving detailed feedback on assessments	1.000	**.593**
Technical problem associated with internet connectivity	1.000	**.818**
Loss of interest due to online T&L	1.000	**.652**
Excessive workload	1.000	**.682**
Un-realistic deadline from the lecturers	1.000	**.716**

Communalities	Initial	Extraction
Lack of transparency in the method of assessment	1.000	**.689**
Absence of contact group discussion class	1.000	**.811**
Absence of physical workspaces	1.000	**.774**
inaccessibility &unaffordability of ICT gadgets	1.000	**.759**
Difficulties in adapting to new changes	1.000	**.638**
Difficulty in assimilating lessons online	1.000	**.590**
Late schedule of classes	1.000	**.645**
Low productivity	1.000	**.735**
Less participation from and amongst the student	1.000	**.701**

Source: Author's Field Survey (2023)

4.3.6 Total variant explained.

Table 4.9 below demonstrates the challenges facing online learning during COVID-19 pandemic in construction, with their respective eigenvalues. The factors have eigenvalues that were not less than one, and the rotation sum of square loading is between 10.809 and 15.714 (Table 4.9). Five components were extracted to represent the underlying factors: 8.908, 1.811, 1.428 and 1.223, with 42.418%, 8.622%, 6.800%, 5.825% and 4.921% of their variance, respectively. This means that the first group had a 42.418% contribution, the second group had an 8.622% contribution, the third group had a 6.800 % contribution, the fourth group had a 5.825% contribution and the fifth group had 4.921. The five groups have a total cumulative variance of 68.584%. (Shrestha 2021) stated that 50% and above is sufficient for variance variability in order to conduct PCA analysis. This study computed 68.584% this means factor analysis can be used to conduct this study.

Table 4.9 Total variance explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	**8,908**	42,418	42,418	8,908	**42,418**	42,418	3,300	15,714	15,714
2	**1,811**	8,622	51,039	1,811	**8,622**	51,039	2,993	14,254	29,968
3	**1,428**	6,800	57,839	1,428	**6,800**	57,839	2,932	13,964	43,932
4	**1,223**	5,825	63,664	1,223	**5,825**	63,664	2,907	13,843	57,775
5	**1,033**	4,921	68,584	1,033	**4,921**	68,584	2,270	10,809	68,584
6	,900	4,286	72,870						
7	,737	3,509	76,379						
8	,662	3,154	79,533						
9	,595	2,833	82,366						
10	,540	2,573	84,939						
11	,509	2,426	87,365						
12	,441	2,099	89,463						
13	,410	1,954	91,418						
14	,329	1,565	92,982						
15	,296	1,409	94,391						
16	,250	1,192	95,584						
17	,230	1,096	96,680						
18	,218	1,036	97,715						
19	,184	,876	98,591						
20	,165	,788	99,379						
21	,130	,621	100,000						

Extraction Method: Principal Component Analysis.

4.3.7 Scree plot

According to (Ledesma and Valero-Mora 2019), a scree plot is the most possible technique to validate PCA findings. The scree plot basically presents the computed eigenvalues using SPSS, starting with the first eigenvalue, which represents the most explained variance, and progressing to the least eigenvalue and the criterion for evaluating eigenvalue means the value for factors should be ≥ one (Malhotra and Birks, 2006). As a result, verifying the scree plot with the component matrix result is critical. This will enhance the decision on which components should be retained (Pallant, 2005). The scree plot in Figure 4.1 shows each eigenvalue as they gradually decrease, the slope of the curve flattens, and the explained variance flattens. The extracted loadings generated five factors, as shown in Figure 4.1. This is also demonstrated in the scree plot. As a result, the number of items retrieved equalled the number of data points above the red line. As a result, data points that were directly below the red line were not counted. Because eigenvalue is a well-known method for factor extraction, it was investigated in this work for the same reason. The scree plot in Figure 4.1 demonstrates the setbacks of online T&L during COVID-19 in the CMQS department. The varimax rotation was employed to interpret the five groups as displayed in Table 4.9 and Table 4.10.

Figure 4.1 Scree plot

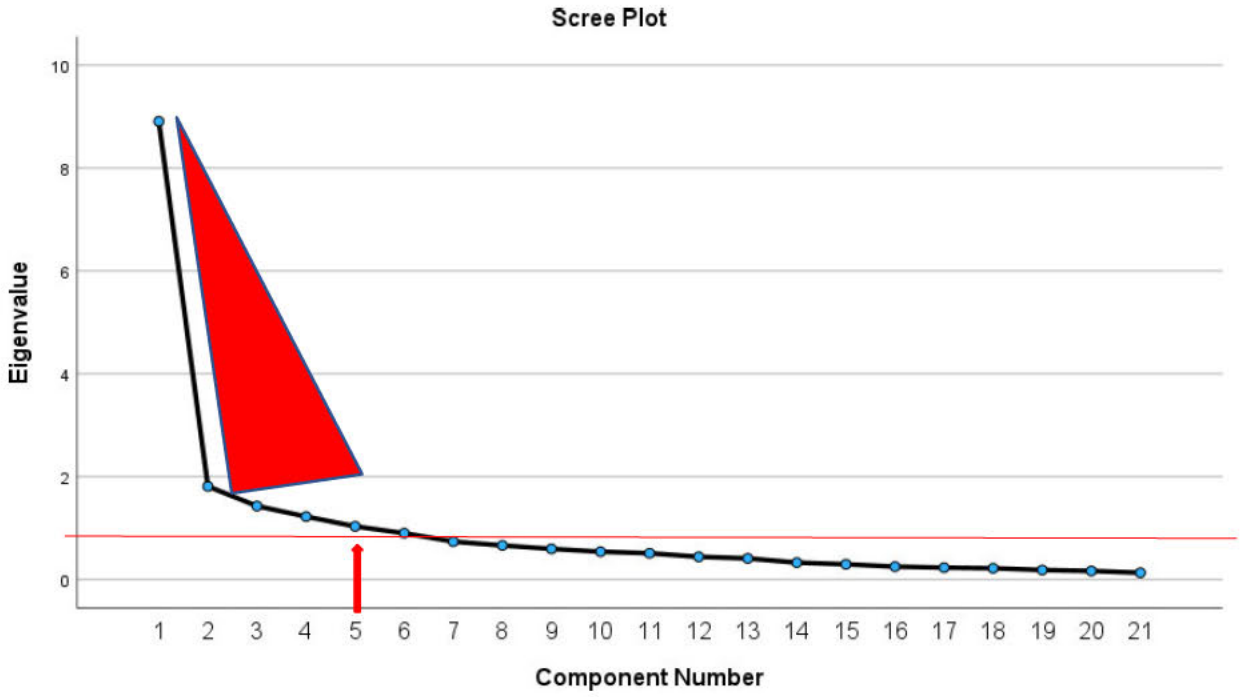

Table 4.10 Rotated Component Matrix

	1	2	3	4	5
Low productivity	0.683				
Late schedule of classes	0.680				
Lack of transparency in the method of assessment	0.652				
Difficulties in adapting to new changes	0.601				
Difficulty in assimilating lessons online	0.546				
Excessive workload		0.749			
Technical problem associated with internet connectivity		0.680			
Loss of interest due to online T&L		0.636			
Un-realistic deadline from the lecturers		0.607			
Trial & error in the online assessment procedure		0.535			
Absence of contact group discussion class			0.815		
Absence of physical workspaces			0.706		
Less participation from and amongst the student			0.580		
Lack of physical consultation with lecturers			0.522		
Anxiety from transitioning from face to face to online T&L				0.840	
Problem of technology adaptability				0.686	
Difficulty to adopt & adjust to new T&L				0.652	
Zero-self exploratory learning				0.573	
Inaccessibility& unaffordability of ICT gadgets					0.747
Inadequate measures to check plagiarism					0.712
Difficulties in receiving detailed feedback on assessments					0.575

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 14 iterations.

The factors loaded in components 1 to 5 showed in Table 4.10 were re-grouped into 5 components to allocate unique names, as shown in Table 4.11

Table 4.11 Components group

Components	**Challenges of online learning during COVID-19**
Component 1: Pedagogical Skills factors	Low productivity
	Late schedule of classes
	Lack of transparency in the method of assessment
	Difficulties in adapting to new changes
	Difficulty in assimilating lessons online
Component 2: Technical factors	Excessive workload
	Technical problem associated with internet connectivity
	Loss of interest due to online T&L
	Un-realistic deadline from the lecturers
	Trial & error in the online assessment procedure
Component 3: Social factors	Absence of contact group discussion class
	Absence of physical workspaces
	Less participation from and amongst the student
	Lack of physical consultation with lecturers
Component 4: Psychological factors	Anxiety from transitioning from face to face to online T&L
	Problem of technology adaptability
	Difficulty to adopt & adjust to new T&L
	Zero-self exploratory learning
Component 5: Infrastructure support factors	inaccessibility unaffordability of ICT gadgets
	Inadequate measures to check plagiarism
	Difficulties in receiving detailed feedback on assessments

Component 1: Pedagogical Skills

Factors loaded to component one are called pedagogical Skills factors with five factors. They include Low productivity with 0.68 loading, Late schedule of classes with 0.68, Lack of transparency in the method of assessment with 0.65, Difficulties in adapting to new changes with 0.60 and Difficulty in assimilating lessons online with 0.55.

Component 2: Technical factors

This component has five factors, and it is named technical factors. They include excessive workload with 0.75 loading, technical problem associated with internet connectivity with 0.68, loss of interest due to online T&L with 0.64, un-realistic deadline from the lecturers with 0.61, trial & error in the online assessment procedure with 0.54 loading.

Component 3: Social factors

This component has four factors, and it is named social factors. They include absence of contact group discussion class with .82 loading, absence of physical workspaces with 0.71, less participation from and amongst the student with 0.58, lack of physical consultation with lecturers with 0.52 loading.

Component 4: Psychological factors

This component has four factors, and it is named psychological factors. They include anxiety from transitioning from face to face to online T&L with 0.84 loading, problem of technology adaptability with 0.69, difficulty to adapt and adjust to the new T&L with 0.65, zero-self exploratory learning with 0.57 loading.

Component 5: Infrastructure support factors

This component has three factors, and it is named Infrastructure support factors. They include inaccessibility and unaffordability of ICT gadgets with 0.75 loading, Inadequate measures to check plagiarism with 0.71, difficulties in receiving detailed feedback on assessments with 0.58 loading.

4.4 OBJECTIVE 2: MEASURES IN IMPROVING THE T&L ON CONSTRUCTION EDUCATION IN THIS ERA OF DIGITAL PLATFORM

This section presented the measures in improving the T&LTL on construction education in this era of digital platform. Mean item scores were used to for the measures. Data was gathered using a well-structured questionnaire. A 5-point Likert scale was used to rank the measures to improve the online T&L on construction education in this era of digital platform.

4.4.1 Descriptive analysis

This section of the questionnaire presents the key measures in improving the T&L on construction education during the era of COVID-19 and digital platform. The students were asked to assess the components of improving T&L during the era of online learning according to a set of pre-set criteria. The scores for each of the criteria were presented as (Strongly Disagree) represented by1, (Disagree) by 2, (Neutral) by 3, (Agree) by 4 and (Strongly Agree) by 5. For each metric assessed by respondents, the five-point Likert scale was translated to mean percentages and mean scores (MSc). The mean scores made it simple to determine the importance of the various characteristics as reported by the respondents. This method was used to interpret the data from the questionnaires. The data was used to generate numerical findings of relative mean scores (MS). The findings of relative importance in this study were based on the rule that the respondent's scores on all selected aspects served as the observationally determined results.

The value of MS for a particular aspect is determined by summing all genuine ratings given by each respondent, which represents a fraction of the total sum of the highest possible ratings on a five-point scale that each respondent can assign for the specific criterion. Every response was assigned a numerical value on a scale from 1 to 5. This can be represented mathematically by: Mean Score (MS) = (5*n5 + 4*n4 + 3*n3 + 2*n2 + 1*n1)/ (5+4+3+2+1), where n5 = the number of respondents representing Strongly agree, n4 = Agree, n3 = Neutral, n2 = Disagree and n1= Strongly disagree. Table 4.12 below reveals the results for these measures and their key rankings accordingly.

Table 4.4.12 Measures improving online teaching and learning

MEASURES	CODING	S.DIS	DIS	N	AGR	S.AD	MNS	SD	RANK
Internet data provided by the institution	MITL4	6(7.8%)	6(7.8%)	3(3.9%)	23(29.9%)	39(50.6%)	4.08	1.254	1
Create accessible materials	MITL14	3(3.9%)	1(1.3%)	13(16.9%)	30(39%)	30(39%)	4.08	0.984	2
Record lectures, and caption videos and audio content	MITL12	7(9.1%)	4(5.2%)	6(7.8%)	25(32.5%)	35(45.5%)	4	1.257	3
Choose adequate digital technologies	MITL13	3(3.9%)	3(3.9%)	16(20.8%)	30(39.0%)	25(32.5%)	3.92	1.023	4
Flexibility in the mode of assessment	MITL20	3(3.9%)	7(9.1%)	12(15.6%)	31(40.3%)	24(31.2%)	3.86	1.085	5
Providing counselling to student	MITL16	7(9.1%)	6(7.8%)	10(13.0%)	24(31.2%)	30(39.0%)	3.83	1.281	6
Digital technologies and online tools correspond to learners' needs	MITL5	2(2.6%)	8(10.4%)	16(20.8)	27(35.1%)	24(31.2%)	3.82	1.073	7
Flexible times in the t &l	MITL15	4(5.2%)	4(5.2%)	18(23.4%)	28(36.4%)	23(29.9%)	3.81	1.089	8
Reasonable access to device for online learning	MITL1	3(3.9%)	6(7.8%)	19(24.7%)	29(37.7%)	20(26%)	3.74	1.056	9
Culture of peer support among students	MITL18	7(9.1%)	4(5.2%)	17(22.1%)	24(31.2%)	25(32.5%)	3.73	1.232	10
Digital learning assistantship program for students	MITL19	7(9.1%)	5(6.5%)	17(22.1%)	22(28.6%)	26(33.8%)	3.71	1.255	11
Adopt a flexible approach to student participation in the T& L	MITL10	2(2.6%)	7(9.1%)	19(24.7%)	33(42.9%)	16(20.8%)	3.7	0.988	12

MEASURES	CODING	S.DIS	DIS	N	AGR	S.AD	MNS	SD	RANK
Ensure financial support and equipment	MITL11	8(10.4%)	7(9.1%)	11(14.3%)	27(35.1%)	24(31.2%)	3.68	1.292	13
Prior competencies and digital literacy	MITL6	3(3.9%)	7(9.1%)	27(35.1%)	24(31.2%)	16(20.8)	3.56	1.045	14
Incorporating online tools effectively into the instruction practices	MITL2	4(5.2%)	6(7.8%)	25(32.5%)	29(37.7%)	13(16.9%)	3.53	1.033	15
Ease with digital tools for T& L	MITL8	4(5.2%)	7(9.1%)	24(31.2%)	29(37.7%)	13(16.9%)	3.52	1.046	16
Adequate training is provided both staff and students	MITL3	6(7.8%)	10(13%)	18(23.4%)	25(32.5%)	18(23.4%)	3.51	1.21	17
Addressing systemic racism	MITL17	8(10.4%)	8(10.4%)	21(27.3%)	18(23.4%)	22(28.6%)	3.49	1.294	18
Different forms of support from the stakeholder's	MITL9	4(5.2%)	9(11.7%)	28(36.4%)	20(26%)	16(20.8%)	3.45	1.107	19
Effective pedagogical practices	MITL7	0%	10(13.0%)	34(44.2%)	22(28.6%)	11(14.3%)	3.44	0.896	20

Table 4.12 above, shows the extant of significance or importance of the 20 measures for improving online learning that can be implemented to surcease the proper delivery of online learning. The measures are indicated in terms of percentage responses on a scale of 1 (Strongly disagree/ not significant) to 5 (Strongly agree/very significant) and the mean score (MS) are between 1.00-5.00 The findings of the study reveal that 40% of the components have mean score MS of >3.80≤4.30, this shows that the components are very significant measures or factors and they are worthy of inclusion. The results also revealed that the remaining components have MS of >3.50≤ 3.80, this indicates that they are also significant in online learning during the pandemic.

From Table 4.12 above, it can be deduced that, internet data provided by the institution has a mean score of 4.08, which suggest that the factor is also worthy of inclusion in any measures to online learning during the pandemic. The mean scores for create accessible materials, record lectures, and caption videos and audio content, choose adequate digital technologies, flexibility in the mode of assessment, providing counselling to student, digital technologies and online tools correspond to learners' needs and flexible times in the t &l are 4.08, 4.08, 4.00, 3.92, 3.86, 3.83, 3.82 and 3.81respectively. These mean scores confirm that the participants agreed that these measures are relevant to the measures of improving the delivery of online learning during the pandemic for CMQS students at DUT.

Reasonable access to device for online learning, culture of peer support among students, digital learning assistantship program for students, adopt a flexible approach to student participation in the t &l, ensure financial support and equipment, prior competencies and digital literacy, incorporating online tools effectively into the instruction practices, ease with digital tools for T&L, adequate training is provided both staff and students their mean scores are 3.74, 3.73, 3.71, 3.7, 3.68, 3.56, 3.53, 3.52 and 3.51 respectively. The scores of each component are >3.50, which indicates that these measures are significant in online learning.

4.5 PRESENTATION OF THE QUALITATIVE FINDINGS (SEMI-STRUCTURED INTERVIEWS) WITH LECTURERS AT DUT

The interviews were conducted at Durban University of Technology in South Africa. Semi-structured interviews give a unique chance to obtain insight or in-depth of online learning during COVID-19 in South Africa, revealing the challenges and possible solutions to be Implemented. The interviews assist the observer in gaining a more in-depth understanding of the research challenge and how it impacts the researcher's approach to accomplishing research objectives.

4.5.1 SELECTION OF INTERVIEWEES

The data collection for interviews was gathered from six lecturers in the CMQS department through digital recording device. The interviewees in the study were chosen based on their profession, willingness to participate in the study, experience during the pandemic, and interest in improving T&L techniques in the field of construction education. To participate in the interview, all participants were given an information guide regarding the study and completed a permission form. The interview was done to contribute to the following research objectives:

- To assess the setback of online T&L towards Construction Education that affect student academic performance.
- To proffer measures in improving the T&L on construction education in this era of digital platform

The evaluation of the literature revealed themes, questions, and gaps to achieve the above-mentioned objectives. The information obtained from the interviewee was obtained utilising a digital recording device that was openly mentioned to them prior to the start of the interview to guarantee their approval to be recorded. The recording equipment allowed the researcher to concentrate only on the responses, but notes were taken both during and after the recording. These notes were considered throughout the study. Each interview was transcribed and submitted to a series of coding exercises related to themes, relationships, and differences concerning the topic matter for the observation stage of data analysis.

4.5.2 DEMOGRAPHIC DATA

Demographic data were collected from a total of six (6) course lecturers at Durban University of Technology in the department of CMQS. Four (4) participants were of the African race, one (1) was Indian and one (1) was coloured. Lecturer's age ranged from 30 years to 65 years. Five of the participants were males and 1 was female. Four (4) of the participants holds PhDs and the other three (2) are holding master's degree.

4.5.3 THEMES AND SUB-THEMES THAT EMERGED FROM THE INTERVIEWS

Data analysis led to the identification of four (4) main themes with subthemes or categories. The themes and sub-themes are illustrated in Table 4.13 below.

Table 4.4.13 Themes for qualitative analysis

S/N	Objective	Themes	Categories
1	To assess the setback of online T&L towards Construction Education that affect student academic performance.	Challenges you faced in the new T&L methods as it relates to construction education	**Resources challenge:** unavailable of data, lack of devises **Skill challenge:** lack of visualisation skills, problem assimilating concepts on specific practical modules etc. **Technical support challenge**: internet connectivity problem Load shedding **Motivation challenge** – This can include excuses from students, non-attendance, **Emotional challenge:** depression, anxiety, fear of failure etc

S/N	Objective	Themes	Categories
1		Various effects of COVID-19 on the performance of Construction Management and Quantity Surveying Teaching & Learning in this era of online	**Performance effects**: class attendance, mental health etc. **Quality effects:** Drawings were not clear enough, plagiarism etc. **Emotional effects**: loosing siblings, sickness due to COVID-1919.
2	To proffer measures in improving the T&L on construction education in this era of digital platform.	1. Measures to be adopted in mitigating the challenges faced in this era of online T&L	**Infrastructure support:** donate old desktops, provision of enough data, supply software's like rivet, auto cad, WinQS. **Training support:** Training for online platforms such as Moodle and MS Teams, Zoom etc. **Quality measures:** online tutors from industry, different assessments technique to eliminate plagiarism, blended learning
		2. Measures that would engender a collaborative approach which will ensure a win-win situation among the Student and Lecturers in this era of online T&L	**Learning styles:** Blended learning, MOOC **Emotional support:** provision for counselling, **Infrastructure support** **Training support** Software training (WinQS, AutoCAD, Moodle etc). for both students and academics

4.5.3.1 Theme 1: Challenges to T&L methods in construction education

From the interview respondents, the following are the challenges to T&L methods in construction education.

Motivation challenge: When the participants were asked about the challenges they faced in their new online teaching and during COVID-19 era, most of the participants mentioned that there was low turnout in the class attendance due the online teaching methods. One of the interviewees (Participant 1) said that **"***students did not attend classes when classes were moved to online, the students would find all the reasons not to attend raising issues like load sheading, lack of internet signal, lack of data*".

In the same vein, another respondent (P6) corroborated this point by saying that "*Do you know that we experience a very low turn-out in class attendance as student refused most of the time to connect to during online lecture. In fact, where we normally have like 30 students in a class during physical classes, but during online, we may have just 6 students connecting*".

Though online classes are the other of the day in this new era, from the responses gathered from the interviewees, it is certain that there are challenges confronting the online T&L methods in construction education. The issue of low turnout in class is a major issue as discovered by the interviewees. To address this low turnout in the class attendance, it is important to encourage students to attend online classes and government in construction education sector can achieve this by providing support through periodic training and regular sensitization on the benefit of embracing the online methods as the new normal.

Technical support challenge: Most of the participants observed that problems relating to technical support are crucial. According to the views expressed by the participants challenges relating to technical support usually arise when there is a lacuna in the internet connection and network. The two most significant reasons for challenges with internet connectivity include: (i) physical places where students live, (ii) loads heading affecting the strength of the network and connectivity. Most of the interviewees stressed that internet connections during loads heading have led to critical problems during online learning. Based on the analysis participant two highlighted that "*I can just tell you that in South Africa there is no equality there are places where internet connection is a major challenge and unfortunately one of our students are from those areas. Participant 2*

"Internet connection in the rural areas is a challenge student battled to connect in online classes "Participant 1

Participant 4 further added that *"I am very constrained by the poor network connection. Inevitably I had to go to the libraries in the city town to get signal. Not to mention if the is power outage in my area am in a risk of not conducting any lecture that day".*

In line with the above view, participant 3 the possibility of total failure in online learning if students and lecturers continue to work from home meaning rural areas. In regards, the participant submitted that:

"…. *The downside of online learning is an issue of poor signal in our areas where we reside" Participant 3*

Poor internet connection affects the progress of delivering the classes online and also time factor is compromised in terms of finishing the required work on time "Participant 5

"Poor signal due was a challenge to conduct online classes during COVID-19 students even said it's hard to hear when the lecture is talking due to poor signal" Participant 6

Skill challenge: As revealed from the analysis, skills interventions are very necessary in providing solutions in online learning. Lack of skills or training is a major challenge, this contributes to setbacks of online learning in any given university if ignored.

Participant 2 specifically intimated that lack of proper skills to procure online learning is one area of challenge. The skill of using online is primarily dependent on the pool of the availability of experts and resources for online learning. It is required that competency of online learning for both students and lecturers be improved through adequate training and mentoring for academic staff to be able to produce a quality work and students to deliver quality work. According to participant 6, addressed that:

"*Lack of skills or proper training on how to use online platforms like MS Teams, Moodle, and Blackboard etc. will have a major impact on productivity of our course. (Participant 6)*

"Lack of technical support from IT department within the university to transfer the skill was ignored" (Participant 4)

"There was no proper training provided to conduct online learning for students" (Participant 3)

"Training for use of online tools was lacking" Participant 5

Resources challenge: Lecturers mentioned that they did not have proper Wi-Fi access at home in order to conduct classes or supplement T&L. They utilised their own data when the one supplied by the institution gets depleted to access online classes and materials during the pandemic. Besides less data provided for online learning, students and CMQS lecturers highlighted that lack of proper computers hindered the success of online learning during the COVID-19 pandemic.

"Respondent 6 was of the view that lack of proper computers and laptops during online learning was a challenge as some of these laptops couldn't install programs like Microsoft teams because their windows were outdated "

"The 10-gigabyte data supplied to students and lecturers by the university is not sufficient this hinders the success or completing the required workload on time also students not able to attend all classes due to shortage of data" (Participant 3)

*"Students relied on the computer laboratories within the campus to do their schoolwork but when COVID-19 came students didn't have devices to connect for online classes. Most of the students are from disadvantage backgrounds where it's not easy to buy a laptop for them" (*Participant 5)

The success of online learning is to increase access to online learning and under-served students by bringing a host of educational resources and experience to those who may have limited access to online learning. The advent of COVID-19 proved that the university have limited access to resources for students and lecturers. Besides poor access to online learning for students and lecturers, the computers are not readily available for learners and lecturers to utilise where necessary. In terms of university management support, the respondents felt that there was limited resource support from the management such that only students with National Student Financial Aid Scheme (NSFAS) were supplied with laptops for online classes.

4.5.3.2 Theme 2: Effects of COVID-19 on the performance of Construction Management and Quantity Surveying Teaching & Learning in this era of online

Performance effects

Participants were asked about the various effects of COVID-19 that would affect the performance of CMQS T&L. Most of the participants highlighted that COVID-19 affected the students.

"The respondent posited that COVID-19 had negative impact on student performance as the attendance issue affected most students and this ended up affecting and their academic performance" (Participant 1)

"According to this interviewee, the students were achieving lower grades as compared to traditional learning due to COVID-19, this was due to lack of class attendance, also they were unable to complete practical assignments and students from disadvantaged areas had lack of access to internet connections, and they were partially excluded in some of the information that was being taught online" (Participant 2)

"The third interviewee was of the view that the performance was satisfactory although students had issues with internet connections and attending classes" (Participant 3)

"First impact was the mental health as COVID-19 affected our students, they were depressed and that affected their performance also attendance in online classes" (Participant 5)

The view of the interviewee was that some students were losing their family members, and some had COVID-19 that affected their mental health and that had a negative impact on their performance. (Participant 6

Quality effects

"The interviewee was of the opinion that the quality of education was compromised during COVID-19 as compared to face-to-face learning but the online learning was beneficial to students as it was easy for them to pass the assessments as they were able to share the information using their mobile phones" (Participant 4)

"The performance of students was okay judging from their pass rate, but the quality was compromised meaning even though they passed the quality was not guaranteed meaning plagiarism was very high" Participant 3

Emotional effects

First impact was the mental health as COVID-19 affected our students, they were depressed and that affected their performance also attendance in online classes.

The view of the interviewee was that some students were losing their family members, and some had COVID-19 that affected their mental health and that had a negative impact on their performance.

4.5.3.3 Theme 3: Measures to be adopted in mitigating the challenges faced in this era of online T&L

Infrastructure support

Also, the university should supply software's like rivet, auto cad so students will be able to practise drawings this will help with analysing and interpretation of drawings" (Participant 1)

"According to this interviewee, the institution provided both students and lecturers with enough data and internet devices to complement online learning" (Participant 2)

"The universities should donate old desktops to under privileged students so that they can have access to online learning" (Participant 3)

"The respondent posited that the content must be provided to students prior starting the lecture online so that they can have enough time to download and familiarize themselves with the information provided and also provision of enough data" Participant 3

"Universities should supply resources to students in order for them to participate in online e.g. laptops, tablets and desktops" (Participant 6)

Skills training

Based on the analysis of the data, there was a perception among the support of skills training to both students and lecturers. This would ensure competence and awareness to the use of online learning. Several reasons were highlighted for having skills training for students and lectures.

"Training must be provided for lecturers and students on how to use online platforms such as Microsoft teams, Moodle platform to mitigate these challenges" (Participant 2)

"Introduction of training to support student and staff with devices for example training on how to use Moodle and MS Teams" (Participant 5)

Technology has become the focus of teaching at all levels of education. However, technology needs to be adapted to teaching environment. This will enable lecturers to facilitate learning and it will help students to engage with the content constructively in multi-modal environments. The ability to incorporate technology into online learning requires appropriate skills to direct learning. Therefor formal training for online learning is required.

Quality measures

For any course to be deemed effective it is expected to produce quality graduates to the industry field. The analysis revealed that the institutions should provide quality assurance in such instances to showcase the quality of their service delivery to students. In support of this finding, Participant 1 provided additional information on how to improve quality education in difficult times. Respondent noted that:

"The university should support students with online tutors and monitor their learning progress" (Participant 1)

"The fourth interviewee prescribed that a different assessments technique for our students must be used to test their knowledge that will ensure quality of education during this online learning" (Participant 4)

"The respondent offered the introduction of blended learning as the one of the best solutions for construction education. Respondent stated that blended learning its advantageous because it includes practical this will also ensure quality of education in our field of study, and it is a must for our students in this department to be exposed to construction sites as this will contribute to their career in the near" (Participant 5)

"(Respondent 6) supported the statement highlighted by interviewee number 5, that blended learning should be introduced as some modules require practical's like Quantises and Documentation, Construction Technology and Price analysis and estimation they make use of drawings and technology they go for practicals".

4.5.3.4 Theme 4: Measures that would engender a collaborative approach among students and lecturers.

Learning styles

According to this interviewee, blended learning should be introduced this will enable the student to prepare for the work environment and also lecturers will be able to assist students with practicals.

The interviewee stated that the university should implement studio-based learning, integrating all subjects (Construction Management, Pricing, Construction Technology and Quantity Surveying)

Skills Training

Universities should offer training for both students and lectures as to how to use the online platforms or software's.

The interviewee believed creation of a platform whereby students and lectures will be provided a training on how to use software's of online learning such as MS Teams, Auto Cad, WinQS and CSS Candy will work on the advantage of the university.

Infrastructure support

The respondent offered the following as the key solutions: universities and government which must provide financial support with regard provision of equipment for online learning.

Emotional support

"Counselling should be provided for both students and lectures are able to cope in these difficult times."

CHAPTER 5

DISCUSSION OF THE RESULTS

5.1 INTRODUCTION

This chapter presents discussions of findings from the previous chapter. A highlight of the study problem and justification is presented. Secondly the motivation of the use of mixed method in this study and research question for each strand of data collection. Finally, this chapter will discuss major findings as related to the literature on the challenges faced in online learning during COVID-19 pandemic and measures to mitigate these challenges and the discussions of this study aimed in answering the research questions, which includes:

5.1.1 What is the setback of online T&L on construction education and construction student performance?

5.1.2 What measures can be taken in improving the T&L in this era of COVID-19 on construction education in the case of CMQS students?

5.2 TRIANGULATION

Triangulation, as described in Chapter 3 of this study, contributes to the validity of this study. In this chapter, convergence triangulation was used after independent examination of quantitative and qualitative data that were obtained concurrently(Farmer *et al.* 2006). Triangulation was used in assessing the impact of COVID-19 pandemic on construction education, T&L in department of construction management and quantity surveying students at DUT in KZN province using quantitative and qualitative methods to gain a comprehensive picture. Triangulation of the quantitative data and qualitative findings determined where the findings offer complementary information about theimpact of COVID-19 pandemic on construction education, T&L in department of construction management and quantity surveying students at DUT in KZN province

(complementarity), where the findings agree with one another (convergence) and where the findings appear to be contradicting each other (dissonance) (O'Cathain, Murphy and Nicholl 2010). During the discussion of each key subject, a summary of the triangulation of quantitative and qualitative data was provided.

5.3 DISCUSSION OF QUANTITATIVE AND QUALITATIVE FINDINGS

5.3.1 BACKGROUND INFORMATION

The survey report from seventy-seven questionnaires showed that a total of 44 students were male, representing 57.1% of the total population of the respondents, and thirty-three 33 were female students, representing 42.9% of the total population of the participants. On the other hand, the background information on the qualitative analysis shows that total of two lecturers were female representing 33% of the total population and four were male lecturers representing 67% of the total population of the participants. The educational level of study of respondents revealed that 31 (40, 3%) of the total population were second year students, 28 (36, 4%) of the total population were third year students and 18 (23, 4%) of the total population were fourth year students. On the other hand, the educational qualification for lecturers showed that three respondents have master's degree, representing 50% of the total population and three have PhD, representing 50% of the total population.

In terms of Age, four respondents above the age of 20 year but below 40 formed 67% of the total population and two respondents above the age of forty but below 60years formed 33% of the total population. Furthermore, in terms of the race, four respondents were African, which represents 66% of the total population, one respondent was Indian, which represents 17% of the population, and one respondent was coloured, which represents 17.0% of the total population.

Finally, years of experience, the survey result shows that one respondent has less than 10 years of working experience, which forms 17% of the population. One respondent has 10-15 years of working experience, including 17% of the population. Two respondents have 15-20 years of working experience, which forms 33% of the population and two respondents have twenty and above years of working experience, which forms 33% of the population.

The discussions of findings presented in this study are discussed according to their objectives. This will enhance the uniformity in the study.

5.3.2 (RO1) To assess the setback of online T&L towards Construction Education that affect student academic performance

The factor analysis revealed that the critical challenges facing online T&L in construction education are in five categories namely: pedagogical skills challenges, technical challenges, social challenges, psychological challenges, and Infrastructure support challenges. From the analysis, five factors were grouped as pedagogical skills-related challenges. The technical-related challenges identified were five factors, the social-related challenges were described by 4 factors, the psychological-related challenges were described by 4 factors and infrastructure support-related challenges comprises of 3 factors. (Please kindly see Table 4.10, page 62).

Component 1: Pedagogical Skills

The researcher delved deeper into the findings and interpretations to ascertain the impact of pedagogical skills in online learning during the pandemic. The findings from the questionnaire revealed that lack of training skills could lead to low productivity, late schedule of classes, lack of transparency in the method of assessment, difficulties in adapting to new changes and difficulty in assimilating lessons online. Furthermore, although the questionnaire revealed that pedagogical skills is one of the challenges to online learning in construction education, it did not reveal the challenges

that are literally faced. However, similar pattern was prevalent in the findings from the semi-structured interviews. Four out of six interviewees (2, 3, 4 and 5) argued that lack of technical support and skills to use online platforms like Microsoft Teams, Moodle was a major challenge in favour of online learning. These findings coincides with the findings of (Al Mulhim 2014; Kundu and Bej 2021). According to (Kibuku, Ochieng and Wausi 2020) the absence of technical abilities in online learning and the inability of online classes or tutors to create effective content are significant obstacles to the successful implementation of online education in universities. In addition, it was noted that even when online classes or e-tutors receive training, the emphasis is primarily on mastering the technical aspects of the system rather than on the more difficult task of receiving proper pedagogical training for online learning. The above findings align with the results of this study that the pedagogical skills should be given attention in this era of online learning.

Among the items in this group, difficulties in adapting to new changes is also a challenge facing online learning in CMQS department. This agrees with the findings of Blankenship and Jones (2021) that the abrupt transition to remote education in response to the global outbreak of COVID-19 presented notable difficulties and disturbances for both students and educators. In addition, these findings are also in line with, the study of Mpungose (2020), the author asserts that South African universities found it to be a challenge to move from face-to-face to online learning (e-learning) because of the (COVID-19). This maybe a result of high cost of the information systems or lack of technical aspect of using the online platforms, or awareness of its full benefits. However, pedagogical skills require efficient and real-time practice and collaboration among students and lecturers to be fully equipped.

Component 2: Technical factors

The technical factors are one of the key issues to online learning. The five- underlying components to technical challenges in this study they include excessive workload l, technical problem associated with internet connectivity, loss of interest due to online T&L, un-realistic deadline from the lecturers and trial & error in the online assessment procedure. Similarly, from the semi-structured interviews all the six (6) of the respondents indicated that lack of internet connection and lack of technical support was a major challenge. Furthermore two (2) of the six-interviewee highlighted that the lack of internet connection contributes to the poor class attendance for students. these findings are in line with study conducted by (Aboagye, Yawson and Appiah 2021) stating that the lack of fast, affordable, and reliable internet connections hinders online education, particularly for individuals residing in rural areas and underprivileged communities. It can be deduced that there is no full support from the managerial personnel within the university and the government towards the essential needs required for effective online learning implementation. This agrees with the findings of Basar *et al.* (2021) the lack of fast, affordable, and reliable internet connections hinders online education, particularly for individuals residing in rural areas and underprivileged communities. Students who are unable to access online content through smartphones are unable to benefit from online learning because a significant amount of the content is not accessible.

Component 3: Social factors

This component has four factors and it is named social factors. They include absence of contact group discussion class with .82 loading, absence of physical workspaces with 0.71, less participation from and amongst the student with 0.58, lack of physical consultation with lecturers with 0.52 loading. The quantitative were in line with the findings of (Peacock and Cowan 2019), the research have it that studying and having a good balance between school work and personal life makes people feel like they belong and helps them connect with others in a positive way. The author further stated that the COVID-19 crisis has caused problems for students in terms of balancing work and personal life and having difficulty socializing. This has led to issues with academic honesty and students feeling sad about not being able to learn in an interactive environment (Joshi *et al.* 2022). These findings also agreed with the study of (Cao *et al.* 2020), stating that the pandemic has disrupted students' social connections with their families and friends, inevitably affecting their academic performance

Component 4: Psychological factors

According (Garris and Fleck 2022) to the lack of emotional support and social interactions which are contrarily related to the mental health of the students will have the dreadful consequences on the academic performance of students. The mental well-being of students during the COVID-19 crisis has a high impact on their academic performance, often resulting in the expression of traumatic distress. The extensive spread of COVID-19 has led to worries among students about the effectiveness of the online education platform.

In terms of this study the quantitative analysis revealed that psychological factors had significance on online construction education during the pandemic. In the findings of quantitative analysis component four had factors which include anxiety from transitioning from face to face to online T&L, problem of technology adaptability, difficulty to adopt & adjust to new T&L and zero-self exploratory learning. Furthermore, these findings were in line w8i0th those of qualitative analysis (semi-structured

interview) where interviewees five and six were of the same opinion that mental health was one of the issues contributed to the poor academic performance of CMQS students. These findings were in line with the findings of (George and Thomas 2021), highlighting that the increasing importance of self-directed learning, leading to concerns about both physical and mental well-being, which ultimately impact students' future careers and achievements. In addition, the author stated that the student workload has increased due to the emotional difficulties they are facing, such as anxiety, depression, and stress.

Component 5: Infrastructure support factors

Infrastructure support is one of the components to online learning. According to the findings of this study infrastructure support included, inaccessibility & unaffordability of ICT gadgets, Inadequate measures to check plagiarism and difficulties in receiving detailed feedback on assessments. Furthermore, findings from qualitative analysis complemented these findings from quantitative analysis. Interviewees one, three, five and six were of the same opinion that lack of proper devices for online learning was a challenge to students and lectures. The participants also highlighted that some of the system they were using had not enough capacity to accommodate the software used during virtual classes. These findings supported the study conducted by (Azorín 2020), stating that one of the challenges faced by students in online education is the limited availability of fast internet connections and necessary electronic devices. Insufficient infrastructure or resources at home may pose challenges for students in their ability to learn online. Furthermore, a study conducted by (Sahu 2020), was of the same view that consequently, parents now face increased responsibility of acquiring laptops and IT devices for their children to enable remote studying. In remote regions without access to electricity, students might face challenges in staying connected as they lack the necessary power to charge their online learning devices, like laptops.

5.3.3 To proffer measures in improving the T&L on construction education in this era of digital platform.

The findings from the quantitative study reveal that 40% of the components have mean score (MS) of >3.80≤4.30, this reveals that the components are very significant measures or factors and worthy of inclusion. It can be deduced that, internet data provided by the institution has a mean score of 4.08, which suggest that it is worthy of inclusion in any measures to online learning during the pandemic. The mean scores for create accessible materials, record lectures, and caption videos and audio content, choose adequate digital technologies, flexibility in the mode of assessment, providing counselling to student, digital technologies and online tools correspond to learners' needs and flexible times in the t &l are 4.08, 4.08, 4.00, 3.92, 3.86, 3.83, 3.82 and 3.81 respectively. These mean scores confirm that the participants agreed that these measures are relevant to be used for improving the delivery of online learning during the pandemic for CMQS students at DUT.

Reasonable access to device for online learning, culture of peer support among students, digital learning assistantship program for students, adopt a flexible approach to student participation in the T&L, ensure financial support and equipment, prior competencies and digital literacy, incorporating online tools effectively into the instruction practices, ease with digital tools for T&L, adequate training is provided both staff and students their mean scores are 3.74, 3.73, 3.71, 3.7, 3.68, 3.56, 3.53, 3.52 and 3.51 respectively. The scores of each component are >3.50, which indicates that these measures are significant in online learning.

From the findings it can be concluded that some of measures to improve online learning have above-average MS, which indicates that they are all relevant in improving the online learning. These views were also discovered in previous sections of the thesis (see Table 4.12) and in the literature. On the study conducted by (Dhawan 2020; Huang *et al.* 2020) states that online learning is flexible when issues of time and place are taken into consideration. Every student has the luxury of choosing the place and time that suits him or her.

Training and Skills

This was supported by the findings from the qualitative analysis as most of the respondents highlighted that students must be taught online software like AutoCAD because they have their own capabilities of doing their own drawings making it easy for them to analyse and understand the drawings during these online classes. And also, training should be provided for lecturers and students on how to use the platforms adopted for T&L during Covid19 which, includes Microsoft teams, Moodle platform and all other online platforms. The findings were aligned with the literature (Narenji Thani, Tizhoosh Jalali and Mostafavi 2021) stated that students who take online courses need digital and socioemotional skills. In addition, resilience is now identified as a mechanism for helping students adjust to current and future crises. Torun (2020) identified e-learning as a predictor of academic progress during the COVID-19 Pandemic. Computer self-efficacy, internet self-efficacy, online self-efficacy, self-learning, learner control, and motivation for online learning are all required skills and abilities for students. In addition (Pham and Tran 2020) identified a set of abilities students would need to participate actively and effectively in online classes, such as computer skills, communication skills, inventiveness, and creativity.

Blended Learning

The educational strategy of blended learning (BL) blends face-to-face (F2F) learning with online or ICT learning. Devices connected to any network using Internet of Things (IoT) technologies are used during online learning. During the COVID-19 pandemic, an IoT-based BL model may be an ideal option for all educational institutions (Siripipatthanakul *et al.* 2023). In this study it was evident that students and lecturers suggest blended learning to be implemented as this was supported by the findings from the qualitative part of the study, stating Blended learning will enable the student to prepare for the work environment and for the lectures they will be more updated in the teaching environment like working from home, working on campus will work for them and it will be the win-win situation for both students and lectures. Again, as far for construction is concerned there is a need for practicals, we need to engage with students so all in all blended learning should be implemented**.** Blended learning shows an opportunity that integrates innovation and the benefits of technology in online learning with the interaction and participation of the benefits of face-to-face learning (Arifin *et al.* 2020; Bokolo Jr *et al.* 2020).

5.3.4 Infrastructure support

In terms of infrastructure support meaning use of proper computers, a significant (87%) of respondents agreed that there is a need of online gadgets to fulfil the implementation of online learning. This provides insightful empirical evidence into two critical points in terms of online T&L at DUT. Firstly, the online method of teaching was not being explored by most of lecturers at DUT prior the pandemic. Secondly the boundaries of social distancing forced the lecturers and students to online learning environment. This was supported by the findings from qualitative analysis, the participants also agreed that they lacked proper computers to conduct lectures some stated that the data supplied by the university was not enough.

CHAPTER 6

CONCLUSION AND RECOMMENDATION

6.1 INTRODUCTION

This study was conducted to identify and investigate the impact of covid19 on the construction education T&L as Durban university of Technology in KZN. This chapter discuses and presents conclusion and recommendations related to the objectives reviewed.

6.2 CONCLUSION

The study exposes critical setbacks to online T&L, it provides information on the factors influencing the utilisation of online learning during COVID-19 pandemic and thereafter provides mitigating measures to the identified challenges and strategies to promote the online T&L. Based on the findings of this study, it is possible to conclude that there are still challenges related to online learning and academic performance of students and these challenges could be responsible for the poor performance of students. This included setbacks of online learning that were not examined by previous studies such as: technical challenges, social challenges, psychological challenges, skills and training challenges etc. These findings represent the concrete contribution of these challenges or setbacks to online learning in higher institutions in South Africa. To answer research questions, this study employed the survey approach using SPSS software to analyse. The research findings significantly focused on the setbacks of online learning during COVID-19 pandemic. Based on the results, the respondents highlighted various setbacks that affects the online T&L during COVID-19 pandemic which included: technical problems associated with internet connectivity, lack of skills training, psychological setbacks associated with mental health, social setback and infrastructure support. This study discovered that all these setbacks are very crucial towards the academic performance of students and a successful implementation of online

learning during the pandemic. From the results of qualitative analysis, it can be concluded that class attendance, internet connections, lack of technical skills and lack of infrastructure support are key challenges facing the delivery of online learning during the pandemic and academic performance of the students. Other challenges that contributed to poor performance are, students were isolated, and they couldn't collaborate they ended up working individually because of online T &L. The study also revealed lack of proper devices for online learning such as laptops and cell phones affected students and the delivery of online learning.

The study also contributed critical mitigating measures that should or rather be employed during the time of COVID-19 pandemic. Globally higher education institutions have demonstrated resilience in response to COVID-19 pandemic. The study highlighted that the use of blended learning approach has been found to offer more learning chances than traditional face-to-face teaching methods. Students can learn theoretical content in a variety of ways, including face-to-face classroom activities, virtual learning on a learning management system, and clinical placement training with structured practical activities. The study concluded that approximately all the mitigating factors have a critical impact as measures to online learning during the pandemic at DUT. This includes the supply of proper infrastructure for online learning, provision of enough data and also proper training for students and lecturers. Note that this study is limited to DUT institution therefore, further studies can be conducted in other higher education institution in South Africa.

6.3 RECOMMENDATIONS

Based on the study the following recommendations were proposed:

1. Students and Lecturers should be well equipped for online learning concepts through training programs such as workshop seminars, television and radios to encourage them since the world is changing or moving towards 4th industrial revolution.

2. The blended T&L approach can offer advantages of two different methods of teaching. Meaning online learning can offer flexibility to learn wherever you are, while traditional learning remains attending classes physically. Therefore, the introduction of blended learning could be a solution during these difficult times.
3. Online learning should be promoted by the government and university policy makers this will help to enhance the practice among students and lecturers also working towards the shift of 4th industrial revolution.

6.4 RECOMMENDATION FOR FURTHER RESEARCH

An assessment of the competence skills required by students and lecturers to utilise the technological functions of online learning.

6.5 LIMITATIONS

While the study offers vital information regarding online learning. The limitations of this study included the following: methodological intervention was at one university in KZN which is DUT. The population used was students and lectures from the department of CMQS.

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APPENDIX

APPENDIX A-SETBACKS TO ONLINE LEARNING

S/N	CODING	SETBACKS
1	SIOL1	Anxiety from transitioning from face to face to online T&L
2	SIOL2	Zero-self exploratory learning
3	SIOL3	Trial & error in the online assessment procedure
4	SIOL4	Inadequate measures to check plagiarism
5	SIOL5	Lack of physical consultation with lecturers
6	SIOL6	Difficulty to adopt & adjust to new T&L
7	SIOL7	Problem of technology adaptability
8	SIOL8	Difficulties in receiving detailed feedback on assessments
9	SIOL9	Technical problem associated with internet connectivity
10	SIOL10	Loss of interest due to online T&L
11	SIOL11	Excessive work load
12	SIOL12	Un-realistic deadline from the lecturers
13	SIOL13	Lack of transparency in the method of assessment
14	SIOL14	Absence of contact group discussion class
15	SIOL15	Absence of physical work spaces
16	SIOL16	inaccessibility unaffordability of ICT gadgets
17	SIOL17	Difficulties in adapting to new changes
18	SIOL18	Difficulty in assimilating lessons online
19	SIOL19	Late schedule of classes
20	SIOL20	Low productivity
21	SIOL21	Less participation from and amongst the student

APPENDIX B- MEASURES IN IMPROVING THE T&L

S/N	CODING	MEASURES IN IMPROVING THE T&L
1	MITL	Reasonable access to device for online learning
2	MITL	Incorporating online tools effectively into the instructionpractices
3	MITL	Adequate training is provided both staff and students
4	MITL	Internet data provided by the institution
5	MITL	Digital technologies and online tools correspond to learners' needs
6	MITL	Prior competencies and digital literacy
7	MITL	Effective pedagogical practices
8	MITL	Ease with digital tools for T & L
9	MITL	Different forms of support from the stakeholder's
10	MITL	Adopt a flexible approach to student participation in the T& L
11	MITL	Ensure financial support and equipment
12	MITL	Record lectures, and caption videos and audio content
13	MITL	Choose adequate digital technologies
14	MITL	Create accessible materials
15	MITL	Flexible times in the T &L
16	MITL	Providing counselling to student
17	MITL	Addressing systemic racism
18	MITL	Culture of peer support among students
19	MITL	Digital learning assistantship program for students
20	MITL	Flexibility in the mode of assessment

APPENDIX C

QUESTIONNAIRE SURVEY ON CRITICAL ASSESSMENT OF THE IMPACT OF COVID-19 PANDEMIC ON CONSTRUCTION EDUCATION, TEACHING AND LEARNING: A CASE OF CONSTRUCTION MANAGEMENT AND QUANTITY SURVEYING STUDENTS AT DUT

I am Phindile Sohuma, a Master student in department of Construction Management and Quantity Surveying at Durban university of Technology, Steve Biko campus, Durban, South Africa. I would like to invite you to participate in this research. Research is a systematic investigation in the impact of Covid-19 pandemic on Education. I am currently conducting a research on **"Critical Assessment of the Impact of Covid-19 Pandemic on Construction Education, Teaching and Learning: A Case of Construction Management and Quantity Surveying students at DUT".**The aim of the study is to examine the impacts that the new teaching and learning methods have on students with a view to proffering possible measures of improving the Teaching & Learning in this era of Covid-19 and digital platform among the construction management and quantity surveying students in South Africa tertiary education institutions.

The questionnaire and Interviews therefore seek to:

i. To assess the setback of online Teaching and Learning towards Construction Education that affect student academic performance

ii. To proffer measures in improving the T&L in this era of digital platform

You are kindly requested to complete the questionnaire. There are no names required in this survey. Participation is voluntary and you are free to withdraw at any time with no negative consequences to you. The questionnaire will take between 25 and 30 minutes to complete. The data collected will be treated anonymously and the findings of the survey will be used for the research purposes only. In a case of any queries problem please be free to contact 21624854@dut4life.ac.za, Cell 0810703723, Dr M.C. Mewomo ModupeM@dut.ac.za Cell 0744870101 / Dr. C. Okorafor ChikezirimO@dut.ac.za Cell- 0780909994

Thank you.

Phindile Sohuma

SECTION A: BACKGROUND INFORMATION

This section of the questionnaire refers to background information. Please note that your response will remain anonymous. Your co-operation is appreciated

1. What is your gender?

Female	1
Male	2

2. Indicate your current level in the department?

First Year	1
Second Year	2
Third Year	3

SECTION B: SETBACK OF ONLINE T&L TOWARDS CONSTRUCTION EDUCATION

Objective 1. The following factors have been identified as some of the setbacks of online learning towards construction education in the department of CMQS at DUT. Kindly rank in order of importance using the following 5-point scale rating; 1= strongly disagree; 2= disagree; 3= neutral; 4= agree and 5= strongly agree

S/N	Student perception on the setback of online T&L towards Construction Education	1	2	3	4	5
SIOL1	Anxiety from transitioning from face to face to online T&L					
SIOL2	Zero-self exploratory learning					
SIOL3	Trial & error in the online assessment procedure					
SIOL4	Inadequate measures to check plagiarism					

SIOL5	Lack of physical consultation with lecturers					
SIOL6	Difficulty to adopt & adjust to new T&L					
SIOL7	Problem of technology adaptability					
SIOL8	Difficulties in receiving detailed feedback on assessments					
SIOL9	Technical problem associated with internet connectivity					
SIOL10	Loss of interest due to online T&L					
SIOL11	Excessive work load					
SIOL12	Un-realistic deadline from the lecturers					
SIOL13	Lack of transparency in the method of assessment					
SIOL14	Absence of contact group discussion class					
SIOL15	Absence of physical work spaces					
SIOL16	inaccessibility unaffordability of ICT gadgets					
SIOL17	Difficulties in adapting to new changes					
SIOL18	Difficulty in assimilating lessons online					
SIOL19	Late schedule of classes					
SIOL20	Low productivity					
SIOL21	Less participation from and amongst the student					

SECTION C: MEASURES IN IMPROVING THE T&L ON CONSTRUCTION EDUCATION IN THIS ERA OF DIGITAL PLATFORM

Objective 2. The following factors have been identified as some of the measures in improving the T&L on construction education in this era of digital platform. Kindly rank in order of importance using the following 5-point scale rating; 1= strongly disagree; 2= disagree; 3= neutral; 4= agree and 5= strongly agree.

S/N	To proffer measures in improving the T&L in this era of digital platform	1	2	3	4	5
1 MITL	Reasonable access to device for online learning					
2 MITL	Incorporating online tools effectively into the instruction practices					
3 MITL	Adequate training is provided both staff and students					
4 MITL	Internet data provided by the institution					
5 MITL	Digital technologies and online tools correspond to learners' needs					
6 MITL	Prior competencies and digital literacy					
7 MITL	Effective pedagogical practices					
8 MITL	Ease with digital tools for T & L					
9 MITL	Different forms of support from the stakeholder's					
10 MITL	Adopt a flexible approach to student participation in the T& L					
11 MITL	Ensure financial support and equipment					

S/N	To proffer measures in improving the T&L in this era of digital platform	1	2	3	4	5
12 MITL	Record lectures, and caption videos and audio content					
13 MITL	Choose adequate digital technologies					
14 MITL	Create accessible materials					
15 MITL	Flexible times in the T &L					
16 MITL	Providing counselling to student					
17 MITL	Addressing systemic racism					
18 MITL	Culture of peer support among students					
19 MITL	Digital learning assistantship program for students					
20 MITL	Flexibility in the mode of assessment					

APPENDIX D

INTERVIEW PROTOCOL ON CRITICAL ASSESSMENT OF THE IMPACT OF COVID-19 PANDEMIC ON CONSTRUCTION EDUCATION, TEACHING AND LEARNING: A CASE OF CONSTRUCTION MANAGEMENT AND QUANTITY SURVEYING STUDENTS AT DUT

I am Phindile Sohuma, a Master student in department of Construction Management and Quantity Surveying at Durban university of Technology, Steve Biko campus, Durban, South Africa. I would like to invite you to participate in this research. I am currently conducting a research on **"Critical Assessment of the Impact of Covid-19 Pandemic on Construction Education, Teaching and Learning : A Case of Construction Management and Quantity Surveying students at DUT".**The aim of the study is to examine the impacts that the new teaching and learning methods have on students with a view to proffering possible measures of improving the Teaching & Learning in this era of Covid-19 and digital platform among the construction management and quantity surveying students in South Africa tertiary education institutions.

The interviews therefore seek to:

i. To assess the setback of online Teaching and Learning towards Construction Education that affect student academic performance

ii. To proffer measures in improving the T&L in this era of digital platform

You are kindly requested to participate in this interview. There are no names required in this survey. Participation is voluntary and you are free to withdraw at any time with no negative consequences to you. The interviews will take between 25 and 30 minutes to complete. The data collected will be treated anonymously and the findings of the interviews will be used for the research purposes only. In a case of any queries problem please be free to contact 21624854@dut4life.ac.za, Cell 0810703723, Dr M.C. Mewomo ModupeM@dut.ac.za Cell 0744870101 / Dr. C. Okorafor ChikezirimO@dut.ac.za Cell- 0780909994

Thank you.

Phindile Sohuma

INSTRUCTIONS:

Please answer the following questions by crossing (x) on the relevant block or writing down your answerin the space provided.

EXAMPLE of how to complete this questionnaire:

Your gender?

If you are female:

Male	1
Female	2

SECTION A: RESPONSE BACKGROUND INFROMATION

This section of the questionnaire refers to biographical information.

1. Gender

Male	1
Female	2

2. Years of experience in the academic enterprise (in absolute number)

0 years – 4 years	1
5 years – 10 years	2
10 years – 15 years	3
15 years – 20 years	4
20 years & Above	5

APPENDIX E

SECTION B: INTERVIEW PROTOCOL

TECHNICAL INFORMATION

Please provide us with technical information related to the following questions:

1. What are the challenges you faced in the new teaching and learning methods as itrelate to construction education?

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2. Highlight the various effects of Covid-19 on the performance of Construction Management and Quantity Surveying Teaching & Learning in this era of online……
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3. Kindly identify and explain measures to be adopted in mitigating the challengesfaced in this era of online T & L

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4. What are the measures that would engender a collaborative approach which willensure a win-win situation among the Student and Lecturers in this era of onlineT&L?

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Thank you for your contribution