



**The impact of remote teaching and learning on engineering
students at University of KwaZulu-Natal**

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Declaration

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Glossary of acronyms

4IR	: Fourth Industrial Revolution
ADKAR	: Awareness, Desire, Knowledge, Ability and Reinforcement
AES	: Agriculture Engineering and Science
BL	: Blended Learning
CE	: Civil Engineering
CE&LS	: Civil Engineering and Land Surveying
COVID-19	: Coronavirus Pandemic
DC	: Dynamic Capability
DCM	: Dynamic Capability Model
DEO	: Department of Education
DHET	: Department of Higher Education and Training
DOH	: Department of Health
HEI	: Higher Education Institutions
KZN	: KwaZulu-Natal
LS	: Land Surveying
RP	: Research Participant
RTL	: Remote Teaching and Learning
RVB	: Resource-Based View
RVM	: Resource-Based View Model
TA	: Thematic Analysis
TAM	: Technology Acceptance Model

TAM2 : Extended Technology Acceptance Model
TRA : Theory of Reasoned Action
UKZN : University of KwaZulu-Natal
WHO : World Health Organization

Abstract

The outbreak of the novel coronavirus (COVID-19) crisis in December 2019 had adversely affected humankind globally in an immeasurable way. Higher education throughout the world was affected as continued learning amidst massive universities closures required the unprecedented decision to make a rapid transition from face-to-face to online learning. This sudden and immediate shift to remote online learning due to COVID-19 pandemic was characterised in South Africa by the Department of Higher Education and Training as Remote Teaching and Learning (RTL). Using a qualitative research methodology, this study is aimed at exploring and evaluating the impact and influence of the COVID-19 pandemic on the curriculum and quality of teaching and learning delivery using the method of RTL for engineering students at the University of KwaZulu-Natal (UKZN). Fifteen (15) participants were selected for the study within UKZN's department of Civil Engineering & Land Surveying (CE&LS) cluster; these participants comprised both students and academics where data was collected from, using unstructured, open-ended, online interviews. Non-probability purposive sampling was utilised as a sampling method and a thematic analysis method was used to outline codes, themes and patterns in the presentation, discussion and analysis of data.

The results revealed that the effective use of blended learning is dependence on educational technology (Ed-Tech). Having a conducive home environment, access to study materials, interactive and effective participation in blended learning is paramount for assessing the impact of RTL on UKZN engineering students amid COVID-19 pandemic. Moreover, inadequate network connectivity and/or load shedding and not having appropriate resources are some of the challenges that students were faced with which hinders their participation in online learning. The study found that most of the students RPs that indicated that they did not have a conducive environment at home, had to change their daily routine, and / or move from their homes to residences in order for them to be in a conducive environment for online learning. The findings revealed that RPs had sufficient digital skills to participate seamlessly and effectively in online

learning. Furthermore, the results revealed that there was suitable support from ICS staff / LAN Manager when students had to access systems remotely.

Keywords

Coronavirus, Educational Technology, Higher Education Institutions, Online Learning, Remote Teaching and Learning, Universities.

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Chapter 1

Introduction of the study

1.1 Introduction

A pandemic called the Coronavirus (COVID-19) affected many countries, sectors, and industries, including educational institutions. Numerous educational institutions started using use of remote operations during the initial stages of the national lockdown. The Department of Education (DEO), particularly the Department of Higher Education and Training (DHET), was also affected. As a result, the Minister of Higher Education, Science and Innovation, Dr Blade Nzimande, introduced remote teaching and learning (RTL) to carry out the academic program. Most universities then adopted the use of RTL. The study seeks to investigate the background of RTL, RTL at an international level, a South African perspective and challenges faced by engineering students in general, and University of KwaZulu-Natal (UKZN), benefits (effects) RTL on UKZN engineering students. Thus, the chapter introduces a broader understanding of the research by discussing the background, problem statement, key research objectives and questions, study significance and the overall structure of the study.

1.2 Background of the study

On December 31, 2019, Wuhan, China, reported finding the first case of the global pandemic COVID-19 (World Health Organisation (WHO), 2022) . Wuhan imposed a lockdown after the outbreak to stop the virus's spread. But by mid-March 2020, the virus had already travelled by flight to more than 100 nations Anderson *et al.*, (2020). According to World Health Organisation (WHO) (2022), there have been 648 million cases and 6,6 million deaths worldwide. South Africa has 24 million tests conducted, 4,04 million positive cases identified, 102 464 deaths, 3,9 million recoveries and about 37 million vaccines administered to date. Self-isolating, social distancing and restrictions or

limitation on travel, are just a few of deployed strategies globally. COVID-19 presented a number of difficulties for nations and industries around the world. On January 7, 2020, the first case in South Africa was officially confirmed. On March 28, 2020, South Africa's (SA) President, Mr. Cyril Ramaphosa, issued a lockdown countrywide in order to limit the virus's spread domestically. Following that, the National Disaster Act was used by the government to enact restrictions, rules, and directives to restrict the disease's transmission or spread (DisasterManagementAct57, 2022).

Only those services that were deemed essential were running throughout that time. Some activity / events were suspended as the global pandemic affected many countries, sectors, and industries, including educational institutions. Some of the restrictions that were suspended include alcohol sale, tobacco sale, non-essential travel and social events. Most companies adapted to the new normal by working from home and or remotely. More than 1.5 billion students globally, of various ages, are impacted by the educational sectors' closure as a result of the pandemic, according to (UNESCO, 2022).

Schools, universities, and several other educational institutions were among the structures used for infrastructure shutdown. All levels of educational institutions started using remote operations during the initial stages of the nationwide lockdown. Additionally, impacted was the Department of Education (DEO), more specifically the Department of Higher Education and Training (DHET). As a result, the Minister of Higher Education, Science and Innovation, Dr Blade Nzimande, introduced remote teaching and learning (RTL) to carry out the academic program. Most universities then adopted the use of RTL. One of the twenty-six (26) Higher Education Institutions (HEI) in South Africa is the University of KwaZulu-Natal (UKZN) which is based in KwaZulu-Natal and operates from five campuses. Professor Nana Poku is the current Vice-Chancellor and Principal. UKZN has four colleges (Humanities, Health Sciences, Law and Management Studies, and Agriculture Engineering and Science). Professor Albert Modi, the Deputy-Vice Chancellor and Head, leads the College of AES.

Over the years, many higher learning institutions have shifted their learning platforms from traditional to online. Laboratory work is a fundamental part of the engineering curriculum, where students can practice, test, and prove theoretical concepts learned in class. According to (Viegasa, et al., 2018), engineers must interact and apply the academic

theory. New variants of the coronavirus were discovered in 2021, worldwide and locally. This occurred when there was already an introduction of the vaccination program. A simple, secure, and efficient way to shield people from diseases before they spread is through vaccination. By leveraging your body's defences to develop resistance to particular diseases, it boosts your immune system. Injections into the arm are used to administer all COVID-19 vaccinations.

In South Africa, vaccines have been rolled out to anyone from twelve years of age. The new variant is likely easier to transmit, but the vaccine is still effective. All citizens were encouraged to vaccinate to limit the number of mutations to save lives and fight against new variants. This has allowed the country to open other activities and for the country to remain at lockdown level one. There have been about 24 million tests conducted, 4,04 million positive cases identified, 102 464 deaths, 3,9 million recoveries and about 37 million vaccines administered to date. The study intends to investigate the background of RTL, at an international and global level, encounters faced by engineering students in general and at UKZN, Benefits (effects) RTL on UKZN engineering students.

1.3 Problem statement

The COVID-19 pandemic has enormously impacted how businesses, society and the academic environment respond to the effects and influence it has caused on the decision-makers. This has resulted in a paradigm shift in the strategies, tactics and actions that the academic authorities use to disseminate the pedagogical curriculum and the associate platform for successful teaching and learning delivery. This has necessitated the adjustment and modifications in the RTL resource application and execution so that there is a lesser impact on the successful delivery of academic programmes. Furthermore, the cognitive impact on the students has catapulted a systemic and logical intervention in migrating into RTL program delivery. The study investigates and examines the RTL context and content in assimilating the student readiness in adopting the new hybrid curriculum dissemination normalcy.

1.4 Aim of the study

The main objectives of this study include the exploration and investigation to evaluate the impact and influence created by COVID-19 pandemic on students' curriculum deciphering and acquisition which has resulted in galvanising the safety protocols and persistent quality teaching and learning delivery. The study will aim to explore and examine the impact of remote teaching and learning on engineering students at University of KwaZulu-Natal. The academic environment has not been immune to consolidating and synthesizing its resources from an asynchronous and synchronous mode (hybrid) of curriculum delivery. The study will evaluate perceptual variables that engineering students are encountering to mitigate the transitory shock.

1.4.1 Research objectives

- a) To critically explore the impact of RTL on UKZN engineering students during the COVID-19 pandemic.
- b) To analyse strategies that could be applicable during COVID-19 crisis that can be used to close the gaps of practical work and simulations for UKZN engineering students.
- c) To determine the extent of the level of pedagogical and academic resources required in facilitating RTL on the UKZN engineering students.
- d) To assess the adaptability perception readiness and transition of UKZN engineering students in acquiring a curriculum within RTL dissemination platform.

1.4.2 Research questions

- a) How to critically explore the impact of RTL on UKZN engineering students during the COVID-19 pandemic?
- b) What could be the applicable strategies during COVID-19 crisis that can be used to close the gaps of practical work and simulations for UKZN engineering students?

- c) To what extent are the levels of pedagogical and academic resources required in facilitating RTL on the UKZN engineering students?
- d) How are the adaptability perception and transition readiness of UKZN engineering students in acquiring a curriculum within RTL dissemination platform?

1.5 Significance of the study

According to the researchers' knowledge, this is the first study to evaluate the perceived influence of RTL on UKZN engineering students within the crisis-ridden era in the emerging economy following the global pandemic. Analysis strategies, resources and the cognate paradigm shifts that can be used, in this study, to close the gaps in practical work and simulations for UKZN engineering students. The study will also determine the extent of constraints, impediments and challenges confronting UKZN engineering students following the transition to RTL. In this way, the study's significance systematically attempts to shift the academic narrative towards a better comprehension, application, and analysis of the pertinent assumptions, constructs and variables of RTL in its entirety within the engineering student's context.

1.6 Literature Review in the Study

The literature review on this study was mainly on assessing the effects of RTL at a global and local outlook. It summarized the research pertinent to the study of RTL and describes the various teaching approaches, including synchronous and asynchronous learning. The primary lens through which the researcher characterized, identified, analysed, assessed, and presented the current and existential literature will be the research questions that are used to support this study.

According to Hodges *et al.* (2020), the quality of the instruction is impacted by a procedure and careful evaluation of various possibilities. Effective method of creating instructional methods that uses an organized technique for strategy and growth are the

foundation and are derived from successful online learning. In contrast to online learning, RTL refers to a provisional switch in the manner of delivery of instruction because of emergency situations. In order to provide an educational service that would often be implemented in-person, through blended / hybrid learning, it is necessary to embrace totally remote teaching and learning solutions. Once the emergency has passed, you can convert back to this format.

In this study, the subtopics encapsulated is introduction; literature review; research methodology; presentation, discussion & analysis; and recommendations & conclusion.

1.7 Theoretical Underpinnings Considered in the Study

The relevant theories that underpin the study are expanded upon in chapter two in literature review section. The author chose Technology Acceptance Model (TAM), Resource-Based View Model (RVM) and Dynamic Capability Model (DCM) as the theories to better understand the concept of the impact of remote teaching and learning.

The TAM claims that perceived usefulness and simplicity can be used to predict whether or not a technology will be accepted. The TAM theory was successfully applied by UKZN to stimulate how members of its community (mostly academics and students) would come to embrace the usage of the technology necessary to support the delivery of RTL at UKZN. The introduction of Ms Teams and Zoom meant that every lecturer and every student would need to have access to a computer or smartphone with sufficient capabilities to be able to participate in a Ms Teams or Zoom lecture. As a result of the introduction of RTL, each lecturer and each student are now required to have access to a computer, or smartphone that is capable of supporting online learning platforms like Ms Teams or Zoom for accessing lectures. Most academic staff have a laptop, the few that had desktops were issued with laptops. The university also ensured that every academic staff was issued with a Wi-Fi router and provided data. On the other hand, students who are NSFAS supported already had laptops. Further to that, every student that was enrolled for that academic year received 10 gigabytes day data and 20 gigabytes night data. A theory, also referred to as an executive paradigm, which is utilised to pinpoint valuable

assets a firm might have viable gain on is called the resource-based view (RVM). The provision of access to online platforms, laptops, Wi-Fi routers and data were some of the tangible and intangible resources that the university provided in order to achieve the desired output. The University of KwaZulu-Natal unlocked value by implementing the resource view theory concepts, collecting the resources required to maintain performance at a very challenging time, and transitioning to a new platform for offering its services online through remote teaching and learning. An organisation's ability to reconfigure internal and external proficiencies, assimilate, develop and be able to address the ever-changing world is dynamic capability (DCM). The Dynamic Capability (DC) emphasizes three dynamic characteristics as being crucial to overcoming new problems. According to Teece (2010), corporate agility is a requirement, and a company should be able to "(a) identify and profile opportunities and threats, (b) grab opportunities, and (c) maintain competitiveness by enhancing, combining, protecting, and, when necessary, reconfiguring the business enterprise's intangible and tangible assets".

Therefore, an organization's staff members must have the ability to pick up new information fast. In order to adapt, transform, and revitalize its processes and systems for the migration to the RTL platform, UKZN employed the DC theory.

UKZN created, integrated, and reconfigured the key competencies of its employees, so that they can effortlessly transition from traditional teaching methods to the RTL platform. UKZN's core competences were used to alter the university's short-term competitive positions when RTL was implemented and to construct the online platform for a long-term competitive advantage after the quickly changing environment caused by COVID-19 had long since passed. UKZN demonstrated extremely adaptable capabilities in order to manage the transition of its systems and procedures to the RTL platform.

1.8 Research Methodology

To fulfil the main research aims, this study employed a qualitative research approach. The problem statement's fundamental questions were addressed by the data analysis section. Data were collected through unstructured, open-ended, online interviews where an interview schedule was sent to all fifteen (15) participants prior to the meeting together

with an informed consent which all participants had to sign. In terms of recruitment criteria, research participants were selected to be academics and students within the department of CE&LS. Non-probability purposive sampling was used as a sampling method that was appropriate for this study, concerning the impact of RTL on engineering students at UKZN. The author utilised a thematic analysis method to outline themes and patterns in presentation, discussion and analysis of data (Sileyew, 2020).

1.9 Contextualization of the study

In research, a method used to approach a project or topic relating to a certain study's context, is often referred to as contextualization where its activity as a whole lends it credibility and support. Contextualizing research can take many different forms, this impacted students' practical experience as virtual teaching and learning methods were adopted (Shehadeh, 2020). Many nations implemented lockdowns and adhered to stringent guidelines to stop the virus's spread, including work from home policies and online schooling (Adnan & Anwar, 2020). The transition from traditional in-person instruction to RTL brought opportunities as well as difficulties for academics and students. This revealed the gap between developed and developing countries more so in terms of ICT infrastructure (Affouneh, Salha, & Khlaif, 2020).

The coronavirus had a significant influence on the country's higher education industry, which had an effect mostly on the 2020 academic year (Baboolal-Frank, 2021). Due to the COVID-19 pandemic, domestic universities found themselves having to shift from tradition methods in 2020. However, a variety of barriers impede disadvantaged students from utilizing online learning to its full potential. The South African educational system is complex, with historical disparities, where some students come from disadvantaged families, and some attend rural universities (Bozkurt & Sharma, 2020). Some of the challenges the students faced were related to their geographic and socioeconomic circumstances, including their socioeconomic environment, inadequate network coverage, lack of internet connectivity, and lack of electricity (Viegasa, et al., 2018).

1.10 Structure of the dissertation

The five chapters that make up this study are briefly outlined:

Chapter 1

By addressing the introduction, background, problem statement, research aims (objectives and questions), detailing how this dissertation came to be. This is done by assessing the impact of RTL on engineering students at UKZN.

Chapter 2

This chapter reviews the relevant theoretical framework through the analysis of literature within the scope of RTL; it details the different teaching methods, i.e. synchronous and asynchronous learning. It further explores the relevant theories underpinning the study.

Chapter 3

Understanding a methodology to be utilised in this research study is important. It outlines the research design, research methods, research paradigms, data collection instruments, the study's location, population, sampling methods and recruitment strategies used, data analysis and ethical considerations a researcher should observe when conducting a study. This chapter also provides an analysis and discussion of the data concerning the impact of RTL on engineering students at UKZN, which was collected from fifteen (15) interviewees.

Chapter 4

The results and conclusions of all data collected during online interviews were summarized in this chapter, which were then synthesised, interpreted and analysed within the context of the research aims and how they connect to the literature review and hypotheses proposed by other researchers.

Chapter 5

This chapter provides a conclusion, makes recommendations for the study and provides insight for future studies within the scope of the findings.

1.11 Chapter summary

The study's aim, to investigate the effects of RTL at UKZN, was thoroughly explained in the study's introductory chapter. It outlined the study's background, problem description, primary study objectives, and research questions. Finally, it explained the importance of the study and the overall structure of the dissertation. The next chapter discusses literature review and theoretical foundation.

Chapter 2

Literature review

2.1 Introduction

The purpose of this chapter is to provide the literature overview that will be appraised on the background while broader content on the impact of remote teaching and learning (RTL) will be analysed, followed by the narration on from the global perspective, while contextualized perspectives of macro, meso and micro perspectives will be narrated. A review of literature and an analysis of the concept impact of 4IR on RTL and the cognate strategic resources will also be unpacked. Transformational leadership attributes and the change environmental will also be narrated, thus culminating into the integrating and the synthesis of theories such as Technology Acceptance Model (TAM 1 & 2) and Resource Based View (RBV) theoretical orientation to solidify the scholastic argument.

The main lens through which the researcher will describe, identify, analyse, examine and present the current and existential literature will be research questions utilised to support this study. In the academic sphere, the emergence of the COVID-19 pandemic created an enormous task that was challenging both policy makers and decision-makers. The pandemic required a swift shift and real-time transition in the mindsets of individuals in positions of authority, and it greatly affected how academic institutions dealt with COVID-19's abnormal and catastrophic consequences on the delivery of the academic program and curriculum dissemination efforts. Globally, there was a big shift in the strategies, plans, tactics and logistics that the institutions of higher learning, specifically, the universities, utilised to disseminate the pedagogical curriculum and the associated platforms to implement a successful delivery of teaching and learning (Tanga, Ndhlovu, & Tanga, 2020). During the Covid-19 pandemic, universities nationwide frantically and emergently switched to remote teaching (Schlesselman, 2020). Teaching and learning are two different concepts; the fact that teaching happened does not mean or guarantee that learning occurred. On the other hand, learning can take place without the need for teaching; therefore, teaching is not the most important aspect of learning, meaning the

student should be the focus of the learning environment and experienced rather than the lecturer (Schlesselman, 2020).

2.2 Background

According to Hodges *et al.* (2020), the meaning of the phrase “remote teaching and learning” is different to that of “online learning” because its ingenious virtual learning practice is profoundly dissimilar to modules delivered online to address a disaster or pandemic. It is the opinion of Hodges *et al.* (2020) that the quality of teaching is impacted by the tools used and the thorough consideration of various design options. Cognitively engaging with online learning is the product of meticulous instructional design and planning that follows a methodical approach.

RTL, in contrast, refers to a provisional switch in the mechanism of transmission of instruction because of a crisis. Using fully RTL solutions is required when using traditional teaching methods usually carried out through blended learning, or through hybrid courses. Once the crisis or emergency has passed, the method of teaching will revert back to its normal form. Hodges *et al.*, (2020) asserts that instead of trying to recreate a whole educational environment under these circumstances, the major objective is to provide temporary access to teaching and instructional aid in a way that is easy to set up and always available during a disaster or crisis.

The internet plays a key role in how we do things and communicate. The distribution of curriculum has been altered by a temporary switch from traditional teaching and learning techniques to internet-based approaches across the globe. (Damoense, 2003). The use of technology inclined platforms provided universities around the globe with the ability to transition to the provision of remote teaching and learning (RTL). In March 2020, during the national lockdown alert level five (5), in South Africa, UKZN decided to suspend all academic programs temporarily. The academic program later resumed on the RTL platform on alert level 3 under strict protocols implemented by the Department of Health (DOH) under the legislative auspices of the Disaster Management Act. These included regular washing hands, sanitizing, and maintaining at least a 1.5-metre social distance.

This was provided for the limited number of students who needed the use of university facilities to do their practical work.

2.3 The international scope / RTL on a global perspective

Coronavirus, originally has been designated as a global pandemic by the (World Health Organisation (WHO), 2022). Following the outbreak, China implemented lockdown measures to contain the virus's spread, affecting many industries, including economic, health and educational sectors globally (Osman, 2020)(Osman, 2020). Academic institutions shifted from traditional teaching techniques, including laboratory experiences, as a result of the global COVID-19 epidemic with a view to eradicate virus's spread (Tarkar, 2020). Additionally, higher educational institutions implemented online teaching mode to abide by the regulations in place, including social distancing. For some, technology-based education is more appropriate as it adds an element of diversity to the teaching and learning environment.

However, some institutions and relevant individuals did not have enough time to prepare for these drastic changes (Mohammed et al., 2020). Following the outbreak's occurrence in December 2019, the virus was declared a worldwide pandemic (World Health Organisation (WHO), 2022). While some nations preferred herd immunities, many pursued stringent rules to stifle and stop its spread, such as complete lockdowns or laws to encourage social distance. Working from home, offering flexible scheduling, or eliminating numerous institutions where people could spread COVID-19 to one another were all attempts to limit the viral outbreak. Schools, universities, and a wide range of other educational institutions were part in the protocols to shut down buildings. Further to that, universities were required to implement their teaching methods remotely, as a result of these circumstances (Bozkurt & Sharma, 2020).

Due to COVID-19, almost 1.5 billion pupils were impacted by the closures of academic programmes in schools and institutions worldwide (Lawson, 2021). The number of students affected by this equates to about 90% of students enrolled worldwide. The closure of schools and universities has broadened inequalities in learning and hurt

vulnerable children and youth disproportionately (Lawson, 2021)(UNESCO, 2021). In response to catastrophes like the COVID-19 outbreak in many nations, remote teaching and learning (RTL) involves an abrupt shift from the traditional form of education, which typically involves face-to-face interaction, to a remote format. This is a setting that is entirely different from what online learning is like in regular situations. Everything should return to normal after an emergency situation (Shamir-Inbal & Blau, 2021).

Furthermore, lecturers must operate in a highly stressful environment while not knowing the disaster's end. Nonetheless, after the COVID-19 pandemic, online learning will be completely different, especially in developing countries (Adnan & Anwar, 2020). To create their RTL systems, academic leaders and policy makers in public and higher education need to acquire new lessons about education during a pandemic. Teachers, parents, students, and others may encounter various challenges when attempting to accommodate and embrace remote teaching and learning due to the unplanned nature of RTL in emergency situations (Affouneh, Salha, & Khlaif, 2020).

The coronavirus pandemic has dramatically changed the teaching and learning landscape worldwide since its initial outbreak in December 2019 (Shin & Hickey, 2020). To contain or slow down the virus spread to protect public health and safety, many educational institutions worldwide closed their campuses (Lawson, 2021)(UNESCO, 2021).

For lecturers and students, a transition from a traditional mode of learning to RTL presented obstacles and opportunities. A thorough analysis of post year 2000 publications show how lecturers and students feel about RTL, as well as possible ways to increase both groups satisfaction with synchronous Tsai *et al.*, (2020)(Tsai et al., 2020). Students now have more freedom to learn and work at their own speed because to the shift to remote teaching and learning. Learning flexibility enables lecturers to be accountable for teaching information, enables students to take ownership of their learning, and allows students to choose from a variety of learning dimensions Tsai *et al.*, (2020).

Moving education online in times of disaster is not something new. Universities offered online classes in New Orleans in the United States of America, during Hurricane Katrina in 2005 (Lorenzo, et al., 2008). On the other hand, students in South Africa received mixed and online learning during student protests where institution closed down between 2015 and 2017 (Czerniewicz, Trotter, & Haupt, 2019). However, existing conditions with

the COVID-19 pandemic is unique. The COVID-19 epidemic caused global interruptions in education, unlike prior occurrences that described regional responses, and educational institutions around the world have been employing some type of remote online learning to fill the void (Johnson, Veletsianos, & Seaman, 2020). Moreover, the shift from in-person classes to online instruction has generated a lot of disagreement in the academic community at large; one particularly contentious topic is the use of the phrase "online learning" (Johnson, Veletsianos, & Seaman, 2020).

In reaction to a pandemic, remote learning is different from online learning, Bate (2021) argues that online learning is more than just a method of distribution and refers to it as a type of remote learning education where a course or program is specifically created with the aim of being taught entirely online. Additionally, for instruction, student involvement, and assessment, lecturers use pedagogical techniques tailored to online learning. Hodges *et al.* (2020), who concur with this explanation, claim that the current circumstance is a brief switch in the style of instruction transmission due to exigencies. For instruction or education that would otherwise be offered face-to-face, as blended or hybrid courses, this shift entails the use of totally remote teaching solutions. Once the emergency or crisis has passed, it will resume using that format.

Online learning is defined by Ferri, Grifoni and Guzzo (2020) as instruction that is delivered via a digital device and is designed to support learning. The literature highlights numerous advantages of online learning, including the flexibility to choose, the ability to save significant amounts of money, the ability to study whenever and wherever, and time savings (Serhan, 2020).

Universities all across the world are increasingly using synchronous online teaching tools like Zoom. Zoom is a videoconferencing technology that enables students to communicate with their instructors and one another, enhancing their sense of community and reducing feelings of loneliness Tsai *et al.*, (2020). It is crucial to support academic staff in delivering quality course material when they provide an online synchronous lecture after switching to distance learning Tsai *et al.*, (2020). (Tsai et al., 2020) studying remotely has become increasingly important for education during the COVID-19 global health emergency; it allows students and lecturers to remain in touch – although remotely - and to follow lectures. Nevertheless, distinct issues have been found in various nations.

The fact that socially disadvantaged groups struggle to achieve the prerequisites for online learning is the most obvious and has received the greatest attention from policymakers and scholars (Ferri, Grifoni, & Guzzo, 2020).

The implementation of lockdowns as a subsequent closure of universities appears to have widened the wealth divide in society, not just between the south and north hemispheres but also inside many nations. The closure of universities could negatively impact students from lower socio-economic backgrounds, broadening the gap with their more privileged peers. We aim to safeguard public health while the mentioned challenges are emerging (Ferri, Grifoni, & Guzzo, 2020).

Implementing online learning in an emergency signifies the necessity. However, this had inspired policymakers, experts, citizens, lecturers as well as students in the quest to discover fresh solutions. Due to this, the concept of online learning was changed to emergency remote teaching (Humphrey & Wiles, 2021). This refers to a temporary change in the manner in which instruction is delivered owing to the disaster's circumstances. As a result, new issues and chances could materialize on the social and technological levels. It is an opportunity for us to consider the various strategies and lessons discovered in many nations, as well as a chance to consider fresh ideas (Ferri, Grifoni, & Guzzo, 2020). The spread of the coronavirus pandemic around the world impacted education in ways that scholars, academic institutions, administrators, lecturers, and students will endeavour to fully understand for many years to come (Stewart, 2021)(Stewart, 2021). One of the main countermeasures to stop the contracting and spread of COVID-19 was social isolation as a result of the pandemic of COVID-19 starting to spread globally in the beginning of 2020. In order to continue offering educational services, this prompted universities and academic institutions all over the world to switch over to remote teaching and learning right once (Stewart, 2021).

Universities all across the world were badly halted, claim Tsai *et al.*, (2020).. The majority of work done in universities is not done in solitary; rather, it is done in large lecture halls with many students present, in laboratories where teams of students and lecturers work side by side for a long time, and in workplaces and athletic fields where people dance, run, and breathe heavily. In the midst of a highly contagious worldwide pandemic, many situations and behaviours became incredibly dangerous. Many colleges around the world

shut down before the start of the academic year in early 2020. This shutdown led to a significant shift toward online teaching and learning (Mogaji & Jain, 2020). With the rapid deployment of digital tools and platforms like Zoom and Ms Teams, teaching and learning interactions were transformed practically immediately. Online learning has developed into a significant and influential paradigm of higher education over the past two decades, as part of the ongoing online revolution in education. This ongoing revolution, however, was immediately eclipsed by what transpired in 2020 as a result of COVID-19. It can be said that a revolution occurred when all instruction in some colleges moved online with less than three (3) days of planning.

Synchronous online teaching platforms like Zoom and Ms Teams have become widely used at universities worldwide. Zoom is a videoconferencing technology that enables students to communicate with their instructors and one another, enhancing their sense of community and reducing feelings of loneliness Tsai *et al.*, (2020). It's crucial to support academic staff in delivering quality course material when they provide synchronous lectures on an online platform after switching to remote education Tsai *et al.*, (2020).

The COVID-19 virus was identified as a global pandemic in 2020. The most practical way to continue teaching and learning, particularly at universities and other higher education institutions, is through remote teaching and learning. Due to the epidemic, the traditional face-to-face teaching and learning method was drastically changed to an online teaching and learning environment (Mazlan, et al., 2021). Universities needed to make sure they streamlined their curricula and modified them to accommodate online teaching and learning. To engage students in class on the online remote teaching and learning platform, lecturers must adjust to new and innovative tactics that reflect the new normal in teaching and learning (Mazlan, et al., 2021).

2.3.1 Contextual perspectives

There are three stages of examination that could be used as the foundation for social scientific research. These three levels show that, despite certain shared attitudes regarding the importance of examining and comprehending human interaction, there are differences

in the depth at which the interaction is examined. The three levels are micro level, meso level and macro level Smith *et al.*, (2019).

Micro level is the individual level where the smallest levels of interaction are examined. This may involve a person alone or private conversations between friends or couples (Carlson, Grzywacz, & Zivnuska, 2009). The investigator may occasionally be curious on how a person's social context affects how they perceive themselves Smith *et al.*, (2019).

Meso level: this is where the study of group interaction takes place. It is the area in the middle where people interact with one another inside groupings like schools, communities, churches, and neighbourhoods Javaid *et al.*, (2019). Larger groups that communicate with the individual directly make up the meso level. It focuses on the connections between people and middle-level social systems. Meso-level researchers may focus on the structure of children's sports groups or how workplace norms differ among professions (Serpa & Ferreira, 2019).

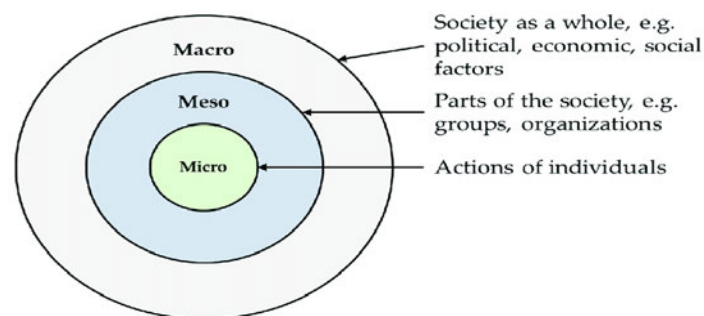


Figure 2.1: Micro, Meso, Macro Levels

(Javaid, Javed Amna, & Kohda, 2019, p. 84)

Macro level – at this level, investigators investigate institutions and social structures. At this level the research examines large-scale patterns such as the process and impact of globalisation. In addition, the study examines the inter-relationships between countries, which would be an example of macro-level investigation (Ruppanner, 2010).

Sociologists frequently research the experiences of groups and interactions between groups at the meso level. Sociologists will likely investigate gang interactions or how several branches of the same gang differ from one location to the next at the meso level Smith *et al.*, (2019).

2.3.1.1 Contextualisation of Impact of 4IR on RTL

The advent of the 4IR brought a great change in the operation of many industries and their systems (Carrim, 2022). The system of education is not detached from the technologies of the 4th industrial revolution, which some scholars have projected that it will have a pivotal bearing on the prospects of learning, education policies, as well as instructions procedures (Al Lily et.al, 2018). New technologies have been witnessed to foster faster processing of new information, which empowers individuals and organizations (Izumi et.al., 2020). Technology innovation may enhance a curriculum's communication and education delivery even in remote environments (Ayentimi & Burgess, 2018). Educators have been pushed to evolve their strategies in curriculum delivery to support creativity, innovation, distance learning and personalized learning. Though it is still a novel concept in many African states and desires many resources on the part of the educational institutions and students, understanding its principles and embracing 4IR would be a start in preparation for such future occurrences like the prevailing pandemic (Mahaye, 2020).

The 4IR strives to create self-learners' because technology is predicted to take over to the extent that work will be mostly done remotely, hence the need for students to still have that experience at a learning institution (Marivate et al., 2021). As a result, it is now appropriate to abandon old pedagogies, and it is necessary to alter the teacher-based classroom model to adequately prepare students for the changes that 4IR has brought about (Singh, Steele, & Singh, 2021).

2.3.1.2 Strategic resources within the RTL context

The onset of the pandemic, as previously mentioned, has had an impact on the transition to RTL; but, given the noble nature of the initiative, the institution's and students' resources will ultimately determine how effectively it is implemented. For instance, to facilitate the delivery of RTL, UKZN had to deploy both tangible and intangible resources to its staff and student population. According to Kamasak (2017), Tangible resources are physical and measurable resources used in an organisation's operations that can be touched and felt. Ferri *et al.* (2020) believe that disadvantaged groups in society find it expensive to meet the RTL requirements. Thus, the whole scenario ends up favouring the well-established and rich. Considering that the RTL, in most cases, is yet to be fully embraced, especially in practical curriculums, the institutions lack the equipment and

money to finance some of the requirements. Some studies have shown that RTL has inspired students because it allows them to stay in touch with their classes and instructors regardless of their location and provides them with valuable, cutting-edge experience relevant to the workforce of the twenty-first century. Rudy (2019) notes that though different, many intangibles in the delivery of a curriculum require empathy and a focus on students' self-esteem. This does not fit well with remote learning and teaching, considering the challenges of acquiring resources vital to learning.

2.3.1.3 Technological transformation strategic imperative and RTL

Technology has changed the way of teaching. The transformation of technology has made possible the continued learning process despite the challenges which may arise (Hassounah, Raheel, & Alhefzi, 2020), in this instance, the breaking out of a pandemic. However, this compelled most institutions to change to accommodate these developments as it became imperative to meet the demands of the transformation even in the face of scarce resources. Pollack (2020) notes that this is not a simple change as it calls for a strategic stand and leaders (Qiao et al., 2021). Hence, it challenges educators and learners caught in the web of technological transformation.

2.3.1.4 Impact of leadership on RTL (Transformational Leadership)

The issue of leaders not being ready for the rapid technological changes in all work sectors existed before the pandemic. Students were also noted as ill-equipped and financially challenged to meet the needs of virtual learning (Molnar, et al., 2019). The majority of educational leaders were unprepared to operate and give instruction in virtual environments, and the introduction of COVID-19 only made matters worse (Kumari & Dash, 2022).

Research shows that just a few educational leadership programs offer the essential training for leading in virtual learning environments, making COVID-19's requirement that leaders be technologically and virtually equipped a significant problem (Azukas, 2022); (Hodges, et al., 2020); (Barbour M. , 2017). School administrators struggle to provide adequate instruction online, deal with infrastructure, hardware, and software issues, and train teachers to facilitate and design online learning and communication strategies (Barbour, et al., 2020); (Beauchamp et al., 2021); (Pollock, 2020); (Pollack, 2020); (Varela & Fedynich L. , 2020). It is then apparent that it is essential to have

transformational or agile leadership in nature, not rigid to change and pushing people towards accomplishing new set goals (Greineder & Leicht, 2020).

2.3.1.5 Transition pipeline

The capacity to use the interface and tools efficiently presents another difficulty for both instructors and pupils. In order to provide the learning resources in the virtual classroom, lecturers will need to use interfaces and tools that are unfamiliar to them. They will undoubtedly need some time to become accustomed to these interfaces and technologies. On the other hand, the students will also have to use tools and an interface that are unknown to them, but they can make use of the copious materials that the lecturers have made available. All of them need both time and effort from the lecturers and students (Ofusori, et al., 2021).

2.3.1.6 Change Imperatives (ADKAR MODEL)

It is challenging to disregard the necessity for all leaders, educators, and students to understand the competences required for virtual, online, or remote learning in light of the COVID-19 problem. Therefore, it becomes imperative to change traditional thinking and strive to understand the competencies needed to understand RTL successfully (Malhotra, 2019). According to the ADKAR model, in order for this change to be effective, all parties must first recognize the need for change, want to participate in that change, work to learn how to change, be able to implement the change, and reinforce the shift to sustainability. Hence the model aids individuals in coping with change and planning accordingly successfully. Thus, where the need for change is recognized (traditional learning to RTL) and planned for, the transitioning process will not offer severe challenges.

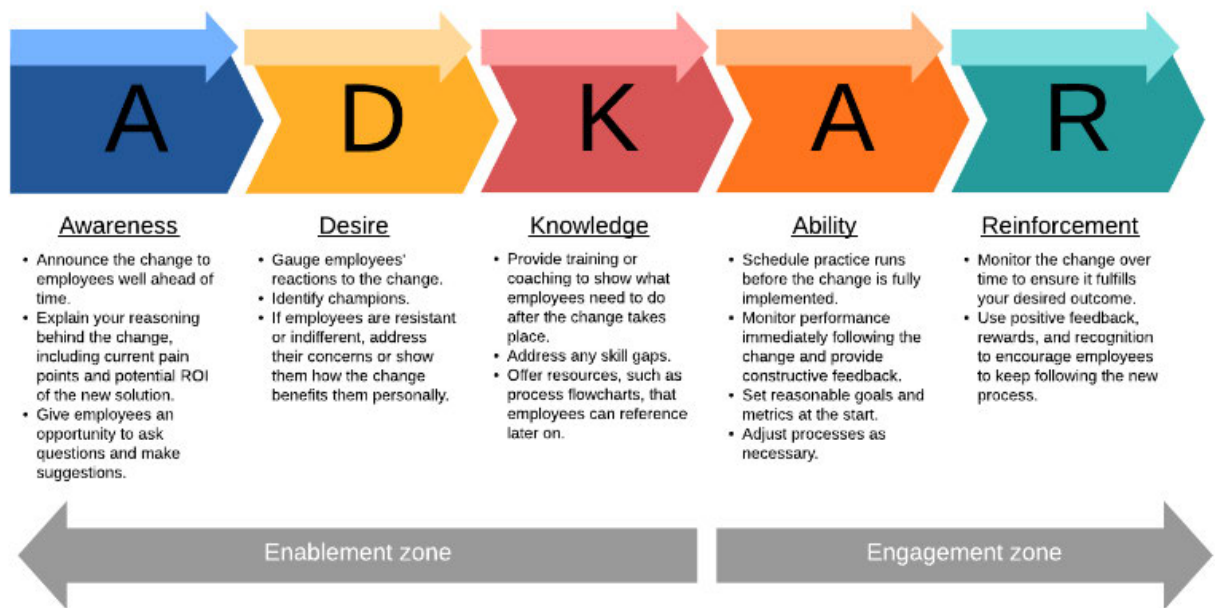


Figure 2.2: ADKAR Model

(Boca, 2013, pp. 247-252)

The concept is built on five elements that lead to effective change. The model is primarily designed to be a coaching tool, and it focuses on supporting and guiding employees through the organizational change process. Employee resistance to organizational change is common. The ADKAR model is a method for change management that may be used to determine why change is challenging and why certain changes are effective while others fail (Lowery, 2010).

2.4 The RTL within the South African scope and readiness of UKZN as case

The COVID-19 epidemic had a significant influence on South Africa's higher education industry, which had an effect on the 2020 academic year. The president of the republic announced a national lockdown, and its implementation began on 27 March 2020; this impacted students' practical experience as virtual teaching and learning methods were adopted (Hudson, Engel-Hills, & Winberg, 2020). In South Africa, RTL are built on back of the #FeesMustFall protests that were first experienced in South Africa in 2015 as students all over the country were protesting in some educational institutions. In previous

years, the student protestors concentrated their efforts just before final exam period to maximize the impact of their interruptions. Institutions decided to end their academic programs early as a result, even delaying some of their teaching and exams until the new year (Blackmur, 2019).

As a consequence of student protests, universities introduced a move of study into online and blended learning during the university's shutdown. When deciding how to shift learning online, Czerniewicz *et al.*, (2019) emphasized the significance of retaining an understanding of student disparities. They observed that while digital inequality raised new issues, blended learning may have helped overcome some practical obstacles like disturbances in the classroom. In the end, these previous studies show that, in order to effectively provide teaching and assistance during a disruptive event, a switch from in-person instruction to online course delivery involves awareness of the multifaceted demands of staff, administrators, students, and lecturers (Czerniewicz, Trotter, & Haupt, 2019)(Czerniewicz et al., 2019).

Due to the COVID-19 epidemic, South African colleges were compelled to switch from in-person to online instruction in 2020. However, a number of obstacles prevent underprivileged students from utilizing online learning to its full potential (Mpungose, 2020). Online learning, according to Mpungose (2020), is any learning that takes place across distance and not on a face-to-face platform. It is defined as education that occurs over the internet.

The learning environment has to undergo significant transformation in order to preserve the pace of teaching and learning in South Africa. A learning program that can be enabled via in-person lectures, online learning, and blended learning can be termed as the learning environment. However, contact activities that are part of the curriculum in the majority of South African universities have to be eliminated because to the requirement for social isolation following the emergence of COVID-19. To ensure that education continues, online learning was introduced. It can be characterized as instruction delivered using a digital device with the goal of promoting learning (Gumede & Badriparsad, 2022).

The emergence of Covid-19 necessitated a shift away from the more conventional in-person instruction in South African universities, with the goal of protecting faculty and students from the virus while minimizing disruptions to students' academic progress.

Switching to remote teaching and learning facilitates space and time flexibility. But the fact remains that many students face daily challenges that make online learning stressful or inaccessible. Mostly because of their physical and socioeconomic circumstances, such as their socioeconomic obstacles, low network coverage, lack of internet connectivity, and lack of electricity (Songca, Ndebele, & Mbodila, 2021).

With historical disparities stemming from the apartheid rule, the South African educational system is complicated. The majority of South African students come from disadvantaged origins, and some attend universities in rural areas (Tanga, Ndhlovu, & Tanga, 2020). The coronavirus is a global public health pandemic that impacted all facets of society worldwide. The pandemic did not spare the education system in South Africa. In the face of the COVID-19 pandemic and the subsequent lockdown, teaching and learning had to move to the online platform across universities (Tanga, Ndhlovu, & Tanga, 2020). The introduction of Remote Teaching and Learning brings with it many challenges that are not only faced by students but also institutions in the implementation phase, inadequate infrastructure, limited budget, ICT skills for staff and students, assessment methods and administration (Sife, Lwoga, & Sanga, 2007).

Synchronous and asynchronous learning modes must be combined for distance learning to be successful. Synchronous sessions allow for social interactions in place of the typical class meets. Synchronous learning sessions mimic regular class courses focused on whole-class activities that involve students in discussions, individual writing, or peer criticism, much like face-to-face classes do. Platforms for videoconferencing, like Zoom, allow for two-way communication through watching (digital camera), speaking and listening (microphone and headphones/speaker), as well as sharing screens for presentations and teamwork. Synchronous videoconferencing that is focused on the students can also encourage peer evaluation, discussions of learning objectives, and student presentations of their learning products (Shamir-Inbal & Blau, 2021).

The advantages of remote learning include the ability for students to catch up and revisit a topic easily and promote flexible schedules (Ferri, Grifoni, & Guzzo, 2020). Higher levels of accessibility and retention for those who do not learn only through sight or hearing when utilizing educational technology, as well as the ability to expand their technological expertise (Damoense, 2003)(Damoense, 2003).

The emergence of COVID-19, which was classified as a worldwide pandemic in March 2020, prompted the adoption of social isolation around the globe in an effort to stop the virus from infecting large numbers of people. To stop the spread of COVID-19, numerous universities and other institutions of higher learning around the world were shut down. This decision significantly affected the learning of millions of students across the world. Many universities introduced remote teaching and learning to continue with the business of offering education to students. However, remote teaching and learning have its challenges for both students and lecturers. According to Ferri, Grifoni and Guzzo (2020), there are three main challenges with remote teaching and learning: technological, pedagogical, and social.

The absence of internet connectivity and the lack of electronic devices are the main technological difficulties. Through uneven access to the technology that both students and their professors require, this issue can occasionally raise the level of inequality. Additionally, not all students have access to the tools and technology required to benefit fully from online instruction, such as quick internet connectivity and a potent computer. These issues particularly affect students from disadvantaged homes that are attending university (Ferri, Grifoni, & Guzzo, 2020).

Innovation is related to new instructional developments as well as technology aspects. The methods utilized in face-to-face lectures must be adapted for remote teaching and learning. In virtual classrooms, educational patterns must be distinct, which both students and lecturers must comprehend (Mhlanga & Moloji, 2020). The lecture is not held in a physical lecture room, and the lecturer functions more like a moderator in a virtual classroom. As a result, instruction, particularly guiding and feedback, should be different (Mishra, Gupta, & Shree, 2020). Innovative teaching strategies are therefore required to interest pupils and encourage their proactive behaviour, which is challenging to achieve when they are only connected virtually. To keep students' interest and participation on a screen for an extended period of time, new strategies are required (Ferri, Grifoni, & Guzzo, 2020).

RTL was considered to be a useful way for students to learn habits that foster independence and responsibility. The loss of interpersonal communication between students and professors as well as between students themselves, however, is one of the

fundamental drawbacks of RTL. Some students need to engage with people in order to learn. Some students require face-to-face interactions in order to experience emotions, and a fully distant teaching and learning environment cannot provide that. Despite the fact that adopting ICT tools extends students' comfort levels globally, experts claim that adequate lecturer-student connection is still essential (Ferri, Grifoni, & Guzzo, 2020).

Students' desire for online teaching and learning is unquestionably one of the difficulties in remote teaching and learning. The desire of students to learn something in a learning setting is referred to as motivation. The contact between professors and students is what inspires the students. Conventional educational methods entail verbal and physical engagement with pupils in a classroom, according to Ramli *et al.*, (2020)(Ramli et al., 2020), conventional education processes involve physical interaction and communication with classroom students. Lecturers struggle with getting students to participate and pay attention in RTL class during the COVID-19 pandemic. They struggle to communicate with and supervise the kids because they are not in person with them, in addition to having trouble motivating the students (Mazlan, et al., 2021).

Students' motivation to learn is negatively impacted by remote teaching and learning for a variety of reasons, including the teaching approach, the lack of amenities like computers and internet connectivity, as well as the interaction process inside the RTL platform. Effective remote teaching and learning would be very challenging without both students' and lecturers' motivation (Mardesci, 2020).

The difficulty faced by university lecturers is a lack of appropriate abilities to carry out RTL. Effective RTL requires adequate technology abilities. Additionally, tertiary institution lecturers struggle to adapt to a teaching style that requires them to be knowledgeable about the online education system. Both the lecturers' and the students' abilities are necessary for RTL to be effective. In an RTL setting, it will be challenging for instructors and students to accomplish their goals without these abilities. If lecturers had the necessary skills, they might design more engaging activities for online teaching and learning while also saving time (Mazlan, et al., 2021).

The availability of internet access is crucial for the efficient delivery of RTL. For students and lecturers who live close to universities, this is not a big issue because those

institutions typically offer internet connectivity. But individuals who live far away can face this problem unless they pay for the internet service themselves. In addition to having to deal with the expense of data and internet service, those who live far from the institutions may also struggle with the difficulty of internet service availability in South Africa's distant areas, especially among those who are considered to be low-income earners (Ofusori, et al., 2021).

The COVID-19 pandemic created a condition for implementing remote teaching and learning. This meant that lecturers at traditional face-to-face interaction universities, the coronavirus forced lecturers to use online methods of communication to teach remotely, utilising online lectures, voice clips, narrated PowerPoints, podcasts, interactive videos and interviews. Online assessments were conducted, from multiple choice questions to assignments, which made the lecturers to re-think different ways how assessments were presented in order to circumvent the easy access to answers found online and, in a textbook, (Baboolal-Frank, 2021). By doing this, it meant that more theory application questions were assessed in a more challenging way to avoid cheating and collaboration with fellow students. The use of formal assessments that were done during remote teaching and learning became the best practice, because innovative approaches were implemented for learning and assessment purposes for the preservation, integrity and accomplishment of the degree via online methods of learning (Baboolal-Frank, 2021).

Academics were able to begin challenging some entrenched beliefs about in-person teaching and learning as a result of COVID-19's transition to remote teaching and learning. After COVID-19 pushed a speedy move to RTL in 2020, many South African universities are actively thinking about the future of teaching and learning. Two storylines have formed as a result of the current conversation. According to the first storyline, online education is more demanding or challenging than traditional classroom instruction. The second myth is that online education is inferior to in-person instruction. These issues appear to be directly related to staff burnout, industry disparities, and complexity, which have been exacerbated by distance learning and teaching, in the context of South African higher education (De Klerk, Krull, & Maleswena, 2021).

The University of KwaZulu-Natal shifted to digital platforms for both staff and students. Initially, all staff worked remotely and resumption of lectures meant that lectures would

be conducted via digital platforms. In some departments, field work was either postponed or replaced by other methods of obtaining similar results. Examinations were also diverted to online platforms where sit-in examinations were highly discouraged but rather formative and summative assessments were implemented. It is imperative that, during this process, no students should be left behind (Fiksl, Flogie, & Aberšek, 2017). Engineering is a practical course and laboratory work is an integral part of the curriculum as it gives students hands on experience on the theoretical concepts learned in class (Viegasa, et al., 2018).

It has been challenging to preserve educational continuity in the face of the suspension of in-person training. Higher Education Institutions have responded with various remote teaching and learning options and solutions, including modifying the university academic calendar and how the curriculum is implemented, modified, prioritized, and adjusted in various ways. In this RTL era, technology is integral in delivering lectures and educational materials to students. In addition, technology can also support the development of new knowledge based on a variety of pedagogical strategies and educational materials. This may encourage the growth of participants' interpersonal relationships and social and cooperative abilities (Shamir & Blau, 2021).

Students who were geographically divided and marginalized may now receive a top-notch university education thanks to the introduction of RTL in South Africa. Access to information and communication technology (ICT) must be considered, balanced, and contextualized with regard to this access to high-quality higher education. This is crucial since access to ICT varies widely among different locations, households, and populations, and networks are not consistent everywhere. This is especially true in South Africa, where just 22% of the population has access to good ICT infrastructures like the internet, compared to 92% and 89%, respectively, in wealthy countries like the United Kingdom and the United States of America. Therefore, it's crucial to frame the discussion about RTL's potential to widen access to higher education within the context, reach, and effects of the digital divide, particularly amongst students from urban and rural locations (Lembani et al., 2020).

2.4.1 RTL challenges in South Africa

RTL has numerous difficulties in South Africa's higher education industry, which have an impact on professors as well as pupils. Technical problems can disrupt the educational environment (Marongwe & Garidzirai, 2021). In a platform of remote teaching and learning, technical issues are more likely to occur. This is a result of erratic network connections, faults in the program, and accessibility issues with the learning application. Since RTL has technological problems, in terms to general technical issues, many things could go wrong. The following are among the challenges that have been identified.

2.4.1.1 Students being left behind

The lecturer is better positioned to monitor progress and the degree of understanding of the taught curriculum in a traditional face-to-face classroom. This gives the lecturer a chance to change speed and even the lecturing approach to accommodate those left behind, a case difficult in RTL (Ofusori, et al., 2021). Students frequently tend to keep quiet while appearing to be focused and paying attention to what the lecturer is saying or explaining. In contrast, they would be experiencing challenges with the lesson. By the end of the day, the student will leave the session feeling despondent, frustration having learned nothing.

2.4.1.2 Internet and data access

The availability of internet access is crucial for the efficient delivery of remote teaching and learning. Since they use the university's internet service, this is not an issue for teachers and students who are nearby. However, the case is different for students or lecturers who reside far away unless they have to rectify their problem by bearing the internet service costs (Montacute & Holt-White, 2020). It is, however, worth noting that despite the ability of those staying off campus or not within the range of the university's internet service, there is a struggle from students who stay in remote areas where internet services are hard to come by (Ofusori, et al., 2021). Thus, it does not only become the high cost of the internet services in itself but the unavailability of the service altogether.

2.4.1.3 Connecting devices

Another major challenge that may concern the students and lecturers is the connection of devices needed to work. These devices guarantee the effective and efficient working of

lectures in providing students with the proper and correct learning resources and materials. At most institutions, the lecturers are privileged enough to be furnished with these devices. Hence, they do not have to incur the costs and, most importantly, face barriers in the delivery of their lectures (Marongwe & Garidzirai, 2021). However, in rare cases, some lecturers may be compelled to purchase these devices as the institution would not have provided them.

On the other hand, the privilege extended to the lecturers is not the same for students as they have to pay their costs in acquiring the needed devices. They are left to depend on their families for a hand out which might not be forthcoming, considering that some students come from low-income families (Ofusori, et al., 2021). In some cases, the students end up looking for jobs to make ends meet, which in most cases puts a strain on a student's academic performance as it would be difficult to balance academic and work life.

2.4.1.4 Service interruption

It is a noble gesture to make available Internet services for students and lecturers to cater for remote teaching and learning. However, the Internet service quality is worth pondering, which leads to service interruption (Ndlovu, Ndebele, & Mlambo, 2022). This then becomes a challenge despite the availability of internet services. Universities or institutes of learning are more likely to experience service interruptions following the large numbers of users of service users. In some instances, the internet service would be abused for non-academic purposes by some individuals, resulting in high data trafficking and slowing internet connections. The same transpires in densely populated areas or urban areas where telecommunication companies give priority since these areas are considered more profitable for business. In areas with partial coverage by telecommunication companies, since they do not contribute much to the business profit, the internet service is always reported to fluctuate (Marongwe & Garidzirai, 2021). The rural or less populated areas are often victim of such occurrences. Interruptions in internet service may also arise as a result of the rural or sparsely populated areas receiving lower priority for uplink-downlink and similar issues in urban or highly populated areas.

2.4.1.5 Curriculum and learning resources integration

The integration of resources for teaching and learning is another difficulty in remote and online learning environment (Montacute & Holt-White, 2020). This is mainly the concern of the lecturers and Instructors. The shift of lectures from the classroom environment to an online platform compels lecturers to restructure an annual academic programme into digital platforms, which is done using unfamiliar tools.

The lectures would be required to make the learning resources available and accessible to each and every student in the virtual classroom, despite the fact that they were traveling in uncharted waters. Given the time restrictions to actually implement the restructure and transfer of the resources needed by the students online, this is a highly onerous assignment for the professors to complete (Ndlovu, Ndebele, & Mlambo, 2022). The lecturers will need to put in a lot of work and extra time because they will be using tools and interfaces that are unknown to them. Additionally, a lot of work is required to make the instructional resources accessible.

2.4.1.6 Virtual classroom inadequacies

According to Bijeesh (2017), eLearning tools and platforms are typically utilized to create virtual classrooms that closely resemble traditional face-to-face classrooms. However, the virtual classroom still has a lot of shortcomings that prevent it from being exactly like the conventional face-to-face classroom (Mhlanga & Moloji, 2020). Firstly, lecturer's and educators struggle to predict how the class will respond to the material they are teaching. The virtual classroom cannot adequately capture the various real-time facial expressions and body language that would have been seen in the physical classroom. Secondly, since any student could opt out of an ongoing teaching session, it is impossible to determine each student's level of engagement, focus, and coordination in the virtual classroom. Even when participating in a current learning session, students may be multitasking by working on various other projects and chores that may not even be connected to the learning that is taking place at that given moment. Thirdly, neither the virtual classroom nor collaborative learning among the students encourages face-to-face social contacts amongst the students. Fourth, there is no guarantee that every student will be willing to participate in the virtual classroom and will do so continuously due to the risk of internet

service interruptions at any time depending on the student's location (Ofusori, et al., 2021).

2.5 Theories underpinning the study

The following theories will be utilised to support the study:

- a) Technology acceptance theory
- b) Resource-based view theory
- c) Dynamic capability theory

2.5.1 Technology acceptance model (TAM)

Davis (1989) developed the Technology Acceptance Model (TAM). The theory of reasoned action serves as a model for it (TRA). Two measures of technological acceptance-perceived usefulness and perceived ease of use-replaced TRA's attitude toward behavior. The model's key characteristic is that it places a strong emphasis on the views of the intended user. Technology is only accepted if both users and its creators agree that it has advantages (Charness & Walter, 2016). According to Davis (1989), TAM is one of the models that has the most influence on how people accept new technology because it affects people's intentions to utilize it and their perception of its value. As a result, behavioural intention dictates how new techniques are used, and behavioural intention is defined by a person's attitude toward using new technology and benefiting from it. According to the technology acceptance model's argument, even though the end user initially opposed new technology, they are likely to use it if it has an impact on performance or provides a solution to a problem (Davis, 1989). Thus, the development of the research framework for this study was done using this model as a guide.

The information systems theory known as the "technology acceptance theory" explains how consumers come to accept and use technology (Zaineldeen et al., 2020). The point at which people really utilize a system is the end-user. People utilize technology for a

variety of reasons, including their behavioural intentions. The general perception of the technology is affected by the mindset of those who will use it, which in turn affects their behavioural intention. According to the Technology Acceptance Theory, consumers' decisions regarding how and when to use new technologies are influenced by a number of factors, including:

Perceived usefulness

This is the extent to which a person thinks that utilizing a certain system would improve their ability to accomplish their work, according to Davis (1989). It reveals whether or not a person believes technology to be helpful in achieving their goals.

Perceived ease-of-use

This reflects the degree to which someone thinks using a certain system would be effortless. The hurdles are overcome when the technology is simple to use. If it is difficult to use and has a confusing UI, no one will think highly of it (Davis, 1989).

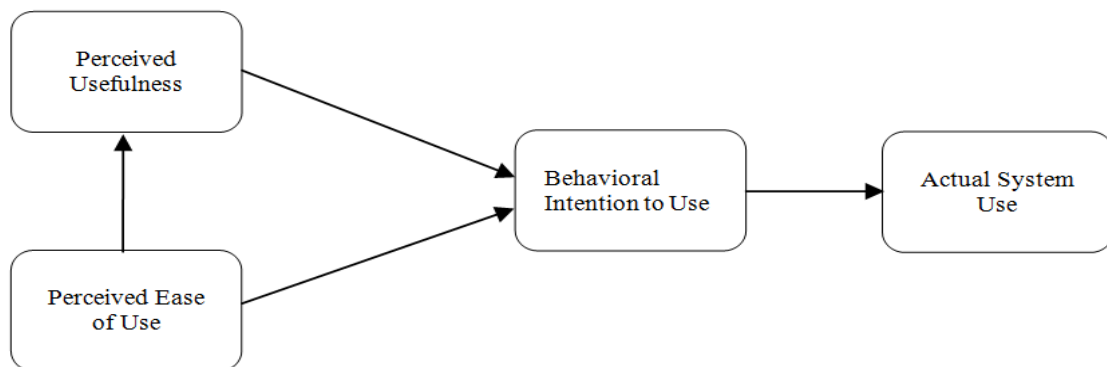


Figure 2.3: Technology acceptance theory

(Davis, 1989, p. 289)

The attitude of technology end users is influenced by external factors including social influence, which is a significant component. People will be willing to use the technology once strategies, procedures, and processes have been established. However, because each person is unique, their views may vary based on their age and gender. Any organization that wants to successfully and efficiently provide better services to its clients must accept and apply technology. Technology adoption refers to the use of hardware and software in a business to boost efficiency, gain a competitive edge, speed up data processing, and make information more accessible (Davis, Bagozzi, & Warshaw, 1989).

2.5.1.1 Theories and Models of Technology Acceptance

Based on behavioural science ideas from psychology and sociology and their effects on how people use the technology, theories have been established to examine how people embrace technology and demonstrate their capacity to absorb new technology. In addition, other ideas have evolved over time as a result of one another's (Davis, Bagozzi, & Warshaw, 1989). However, the Extended Technology Acceptance Model (TAM 2) and the Technology Acceptance Model (TAM) are the most pertinent to the research of Remote Teaching and Learning (RTL).

2.5.1.2 Technology acceptance model (TAM)

The Theory of Reasoned Action (TRA) work by established the Technology Acceptance Model (Davis, 1989). It substituted two technology acceptance metrics—perceived usefulness and perceived ease of use—for TRA's attitude toward behaviour. The subjective norms of the TRA were not incorporated into TAM's framework. It was created following the use of information systems by businesses. It was created in the field of information technology, whereas TRA was created in the field of psychology and is less all-encompassing (Davis, Bagozzi, & Warshaw, 1989).

Adoption, validation, and extension are the three stages that TAM development goes through. It was evaluated and adopted throughout the adoption phase through a massive number of information system applications. Researchers found that TAM accurately evaluates users' acceptance behaviour for various technologies throughout the validation phase. The final stage is extension, during which numerous researchers add fresh variables and new connections between the TAM's structures (Momani & Jamous, 2017).

2.5.1.3 Extended TAM (TAM2)

The information technology industry produced the Extended Technology Acceptance Model. The Technology Acceptance Model was expanded to include the perspectives of social impact and cognitive instrumental processes in order to explain perceived usefulness and ease of use. While cognitive instrumental processes pertain to job relevance, output quality, outcome demonstrability, and perceived simplicity of use, social influence processes refer to subjective norm, voluntariness, and image (Venkatesh & Davis, 2000). By incorporating the TRA model, Venkatesh and Davis (2000) added

the subjective norm as an extra concept. Perceived utility and usage intention are directly related to subjective norm. Subjective norm has direct relations with perceived usefulness and intention of use.

The association between perceived usefulness and user experience is moderated, whereas the relationship between use intention and user experience is moderated by voluntariness of usage. The performance of the model is improved by extending TAM to TAM2 and incorporating certain constructs from earlier theories as well as some moderators to perceived usefulness and perceived ease of use. The presence of an experienced moderator will demonstrate the users' growing comfort with technology over time, which will result in a noticeable shift in their acceptance of it (Momani & Jamous, 2017).

2.5.1.4 Application of TAM within the context of RTL

Academic institutions were impacted by the global coronavirus (COVID-19) pandemic, which was initially identified in Wuhan, China, in late 2019. After that, spreading across the world even to South Africa, affected a lot of countries, economic sectors and industries, including academic institutions (World Health Organisation (WHO), 2022). Many universities in South Africa chose to operate remotely when the government first decided to impose the national lockdown on the country, these included the University of KwaZulu-Natal (UKZN). Dr Blade Nzimande, the Minister of Higher Education, Science and Innovation, in order to carry out the academic programme introduced the use of RTL. Thereafter, UKZN implemented this decision by adopting the use of RTL, subsequently the use of RTL extended to engineering students at UKZN. Numerous institutions of higher learning have switched their learning methods throughout time from traditional face-to-face engagement to online learning. UKZN was forced to switch over immediately to the RTL platform due to the development of COVID-19 and the enforcement of the national lockdown. UKZN chose to use the mixture of available technologies to implement RTL. This included the use of the UKZN learning platform (Moodle/Learn22), Ms Teams and the Zoom video conferencing to offer lectures and meetings between academic staff and students.

The technology acceptance theory is a theory of information systems that describes how users adopt and make use of technology, with real system use serving as the endpoint when people employ the technology. The introduction of Ms Teams and Zoom meant that

every lecturer and every student would need to have access to a computer, laptop or smartphone with sufficient capabilities to be able to participate in a Ms Teams or Zoom lecture. A big part of the technology acceptance theory is about behaviour and attitude of the people to the use of technology. UKZN overcame this hurdle by giving the academic staff and students the resources needed to be able to use the technology so that they can fulfil the end goal of RTL. All students that were enrolled at the university were provided with data monthly at the cost of the university. This data was 10 gigabytes day data and 20 gigabytes night data, to enable students to use technology to access RTL classes, and to assist with their study preparations and research.

Students from impoverished background were provided with laptops at the expense of the university. All the tools necessary for this RTL aim were made available to academic and students. These included computers, screen, laptops, wi-fi routers, and data amongst other things. “The perceived usefulness and the perceived ease-of-use” of the Ms Teams and Zoom platforms, including the university decision to support staff and students with the mentioned resources, ensured that the UKZN community warmed-up to the idea of using Ms Teams and Zoom platforms for RTL. Thus, it can be said that UKZN successfully used the technology acceptance theory to model how users in its community would come to accept the use of the technology that was required to facilitate the conducting of remote teaching and learning at UKZN. This also meant that the university community accepted the use of the introduced technology.

2.5.2 Resource-based view model (RVM)

The resource view hypothesis was made by (Barney, 1991). The "Firm Resources and Sustained Competitive Advantage" article by Barney played a key role in the development of the resource-based viewpoint. The principal source for the theory was Penrose's study (Nair, Trendowski, & Judge, 2008). Penrose's study recognizes unused managerial resources as influential in growth. Thus, internal managerial resources can either drive or limit the expansion of an organization. The resource view theory advances the significance of resources in an organization that make it valuable or able to sail in any situation or environment. One of the modern strategic management concepts, it is used to create an organization's strategy.

A concept called the resource-based view (RBV) believes that resources are essential to achieving exceptional organizational performance. RBV is a strategy for gaining a competitive edge that first appeared in the 1980s and 1990s. A resource can help an organization obtain and maintain a competitive advantage if it demonstrates a value attribute (Jurevicius, 2021).

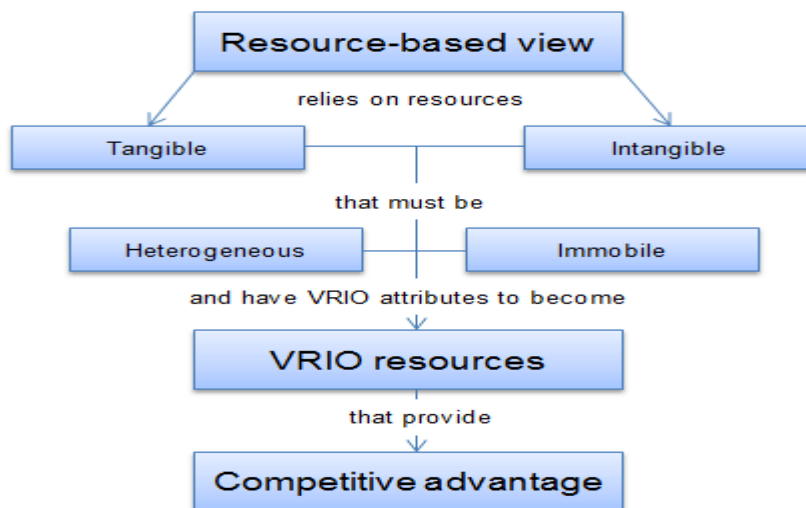


Figure 2.4: Resource-based view model

(Jurevicius, 2021, p. 39)

A managerial paradigm called the resource-based view is used to identify the strategic resources that a company might use to gain a long-term competitive advantage. The RBV model assigns resources a vital role in assisting businesses in achieving improved organizational performance. Resources come in two different forms: tangible and intangible. The resource-based theory further argues that resources are heterogeneous to organisations, making them competitive. So organizational strategy rests on these resources, which may be important in times of crisis. Resources are therefore useful if they enable the organization or institution to put into practice plans that increase its effectiveness and efficiency (Barney, Firm resources and sustained competitive advantage, 1991). Tywoniak (2007) notes that RBV usefulness is greater as it generates understanding and provide a structure for strategizing. Barney (1991) goes on to reveal

that resource-based logic, to some extent, may aid leaders in understanding the kind of resources that help generate sustainable strategic advantages and use this understanding to evaluate the resources their organization possesses. This may enable them to be both sustained and tackle the needs of the new environment.

More so, the RBV drives the notion that resources are essential to an organization and its capability to make use of those resources. So, the stand of the theory is on what the organization can do based on the resources it possesses. Thus, in novel circumstances, an organization can utilize available resources to try survive in the situation and rise or expand over time as the organization takes action that builds on its strategic resources. It is through capabilities that an organization can capture the potential value that resources offer.

2.5.2.1 Application resource-based view model within the RTL context

The University of KwaZulu-Natal realised that resources would need to be provided to achieve its goals, when implementing RTL during the national lockdown caused by the coronavirus. Computers, laptops, zoom platform licence, wi-fi routers and data were some of the tangible and intangible resources that UKZN identified as strategic in achieving the desired organisational performance given to academic staff and students. The provision of these resources gave UKZN a competitive advantage against other universities and institutions of higher learning because it guaranteed that teaching and learning in the institution could continue without undue delay and within the parameters of the prevailing government regulations to limit the spread of COVID-19. Whilst other universities were struggling to come to terms and deal with the learning environment created by COVID-19, UKZN was continuing to deliver on its core mandate of provision of teaching and learning, including research work. To sustain its competitive advantage and deliver superior performance in its goal of providing high-quality teaching and learning, the university applied the resource view theory to identify strategic, tangible and intangible strategic resources. Its community would require that of staff and students.

The RBV, following the above arguments, proved to aid the study. It helped me understand why an organisation may adopt a new operating approach. By utilising the resource view theory principles, the University of KwaZulu-Natal unlocked value by

making a budget available, acquiring the needed resources to ensure continued performance during a very difficult period and migrating to a new platform of providing its services online through remote teaching and learning. This investment in providing these key resources enabled UKZN to perform optimally during an abnormal time of COVID-19. As a result, the university continued to sustain a competitive advantage over other universities and institutions of higher learning. This is because resources are core to an organisation's operation, and its capability to make the resources meet the prevailing environmental demands renders it competitive. Thus, being able to understand the availability of resources UKZN possess and if they meet the requirements of RTL. If the resources the university has are valuable, then the concept of RTL will not pose a challenge, but if they cannot meet the demands of RTL, it even becomes a challenge for the learners to benefit from it. Thus, this theory was applicable to this study.

2.5.3 Dynamic capability model

Teece (2007) are the main tenants of the Dynamic capabilities/capability (DC) theory, though Teece contributed more to the theory than any other scholar. The theory developed as an addition to and to react against the shortcomings of the resource-based view (RBV). The RBV failed in the interpretation of the growth and regrowth of capabilities and resources as a means in addressing the fast-changing environment, which the DC theory aimed to rectify. As a result, the dynamic capacity theory defines the process by which an organization can reorganize its resources and strategy to achieve superior performance and a long-term competitive advantage in a rapidly changing environment.

The Dynamic Capability theory is a theory that is concerned with gaining a competitive advantage in an environment that is rapidly changing. When confronting a quickly changing environment, it is the organization's capacity to integrate, create, and reconfigure both internal and external competences. Operational or ordinary capabilities, which relate to an organization's existing operations, can be contrasted from dynamic capabilities.

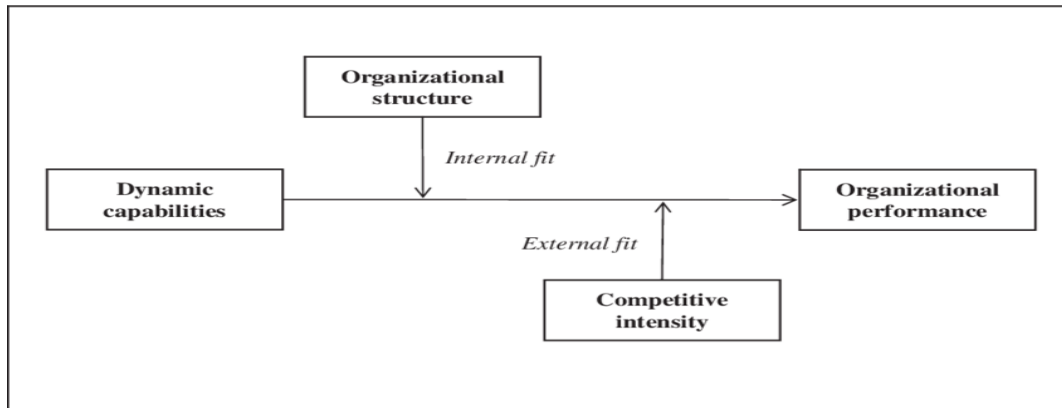


Figure 2.5: Dynamic capability theory

(Ralf et al., 2013, p. 75)

The central tenet of dynamic capability theory is that organisations can evolve their processes to enable development, change and rejuvenation. Contrarily, dynamic capabilities refer to an organization's ability to consciously build, extend, or adjust its resource base (Helfat, 2007). The Dynamic Capability Theory's fundamental premise is that an organization's core competencies should be put to use in adjusting its short-term competitive situations in order to create a longer-term competitive advantage.

According to the DC theory, an organization's resources or competencies can be quickly and significantly reconfigured to match the opportunities and demands of the business environment. According to the framework for dynamic capabilities, core skills should be used to alter short-term competitive situations, which will then be used to create longer-term competitive advantage. The DC goes on to stress the point that three dynamic capabilities are essential if new challenges are to be met. According to Teece (2010), corporate agility is a requirement, and a company should be able to (a) sense and shape opportunities and threats, (b) seize opportunities, and (c) maintain competitiveness by enhancing, combining, protecting, and, when necessary, reconfiguring the business enterprise's intangible and tangible assets. Therefore, an organization's staff members must the ability to pick up new information fast.

2.5.3.1 Application dynamic capability model within the RTL context

This theory aided in understanding how UKZN used Dynamic Capability theory to evolve, change and rejuvenate its processes and systems to migrate to RTL platform. The theory also gave a peak into how UKZN evolved to accommodate change and how it managed to reconfigure its strategies and resources to meet the changing learning environment affected by COVID. As per the DC theory argument, it is only through change in the strategic approach that the new environment requirements can be tackled, which was noted in the context of UKZN.

The spread of the virus caused the South African government to impose a national lockdown on the country, creating a rapidly changing environment for the University of KwaZulu-Natal. To gain competitive advantage during this rapidly changing environment where UKZN had to, for the time being, do away with the traditional mode of educational instruction, and move to RTL, the university needed to mobilise resources. UKZN used Dynamic Capability theory to evolve, change and rejuvenate its processes and systems to migrate to RTL platform. The University of KwaZulu-Natal built, integrated and reconfigured its staff's core competency to move teaching and learning to the RTL platform seamlessly. The core competencies of the University of KwaZulu-Natal were utilised to modify the short-term competitive positions of the university when RTL was introduced and to build the online platform for long-term competitive advantage after the rapidly changing environment created by COVID-19 had long passed. UKZN proved to have very dynamic capabilities to be able to cope with the change of its systems and processes to the RTL platform.

2.6 Chapter Summary

It is a well-known fact that the development of COVID-19 and the lockdowns that several nations' governments implemented to stop the virus' propagation prompted many colleges and other institutions of higher learning to introduce RTL. There has been a growing movement towards RTL globally and in South Africa. This started with distance learning,

moved to eLearning, then online learning, and then blended learning before the final transition to remote teaching and learning. RTL came with both benefits and challenges for academic staff and students. The benefits, however, far outweighed the challenges because, in many cases where challenges occurred, there were ways that could be employed to mitigate those challenges. The biggest benefit of RTL is that teaching and learning continued during the peak periods of virus proliferation. This is significant because, as a result of implementing RTL, universities and other higher education institutions were not forced to close their doors; rather, they were able to keep offering instruction to the general public by switching from the conventional face-to-face contact method to sessions held on remote teaching and learning platforms.

Chapter 3

Research methodology

3.1 Introduction

Discussed in great detail in this chapter, is a research design, paradigm and research methods utilised during data collection process. Further to that, it highlights the qualitative representation of the effects of RTL to engineering students at UKZN. This chapter demonstrates the methods utilised to recognize, choose, process, and analyse the data as well as how the research problem was examined (Lewis & Thornhill, 2018). This chapter covers the research strategy, research design, target population, study site, sample, and data collection instruments. In addition, the chapter concludes with a review of the ethics addressed when doing this research, as well as the study's shortcomings.

3.2 Research design, methods and paradigms

To ensure that good decisions are made during data collection, online interviews were used as a research technique. According to Merriam (2002), a research design is a method a researcher uses to respond to a research issue. These goals must to be straightforward, quantifiable, doable, trustworthy, and time-bound. There are three different sorts of research methodologies: mixed, qualitative, and quantitative. To validate the interpretations made from the data obtained, qualitative data can be derived from primary and/or secondary sources, such as individuals, focus groups, and online sources (Hennink, Hutter, & Bailey, 2020). The researcher investigated constructionism as a paradigmatic perspective since it is more qualitative in character, looks at what goes on in people's heads, and attempts to comprehend RTL's effects on UKZN engineering students without generalizing them. The classification of a study as exploratory, descriptive, causal, or correlational is determined by the goal of the investigation, not by the method employed (Creswell & Creswell, 2018).

For the purpose of this study, descriptive and exploratory analyses are used where descriptive studies were used to produce a precise illustration of the research. In contrast, exploratory studies are when a researcher asks relevant questions and seeks new insights to assess the topic (Saunders & Thornhill, 2019). An approach to theory development used in this study is inductive reasoning, which involves developing new theories from data collected (Vibha, Bijayini, & Sanjay, 2013).

There are six strategies that can be used in qualitative research to analyse data: narrative, phenomenological, grounded, thematic, ethnography and case studies. A commonly used and foundational method for qualitative data analysis called thematic analysis, which is based on the study's nature and objectives, will be used for this study (Saunders & Lewis, 2018). In addition, Fossey, Harvey, Mcdermott and Davidson (2002) state that the researcher uses this method to present a clear picture of data through themes, following a set of steps using codes. It is paramount to ensure the credibility of research findings and conclusions (Creswell & Creswell, 2018).

3.3 Location of the study

The location of where the study was carried out is UKZN, Engineering Department, Howard College Campus. The School of Engineering is part of the CAES with seven (7) divisions. It is located in Durban, the largest city in KwaZulu-Natal, South Africa. Howard College campus is based in Glenwood, a residential area located on the south of KZN. It is part of the eThekweni Metropolitan Municipality, which includes the greater Durban area.

3.4 Population and sample of the study

Saunders and Lewis (2018) defines a population as a broad set of grouped individuals selected according to different categories like location, gender, age etc. The actual list of people from which the sample will be selected is known as a sampling frame (Saunders

& Thornhill, 2019). It should ideally involve the whole intended audience. The population size determines the size of the sample (Taherdoost, 2016). The target population for this study was five (5) academics and ten (10) students in the Department of CE&LS in Howard College campus. There are about forty (40) staff members, of which twenty-seven (27) are academics, ten (10) are technical staff, and three (3) are administration staff. In total, for 2021, there were six hundred & fifty (650) registered students; four hundred & twenty (420) Civil Engineering and one hundred & ten (110) in Land Surveying. The sample for this study was selected from both the academics and students. For this study, the researcher will include male, females, academics and students from all levels of study in the population. Cross-sectional studies involve studying a particular topic at a specific time, where the researcher will interview a fresh sample of a population (Alkassim & Tran, 2015).

3.5 Sampling method

Sampling is a process of choosing the right people, objects, or events to sample from the entire population (Taherdoost, 2016). The two types of sampling procedures that can be utilized to generate trustworthy conclusions from their data are probability sampling and non-probability sampling. Non-probability sampling, which is utilized in this study, is the best method for a qualitative study.

According to Sekaran and Bougies (2018), non-probability sampling is the process of choosing a sample using a non-random method which is convenient for collecting data and the results cannot be generalizable. Non-probability sampling design can be categorized into convenience and purposive sampling. Purposive sampling is when a researcher uses their judgement to select a sample based on certain characteristics (Campbell, et al., 2020). Purposive sampling will be used since the researcher has focused on a particular population segment to elicit their experience, expertise, and insights in providing closer to naturalistic settings are located (Alkassim & Tran, 2015).

To choose the appropriate sampling method, the researcher needs to understand the difference between a sample and a population fully. A sample, according to Creswell and Creswell (2018), is a portion of the population made up of individuals chosen at random.

3.6 Recruitment: inclusion and exclusion of participants in the study

Exclusion criteria are qualities that prevent potential participants from taking part in the study, whereas inclusion criteria are qualities that potential participants must possess in order to be considered for the study. This paper has observed research that looked at any asynchronous learning and remote teaching and learning. Participants would be academics and students within the department of Civil Engineering and Land Surveying.

3.6.1 Inclusions

- i. Civil Engineering and/or Land Surveying registered students for the academic year 2021
- ii. Academic staff in Civil Engineering and/or Land Surveying
- iii. Professional (IT) staff in Engineering

3.6.2 Exclusions

- i. Students that are not registered for Civil Engineering and/or Land Surveying
- ii. Academic staff that does not teach Civil Engineering and/or Land Surveying students
- iii. Administration staff in Engineering

Table 3.1: Sample size

Portfolio	Number of participants
First year student	2

Second year student	2
Third year student	3
Fourth year student	3
LS academic	2
CE academic	3
Total participants	15

Source: compiled by author for the purpose of this study

Table 3.1 outlines the portfolio of research participants (RP) as well as the number of participants that participated in the study.

3.7 Data collection

Data is information that needs to be processed, interpreted and analysed. Information is a group of data which makes logical meaning. Data collection instruments are methods used to collect data (Saunders & Thornhill, 2019). Qualitative interviews refer to a researcher conducting interviews using open-ended questions aimed at fundamentally producing elicited opinions and views from participants (Creswell & Creswell, 2018). Unstructured online interviews, through the use of Ms Teams and Zoom video conferencing platforms, which are open-ended questions that provide interviewees the chance to discuss their own experiences on the topic, were used by the researcher for this study. Due to COVID-19 restrictions, only online interviews were conducted for this study. The selected data collection instrument complements the research methodology and designs that were used for this study. These instruments have effectively enabled the researcher to derive conclusions from respondents' views on the research problem.

The researcher sent emails to several students and academics with an informed consent attached and requested interested participants to fill in the informed consent. Then, those who were interested in participating were given access to an interview schedule. The researcher then set an online meeting via Ms Teams and Zoom where interviews were conducted.

3.8 Qualitative data analysis

Data analysis, according to Saunders and Lewis (2018), is an exploratory method that is utilised to examine raw data and later drawing conclusions. Analysing qualitative data include text data and non-text data (audio, video and images). According to Sekaran and Bougie (2016), qualitative data analysis is aimed at reaching conclusions on the basis of evidence and reasoning. A thematic analysis will be used in this investigation. TA can be described to be a process of classifying data, discovering and analysing data collection with a minimal quantity of rich descriptions. The author chose a prominent TA topology that is centrally focused on the data, and the coding that was used to align with all of the study objectives is open-ended (Braun & Clarke, 2013). By addressing questions that are typically pre-specified by the researcher, TA is helpful in that it identifies pertinent patterns, themes, and ideas that can then be interpreted and explained.

3.9 Thematic analysis (TA)

Researchers appropriately analysed the data using a thematic analysis approach and transferred and transcribed the recorded interviews. A process of detecting, analysing, and reporting patterns is known as thematic analysis (also called themes). Saldana (2009), cited in Saldana (2015) confirms that a theme emerges from coding, categorizing, and analytic thinking. Thematic analysis is a cyclical process that involves travelling back and forth between data and analytical phases (Braun & Clarke, 2006).

Thematic Analysis (TA) can be described, by Ryan and Bernard (2003), to be data-driven procedures such as pattern investigation and classification. The application of this method is crucial in qualitative research and can be used in four processes such as “themes and subthemes, identifying the main themes, building theme pyramids, and integrating themes into theoretic models” (Ryan & Bernard, 2003)(Ryan and Bernard, 2003). Such themes arise when data analysis has occurred. The ability to synthesize notions repeatedly arising, as well as the transcription of digitally recorded data, are key factors in the analytical process. Data differences and similarities may be of paramount importance in during the expansion of themes.

Thematic Analysis (TA), according to Creswell (2009), is a conceptual framework that creates prominent themes to examine similarities and differences. On the other hand, TA is used for dissecting and describing important patterns in qualitative data, according to (Neuman, 2011). The researcher detected emergent themes in this study coding reoccurring subjects, categorically. The research output was subjected to a thematic analysis to ensure that it complied with the standards set out by the study design. One of the benefits of employing thematic analysis is its versatility in presenting data in a complete yet complex manner (Braun & Clarke, 2013).

Thematic analysis was separated into six phases by (Braun & Clarke, 2013)(Braun and Clarke, 2013). These stages are iterative rather than linear. The six steps of thematic analysis are explained below:

Table 3.2: Six TA stages

Coordination with the data	The researcher must become acquainted with the data by reading and re-reading it.
Assign codes	The initial codes are produced by using pithy labels to document where and how the patterns occur.
Search for patterns or themes	The researcher merges codes into broad scale themes that correctly detail the data. It is vital that the researcher narrate the true meaning of the themes, even when the theme does not seem to 'fit'. The researcher should also report on what is absent from the analysis.
Review themes	The researcher checks and analyses how the themes support the data and the comprehensive theoretical perspective.
Name and define themes	The researcher names and defines each theme, writes what is interesting about the theme, and highlights the aspects of data that are captured.
Producing your report	The researcher decides which themes are meaningful to understanding the data. This phase creates a logical and convincing story about the collected data for the reader and examines it in relation to existing knowledge/literature.

Source: (Braun & Clarke, 2013, p. 121)

The researcher found emergent themes in this study by coding and categorizing reoccurring themes line by line. Coding is a problem-solving technique involving much trial and error (Saldana J. , 2015). Saldana (2015) further notes that, encoding data from transcripts allows researchers to control and limit data volume. The data was organized in this study by finding themes and subdividing them into sub-themes. This was accomplished through the use of matrices, which have proven to be useful in the data

processing. This procedure aided the researcher in interpreting and organizing the information gathered.

Maguire and Delahunt (2017) describes a thematic analysis as a procedure in which topics (themes) or patterns that contribute to the research's interests or aims are identified. Qualitative research generates a large amount of data; therefore, data reduction is an important stage in scrutinizing the data before editing, coding, and categorizing it (Bougie & Sekaran, 2016).

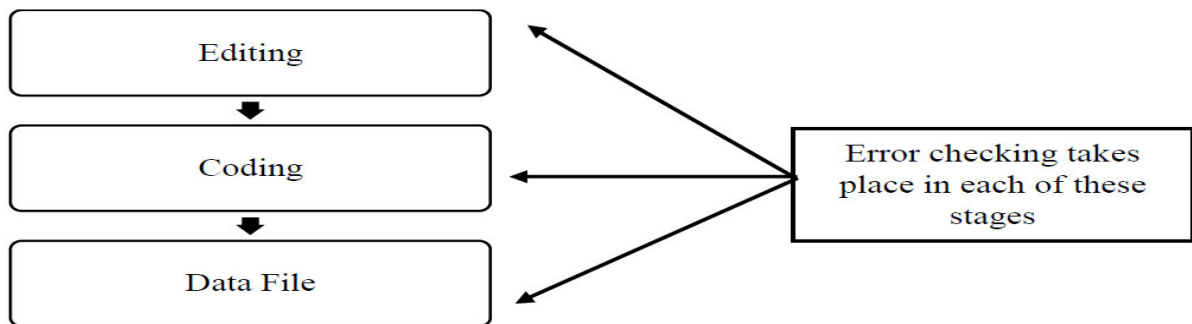


Figure 3.3 Process of data reduction

Source: (Zikmund et al., 2013, p. 127)

According to the graph, the editing of data follows after reducing the amount of the collected qualitative data. But to avoid instances in which important or relevant information is omitted there is regular checking of the edited data, falling back to the raw data to ensure that all the information is represented. The edited data is then labelled, identifying the recurring phrases or words to coin them into different themes. Relationships between them are also investigated. After this phase there is error checking again to ensure the phrases and words reflect the participant's words, not the researchers, before being stored in the correct data file.

3.10 Data quality control / management

Data quality control, according to Lavrakas (2008), is the process of ensuring that data collected is correct, consistent, and dependable. Although the process of data analysis in qualitative research is adaptable and suited to the needs of each study, it also follows a set of rules and makes use of rigorous methodological methodologies. According to Stenbacka (2001), reliability and validity are frequently used in quantitative research and are currently being reconsidered in the qualitative research paradigm. Different scholars use different terms for applicability within the qualitative research. For instance, some use credibility, trustworthiness, dependability, transferability and confirmability as the bedrocks of quality justification within inductive oriented philosophical and methodological analysis (Noble & Smith, 2015).

For the purpose of this study the term applicability is used, which refers to how trustworthy the data and the interpretation of data are. In qualitative research, the researcher must take precautions to ensure the validity or accuracy of the findings, just as they must in any other research method. Sekaran and Bougie (2016) indicate that validity is used to validate research findings and that it is imperative for a researcher to validate data and ensure data collected and analysed is reliable. For instance, Street and Ward (2012), submit validity requires that test results be understood in the way or context in which the test was performed.

Lincoln and Guba (1985) base their assessment of reliability on four general criteria. To be “trustworthy, one must prove that credibility is based on believing the accuracy of its output; transferability is the ability to show that the results are applicable to other situations; dependability is the output of reliability and reproducibility of results; confirmability is a measure of neutrality or the extent to which a study's conclusions are influenced by the participants rather than the bias, motivation, or interest of the researchers” (Lincoln & Guba, 1985).

3.10.1 Credibility

As mentioned above, credibility examines the "fit" between the researcher's portrayal of the participants' views and their actual beliefs, loosely refers to internal validity. To ensure credibility of the study findings, the researcher must ensure that they adopted strategies to ensure trustworthiness. These include ensuring that participants are not biased in their responses. Participant bias could be a result of a participant wanting to please the researcher or feeling threatened by the said topic. Further to that, the researcher ensures that there was no researcher bias which relates to the influence of the researchers' previous knowledge or assumptions on the study. Moreover, the author ensured reactivity where the role of the researcher, their physical presence or possible influence on the data is not present. The author also used interviewing techniques where they reframed questions in order to ensure there is no biasness. This is supported by Tobin and Begley (2004) who states that research activities and reports by researchers are reliable when specific research protocols are followed.

3.10.2 Transferability

Generalizability of queries is called portability, which is synonymous with external validity. All qualitative research is about moving from case to case (Tobin & Begley, 2004). Researchers are responsible for providing full descriptions so that transferability can be assessed by those wishing to transfer results to their site, but researchers cannot be made aware of sites that may do so. (Lincoln & Guba, 1985). Guba and Lincoln (1989) agree with Tobin and Begley (2004) who by showing the reader that the conclusions of research studies are applicable to different settings, places, times, and populations said transferability is established. This study's' nominated sample was applicable to engineering students at UKZN who studied during the COVID-19 era.

3.10.3 Dependability

Dependability of qualitative research is synonymous with reliability, which is consistency of the findings. In qualitative research, examining the process of inquiry, in terms of how data was gathered, stored, and how accurate it was, refers to dependability (Lincoln & Guba, 1985). This is endorsed by Tobin and Begley (2004), who state that researchers can ensure that research processes are rational, traceable, and fully documented in order to achieve reliability. Readers, on the other hand, can better assess the credibility of a study if they can see how, it was done (Lincoln & Guba, 1985). The author as an instrument was consistent and reliable where they used code-recode procedure, which is when a researcher re-does an analysis without going back to check the initial coding and analysis, then compare the findings.

3.10.4 Confirmability

Confirmability, also called objectivity, is the final element of reliability that a qualitative researcher must demonstrate. Researchers must provide evidence of how they arrived at their conclusions and interpretations to show that their interpretations and findings are clear from the data (Tobin & Begley, 2004). Lincoln and Guba (1985) supports this opinion as they state that evaluating the output to confirm that the conclusions, interpretations, and suggestions are backed up by data. According to Guba and Lincoln (1989) reliability, communicability and reliability are all achieved. To help people understand how and why decisions are made, Koch (1994) asks researchers to study markers such as the theoretical, methodological, and analytical rationales for decisions. I advised it to be included throughout. The author ensured neutrality in the analysis of the research where they allowed the participants reality to dominate instead of their own by keeping focus on participants.

3.11 Ethical consideration

Ethics is a principal part of conducting research. According to Saunders and Lewis (2018) (Saunders and Lewis, 2018) research ethics is ensuring that rights of the participants are protected by the researcher in the research process. Subsequently, UKZN upholds a research ethics policy that applies to anyone wishing to conduct research with employees or students. For this study, ethical approval was obtained from UKZN Ethics Committee and is attached as an annexure in this document. Also, a gatekeepers' letter was obtained from UKZNs' Office of the Registrar which is also attached as an annexure in this document.

Researchers may conduct interviews after receiving the aforementioned approval in compliance with the pertinent study ethics policy. The enforcement of this policy and the prevention of policy violations were the responsibility of the researchers. There is a code of conduct for the survey, which all respondents sign and commit to comply with. The researcher ensured that all study participants had signed an informed consent form confirming that they were not promised money or financial benefits. not be forced to participate. The informed consent document detailed the guidelines such that the participant can withdraw or discontinue participation should they wish to. The researcher ensures that details of research participants are not disclosed. The researcher will ensure that all documentation remains confidential and anonymous.

3.12 Chapter summary

Chapter 4 A general summary of methods employed in this study as well as the underlying theories that shaped it are given. The purposive sampling approach was used in conjunction with qualitative research methodology and the interpretivism paradigm. In semi-structured online interviews, fifteen (15) RPs responded to the main questions and questions that came after that. The research instruments that were employed to regulate the research were thoroughly discussed. In addition, the study looked at the research strategy, study site, target demographic, sample, and research design. The study's importance and limitations were also discussed in depth. Furthermore, the researcher also ensured that ethical considerations were considered when conducting the research.

Presentation, analysis of results and discussion

4.1 Introduction

This study explored how engineering students at UKZN were impacted by RTL, it further presents the responses gathered from the research participants (RP) of the study, of which five (5) were academics and ten (10) were students, which is a total of fifteen (15) RPs from all levels of study. Participants' responses from the online interviews (using Ms Teams and Zoom video conferencing platforms) that were conducted were categorized into themes and sub-themes based on the aims of the study. In this study, a thematic analysis was used as a method of qualitative data analysis. A gap in previous studies describing the topic in mention, particularly within the scope of engineering students at

UKZN, stimulated my interest in looking into engineering students at UKZNs' perceptions on the impact of RTL. Data collection and analysis were driven by a topic approach, which is common in qualitative research. The outcomes represent a culmination of the participants voices, and they give a profound perspective on their lived experiences as students and academics within the department of CE&LS at UKZN.

The research objectives were as follows:

- a) To critically explore the impact of RTL on UKZN engineering students during the COVID-19 pandemic.
- b) To analyse strategies that could be applicable during COVID-19 crisis that can be used to close the gaps of practical work and simulations for UKZN engineering students.
- c) To determine the extent of the level of pedagogical and academic resources required in facilitating RTL on the UKZN engineering students.
- d) To assess the adaptability perception readiness and transition of UKZN engineering students in acquiring a curriculum within RTL dissemination platform.

4.2 Demographics of research participants

Since demographic data about research participants "provides data regarding research participants and is necessary for the determination of whether the individuals in a particular study are a representative sample of the target population for generalization purposes," the importance of participant demographics is emphasized by Salkind (2010). Accordingly, the sample of the research participants (RP) in this study, as per table 3.1, includes UKZN students (10) and academic (05) employees in the department of CE&LS cluster. The RPs mentioned above illustrates those numerous subjects within the department of CE&LS at UKZN were involved, allowing the researcher to acquire information from a variety of knowledgeable subjects. The RPs in this study answered to the questions related to the themes that were developed to address the aforementioned objectives.

4.3 Identification of dominant themes

The categorization of data, illustration of themes related to it and employment of interpretations about a range of subjects is a branch of qualitative analysis referred to as thematic analysis (Guest, MacQueen, & Namey, 2012). This is supported by Kiger and Varpio (2020) who states that it is of utmost importance to purposefully displays the participant data in a way that reflects various viewpoints, agreements and disagreements, and any other pertinent details related to theories. Braun and Clarke (2013) contends that all information should be organized into codes, themes, categories, and patterns. According to Braun and Clarke (2006) thematic analysis describes an iterative process as to how to go from messy data to a map of the most important themes in the data which is a view that was corroborated by Cruzes and Dyba (2011) the process contains six steps:

1. Familiarize yourself with your data
2. Assign preliminary codes to your data in order to describe the content
3. Search for patterns or themes in your codes across the different interviews
4. Review themes
5. Define and name themes
6. Produce your report

Nowell et. al (2017) posited that there have been scant deliberations in the literature about how to undertake a data rich contribution from participants in the study that has similarity with systematic and rigorous and relevant thematic analysis. Thematic (applications of dominant and emergent themes) analysis does not prescribe a rigid and complicated or comprehensive theoretical and technological cognitive traits and attributes of other qualitative methods, it provides a more rigorous form of investigating the phenomenon, with specific reference to emerging researchers Braun and Clarke (2006).

The following were dominant themes found in the data:

- a) Ability to participate effectively in blended learning (BL)
- b) The level of digital resource-sufficiency

- c) Constraints in home or learning environment for successful participation in synchronous learning
- d) The impact of using pedagogical resources to facilitate blended remote learning

4.4 Presentation, Analysis of Results and Discussion

The literature evaluation in chapter two demonstrated the researcher's commitment to advancing the study of the effect of RTL on engineering students at the University of KwaZulu-Natal. Thematic analysis was utilized to make conclusions about students' opinions which was discovered during stages of data collection, as was detailed in chapter three. The collection of data was done using open-ended questions, through semi-structured interviews in order to assess the success and challenges of engineering students at UKZN. In order to analyse the data that has been collected, necessary structure and predicted analysis orders must be created (Harper, 2011). Thematic analysis was chosen because it allows those who have been influenced or heard to speak about their experiences (Alhojailana, 2012). The author realized that their stories were crucial in conveying the current situation and allowing them to make comments that could be presented in order to understand the impact of RTL on UKZN engineering students.

4.4.1 Objective one: “To critically explore the impact of RTL on UKZN engineering students during the COVID-19 pandemic”

Table 4.1 Dominant and emerging themes associated with objective one

Dominant theme 1	<i>The ability for an effective transition and assimilation to the asynchronous and synchronous (hybrid and blended) RTL</i>
Emerging theme 1	Acceleration in access to study materials during blended learning
Emerging theme 2	Expediency in interaction and participation during blended learning
Emerging theme 3	Embracing the conduciveness environment to ensure effective participation in blended learning

Source: author

During unstructured interviews, the first set of questions that was posed at research participants (RPs) were intended to gauge how RTL affected engineering students at UKZN amid the global pandemic. This was done to address study aim number one, which is in line with dominating topic number one, as shown in table 4.1.

2.1.1.1. Ability to participate effectively in blended learning

There could be a number of contributing factors to challenges related with effective participation in blended learning. Challenges differ per student and depend on the approach followed by each student understanding their background and environment (Geith, Christine, & Vignare, 2008). According to Bates (2015) there is another dimension to learning, which is deliberative and reflective processing of ideas that includes internalisation of new concepts and gradual synthesis and integration that leads to a deeper and more personal meaningful form of learning. Fernandez, Ramesh, and Manivannan (2022) corroborate with (Bates, 2015) who states that some students may be able to achieve this deeper level of understanding in class but for most it will come sometime later for each student.

4.4.1.1.1 Access to study materials during blended learning

Traditionally, online learning would generally be offered through an asynchronous or synchronous (blended) structure to support traditional learning (Geith, Christine, & Vignare, 2008). Tremblay, Lalancette, and Roseveare (2012) reflects that the intrinsic lack of flexibility it offers, the holding back of students, and the reliance on technology are perhaps the three main problems with synchronous (blended) learning.

The following statements were elicited from RPs who experienced different forms of challenges, mostly linked to network connectivity.

RP01: *“Most of the challenges I personally faced were due to not having connectivity from time to time, so I figured this I then decided to plan in advance. This assisted me to learn to plan in advance by downloading study materials before my lectures”.*

RP07: *“I would have network connectivity problems from time to time whenever trying to access online material. This usually happened when I tried to download it during or just before a lecture then I later on decided to either download it a day or few hours before the lecture or by using mobile devices”.*

RP09: *“The challenge that I had to face most of the time, was network problems when trying to access study material on the internet or on the UKZN webpage (Moodle/learn22). So, the challenges in the way in which I dealt with them, was to download study material before lectures resume. So, I found that to be more effective than trying to download the notes during a lecture as soon as they become available, to avoid unforeseen circumstances”.*

This is corroborated by Fabriz, Mendzheritskaya and Stehle (2021) who states that some students faced challenges with inadequate network connectivity and not having appropriate resources to participate in online learning.

4.4.1.1.2 Interaction and participation during blended learning

Blended learning (BL) activity requires interaction in the classroom as it facilitates teaching and learning and can improve students' communication skills (Park & Bonk, 2007). This is confirmed by Manou *et al.*, (2021) who states that in BL a student can raise questions as the presentation is happening when it's synchronous. Fabriz, Mendzheritskaya, and Stehle (2021) further concurred with the above scholars in describing blended learning as an interaction of how the students engage with one another, the lecturer, and even the rest of the class. This complements the views of Park and Bonk (2007) who stated that collaboration abilities and interactions with peers and instructors were discovered to be crucial factors determining normal learning experiences in online courses.

RP03 and RP04 resonated the same sentiments of being able to hear the lecturers clearly and participate effectively.

RP03 *“Yes, I was able to log in and follow, hear and follow the lecturer’s screen without any problems most of the time”.*

RP04 *“I can follow the lecturer screen but interaction is usually hard as the lecturer hardly looks at questions in the chat box”*.

RP05 indicated that they could hear the lectures but had problems interacting with them and the class.

RP05 *“I am able to hear the lecturer clearly and follow their screen for the most part but interacting with them can be a challenge at times”*.

RP06 and RP10 shared different opinions and said:

RP06 *“I don't have an experience where an online class actually went according to plan. Very few lecturers' posses' laptops that can enable them to be able to write clearly on the screen for us to see. Most also lack the know how to be able to use apps like zoom, Microsoft teams etc. if it was not load shedding affecting the network if was most likely a lectures bad connection, which at some point ensured that the online lesson would be interrupted or disturb at some stage”*.

RP10 *“The truth is, this did not work well at times but relatively it was good. Sometimes the lecturer will have a microphone problem where they would speak and the class wouldn't be able to hear, and sometimes I myself actually can't hear because my PC is quite old as well”*.

4.4.1.1.3 Conduciveness of environment to ensure effective participation in blended learning

A conducive study environment is described by Fabriz *et al.*, (2021) as a supportive atmosphere that must encourage us to concentrate on our tasks otherwise it can produce distraction that can cause us to lose focus. Geith *et al.*, (2008) supports this view as they state that the environment where students learn and study affects their productivity. This is further corroborated by Kadir *et al.*, (2022) who mentioned that it is important for a lecturer to ascertain whether their students have a conducive environment at home that promotes learning (Kadir *et al.*, 2022).

Numerous RPs compliment the views of the above scholars on the importance of having a conducive environment in order to fully participate in online lectures, where they stated that:

RP01: *“Living with a family of 8 in a shack really disadvantaged me when it comes to online learning. Apart from the noise level from my siblings during a lecture, I also had a very big problem with load shedding. Sometimes I missed classes as we would be on load shedding during a lecture. I could not manage and the environment was not conducive at all”*.

RP02: *“I stay at home with family and my greatest challenge was not being able to control the environment. The environment at home was not conducive at all for me, as we live in a very small house and I don’t have a dedicated room where I could attend my lectures without being disturbed”*.

RP04: *“I live at home with my family, I have a 3-year-old daughter and as you could also hear right now she is disturbing me. I have always had a challenge with her as sometimes I didn’t have anyone to look after her, so my environment was definitely not conducive at all which is why I have also preferred to stay at residence”*.

RP10: *“For me, the environment at home was not conducive at all for studying, because I live at a commune so the environment is definitely not conducive. We have students which are normally rowdy as they had more time to themselves and it was very difficult to keep up. Another problem I had was load shedding, which sometimes happened twice a day”*.

4.4.2 Objective two: “To analyse strategies that could be applicable during COVID-19 crisis that can be used to close the gaps of practical work and simulations for UKZN engineering students”

Table 4.2 Dominant and emerging themes associated with objective two

Dominant theme 2	<i>The level of digital resource-sufficiency (to facilitate seamless participation in blended learning)</i>
Emerging theme 1	Sufficiency of digital skills to participate effectively in blended learning

Emerging theme 2	Availability of ICS staff / LAN Manager
Emerging theme 3	The role of adequacy of network coverage or lack thereof

Source: author

This objective main aim is to analyse strategies that can be used to close the gaps of practical work and simulations for UKZN engineering students. This is aligned to dominant theme two, indicated on Table 4.2.

4.4.2.1 The level of digital resource-sufficiency in order to facilitate seamless participation in blended learning

Bawden (2001) supports this view and further mentions that digital learning technologies may include databases of educational materials, tools for reading and writing, multimedia (audio, video, and image) features to enable one's effective participation in online learning. According to Herring (2009) to produce material, communicate, and exchange knowledge, a variety of technologies can be employed, such as blogs, wikis, and social networks. Further to that, Sousa *et al.*, (2017) states that when using these technologies, new pedagogical techniques and learning paradigms must be considered. The cornerstone of effective educational processes, according to Bozkurt and Sharma (2020), is reliant on appropriate usage of technological activities.

4.4.2.1.1 Sufficiency of digital skills to participate effectively in blended learning

In the 21st century, the world revolves around technology and requires people from all walks of life to be literate in order to effectively make use of information, the internet and computers (Bawden, 2001). Herring (2009) is congruent to this view and further confirms that one can be literate through a collection of different abilities, simply by learning new skills.

RP02 confirmed the views of the above scholars, in stating that they are computer literate *“I am computer literate and have completed a couple of computer courses. I am familiar with technology and can easily use any gadget including accessing digital technology”*.

RP03 shared the same sentiments as the above RP and said *“I was exposed to technology centred learning in high school and thus feel I have the necessary skills to participate effectively in an online lecture”*.

RP10 reiterated that *“Lucky enough for me I was exposed to computers and digital resources before the lockdown so I knew my way around everything. however, I had never used the platforms we were using, Ms Teams and Zoom before so I had to learn a few things on how it works during the lectures etc”*.

4.4.2.1.2 Availability of ICS staff / LAN Manager

Higher education institutions (HEI) need IT infrastructure to assist instructors with course design and resource development, eLearning platform analysis, website development, and policy making for the use of IT resources (Lau & Yuen, 2014). This is confirmed by Esterhuizen (2015) who states that HEI must guarantee that the necessary parties are able to access resources off-campus. This is further complimented by Bozkurt and Sharma (2020) who states that the availability resources that do not require a university license is made centrally and thoroughly known by institutions. Moreover, UFS (2022) states that ICS staff also enable staff and students’ adequate access to resources on digital platforms.

RP02 and RP09 indicated that they received adequate assistance from ICS staff.

RP02: *“I feel the ICS staff as a whole provides adequate assistance and plays a crucial role in maintaining the medium through which we in our online lectures”*.

RP09: *“The LAN manager was always available. So, both on email if we needed to contact them so you know they're always available, ready to help and always helped us as well as they could with the information that we could give over. So yeah, I think it worked very well”*.

Further to that, RP04 mentioned that at first, they had challenges adapting to being assisted remotely as the ICS staff would connect to their computers remotely:

RP04: *“It was quite a challenge at first to learn to narrate your challenges/issues over the phone and having someone to work on your computer / problem remotely but I got used to it. I've also had numerous instances where I've actually needed help with something online, and I always received the help that I required. At the later part of my*

studies were then allowed to be on campus and I was always at the computer LAN and LAN manager is always there, to assist us”.

RP06: *“I received great assistance from my LAN manager as she granted remote access to a LAN PC using my own laptop as I my personal laptop is a very low spec. I have never had an issue with the availability of ICS staff, she always responded to emails, connected to my pc remotely to assist, allowed us to call or WhatsApp her even after hours”.*

RP10: *“Whenever I had a problem, my LAN manager tried by all means to assist whether directly or indirectly. Some of the problems I had were solved optimally remotely, even though there were delays on some”.*

Comments by RP04, RP06 and RP10 complemented Lau and Yuen (2014) who stated that digital platforms can be used by students and staff to access resources such as face-to-face support, computer facilities and use of remote connection.

4.4.2.1.3 The role of adequacy of network coverage or lack thereof

According to Shank (2020) technology facilitates blended learning, although it can help with teaching and learning, on the flip side it can sometimes lead to technical challenges and glitches. Some of technological constraints include, but not limited to, a) problems using the actual interface, tools, and platform b) issues with bandwidth and connections, and c) need for specialized tools (such headsets), facilitation, and design (Shank, 2020). Meanwhile, the internet or network connectivity plays a vital role in blended learning; however, the importance of internet connectivity can be compromised by the exogenous load shedding reality for instance, worst case scenario stage 6. To guarantee employees perform at their best, the ICT department must provide good network availability and connection backups. It must also maintain a high degree of information security to guarantee system availability and accurate secure electronic data (UFS, 2022). This then might allow the university stakeholders to perform at their best.

All RPs confirmed that adequate network connectivity plays a big role in enabling them to participate in an online class.

RP04: “Network coverage plays a big role because when the network is down, I am not able to attend lecturers”.

RP07: “Most of my problems came from this, I used to have connectivity issues during peak times, I would get kicked-out of the class quite often in 2020. Even though things got better over time but I did struggle, which is why I moved to residence in 2021”.

RP08: “Yeah it plays a huge role. I mean, without proper connection you can't really participate in a class. I think to have a proper connection makes a huge difference so that you can be in the class and ask questions”.

RP09: “Network coverage is the driving force when it comes to online learning. Without adequate network coverage in residence, there was absolutely no way you can engage in a class effectively. We identified this problem and reported it to ICS, through appropriate channels, and it was later improved”.

RP10: “Network coverage is important so that we can share real time data and that there's no time lags. I believe we actually had an insufficient network coverage at the commune because during lectures we used to have either connectivity problems or data issues. This then affected my teaching and learning process, as I couldn't really attend some lectures, due to such circumstances. However, this improved at a later stage”.

Power outages, the dependability of the university network, the accessibility of after-hours or weekend IT help, the dependability of external networks, the dependability of cloud servers, and the local circumstances at each regional support centre were among these (Hrastinski, 2008). For blended learning experiences to be successful, each of these components must operate at their peak potential (Esterhuizen, 2015).

4.4.3 Objective three: “To determine the extent of the level of pedagogical and academic resources required in facilitating RTL on the UKZN engineering students”

Table 4.3 Dominant and emerging themes associated with objective three

Dominant theme 3	<i>Constraints in home or learning environment for successful participation in blended learning</i>
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Emerging theme 1	Changes made to create a conducive environment for blended learning
Emerging theme 2	Challenges and constraints (experience) in completing an individual, group assignment or a project without access to a computer LAN and/or laboratory
Emerging theme 3	The importance of laboratory work or practical training in any of the modules

Source: author

This objective's major goal is to establish constraints in students' home or learning environment that could impede them from participating successfully in blended learning. This objective was addressing objective one of this study, which is aligned to dominant theme one, indicated in table 4.4

4.4.3.1 Constraints in home or learning environment for successful participation in blended learning

It is of utmost importance that everyone understands a vital role the physical environment plays in one's ability to participate in online learning (Ng, 2021). This is complemented by a study conducted by Kadir, Aris, Rahman and Hasri (2022) which asserts that a persons' physical and psychological qualities contribute to creating a favourable learning environment for students studying design. On the other hand, Bates (2015) states that students require dependable digital technology as well as a learning environment that respects their personal space and physiological needs, especially in light of the current global health crisis. Moreover, Ng (2021) corroborates with this opinion as they indicated that a person's living environment greatly affects how a person responds to challenges and develop self-determination from there.

4.4.3.1.1 Changes made to create a conducive environment for blended learning

One's environment has an impact both consciously and subconsciously (Manou, et al., 2021). This is confirmed by Tsai *et al.*, (2020) who states that a person's environment can enhance and assist their concentration levels. Moreover, Adnan and Anwar (2020) concurred with this view as they stated that productivity can be improved by changing an environment. The added advantage cogent with blended learning are also the storage recordings that has been facilitated by the usage of IT platforms such as Zoom and Ms Teams.

Most of the students that indicated that they did not have a conducive environment at home:

RP01: *“When I stayed at home is very difficult, to be honest I never managed to have a conducive environment at all”*.

RP01 further explained that they had to move from home *“Things got better when I was at residence as I could also use a library and would study when it was most convenient to me, I had to learn habits of my peers and planned ahead”*.

RP03, RP04 and RP05 mentioned that they had to change their daily routine, and / or move from their homes to residences in order for them to be in a conducive environment for online learning.

RP03: *“I had to change my routine to make sure that I am home early in the afternoon and ready for the start of the lectures by 18h00. I saved money to buy more data so that I don't miss out and can always log onto the lectures online”*.

RP04: *“I had to change my daily routine and my family's so that I am able to have a conducive environment and effective lectures. I had to buy a desk in order to be comfortable to learn. My parents had to buy me a new laptop so I don't have problems with storage”*.

RP05: *“I had to change my study/work time to later hours such my family members would be asleep”*.

RP07 had to make mindset changes, and also invest in purchasing appropriate equipment *“Changes in mindset to adjust to the atmosphere. Obtaining a proper studying space”*.

RP08 stated that they had to buy devices to make their environment conducive for online learning *“Firstly, I had to invest in a few devices. I had to purchase a mouse that worked well, and earphones that were comfortable and worked well. My learning space, including my desk and chair had to be changed as I was spending many hours at my screen and required a comfortable chair. Those were some of the changes I had to make to be physically comfortable while learning online. Secondly, my family had to adjust to being relatively silent during my online lessons to not disturb me”*.

4.4.3.1.2 Challenges and constraints (experience) in completing an individual, group assignment or a project without access to a computer LAN and/or laboratory

According to Bates (2015) models of blended learning are heavily reliant on technology and further mentions that as a result, in order to benefit the most from their course, students must be tech-savvy. On the contrary, Mpungose (2020) stated that you cannot expect that all of the students will be familiar with using a digital device which is why it is of paramount importance that lecturers carefully consider students and consider their current skill levels (Viegasa, et al., 2018).

Students can learn, use software, complete assignments, and communicate with their peers with the aid of computer laboratories (Edward, 2002). For engineering students, successful professional practice is predicted by competent practice in an engineering laboratory. Who is regarded an engineer is therefore determined by their proficiency in the laboratory and their adherence to the standards of laboratory operations (Bretz, 2019).

RP01, RP08 and RP09 share the challenges faced with unavailability of adequate resources:

RP01: *“Not having access to a computer and practical sessions was new and it was hard to adapt to this but we had to make it work as we wanted to pass”.*

RP08: *“The lack of exposure to laboratories has hindered my knowledge and experience as a Civil Engineering Student”.*

RP09: *“The major challenge was late submission, because cause without access to a computer LAN and/or a laboratory. Most of our work as engineering students is based on working on a computer LAN and/or a laboratory”.*

RP01, RP09 and RP10 stated that individual assignments were manageable but not having adequate access to resources like a computer LAN and a laboratory was a challenge:

RP01: *“Not having access to a computer and practical sessions was new and it was hard to adapt to this but we had to make it work as we wanted to pass. For individual*

assignments it was not easy but it was better than group assignments. I had to use my smartphone which is not easy but at least time is managed better with individual work”.

RP09: *“Individual assignments were not a big issue as I was able to work on them on my own, at a preferred time as it didn’t affect anyone else”.*

RP10: *“I didn’t have any issues with individual assignments as I have always been able to work on my own effectively, and I plan my time well”.*

One of the most studied and used teaching strategies in the world is the utilization of group work in the classroom. The advantages of collaborative learning on academic achievement, communication abilities, and confidence have been demonstrated in several research studies.

RP01, RP08, RP09 and RP10 share their experiences on the challenges they shared with group work and projects:

RP01: *” The group assignments were a big problem, before we were able to meet in the LAN to distribute and discuss work we needed to do, how we would do it then do practical work together but now we couldn’t. We were also not able to run practicals in 2020 which is bad because we needed the practical experience. We had a lot of network connectivity challenges since we had remote meetings”.*

RP08: *“Group projects were difficult to complete, as most of our meetings were held online. Some group members had limited data, access to network and inadequate devices. Meeting in person was also a difficult task, as students of the group could never find times suitable to each member”.*

RP08 further elucidated that: *“I have been fortunate to have access to a laptop to complete projects, but have found it difficult to complete work with no access to laboratories for most of 2020 and 2021”.*

RP09: *“Group assignments were always challenging, more so due to inconvenience by other members, more so in not being able to plan their work properly and in advance. So, now without having proper access to a computer LAN and/or laboratory was quite a challenge. In the past we would use the computer LAN to do research, meet as a group to discuss and work on it together. It was also difficult to write some assignments without proper prior testing in the LABs, which is a critical part of our learning as engineers”.*

RP10: *“The only challenge I had was with group assignments where we would get individuals contribution late and leading to late submissions. Also, we could not do the practical part of the project as a group to further understand what each person contributed and how they got to the conclusions. In essence, some poor work was submitted due to lack of access of resources resulting in class marks dropping significantly, compared to previous years”.*

The above views complement those of Bijeeesh (2017) who stated that the effectiveness of group work dynamism is a topic of increasing discussion among educators due to the risk of complacency, unequal workload, disagreement between pupils, and a loss of concentration on the task at hand.

4.4.3.1.3 The importance of laboratory work or practical training in any of the modules

According to Bretz (2019) the majority of science-based courses, like engineering, incorporate hands-on laboratory experiments as part of the curriculum. A large amount of such work, according to many academics and authoritative organisations, is crucial to the development of technologists (Edward, 2002), and in this case engineers.

RP01 indicated that they only had one module that required practical work which was postponed to the following academic year:

RP01: *“I only had one module that required us to do practical work in the field which we ended up not doing but was compensated in the following year. It was not a great experience as we missed out on an important practical training”.*

Many students claimed that by connecting theory to practice, the course's principles were strengthened and better understood (Viegasa, et al., 2018). Geith *et al.*, (2008) concurs with these views as they mention that engineering education embrace laboratory work as a way to combine theory and practice, learn via inquiry, experience elements of professional practice, and work collaboratively.

RP04, RP05, RP08, RP09 and RP10 resonated the same sentiments that the lack of exposure to laboratories hindered their knowledge and experience as CE students:

RP04: *“It’s very important as it covers part of my semester mark. RTL affects my practical training as I often had to do it online and instead of first-hand experience, I had to do things online. No lecturer to help me physically. I don’t enjoy or get interested in my practical work”.*

RP05: *“Lab work is fairly important in a few of my modules because it provides us with a better understanding of the concepts we study in class, RTL has seen a sharp decline in the practical work we do and thus robbed us of a full understanding in our modules”.*

RP08: *“I believe this aspect is extremely important. I have recently completed my undergraduate dissertation, and the lack of laboratory work made completion substantially difficult. I had a chat with some engineering alumni and realized the unfortunate negative impact of online learning. Specifically, for engineering, laboratory work or practical work is imperative”.*

RP09: *“In engineering laboratory work is very important. Most of the content we learn in class is theory based, so during contact learning / prior to covid-19, we were able to perform experiments, and you would be able to relate the theory learned in class and the practical experiment done in a laboratory work”.*

RP09 also explicated that: *“This assisted me in grasping some content easier, as compared to just following slides or a presentation. Not having access to laboratories, for some modules, we were at a disadvantage. For me, it was quite a challenge in my final year to conduct my dissertation project as I had not had a chance in my third year to do some experimental/practical work and this affected the quality of my results/output but I had to put in more effort to obtain the desired output, which was to complete my degree”.*

RP10: *“Laboratory work / practical training are very important in the field of engineering, because what you learn in the textbook may not particularly be what's out there in field. So, the remote learning has really not supplemented any practical training at all, because I feel like we're more inexperienced than previous engineering learners due to online, because the videos that they show do not suffice in a sense that”.*

RP10 also added that: *“When you look at those videos, you don't actually see the constraints of which perhaps or particularly a particular experiment had that you would have also encountered, so hence we don't really gain much information on the field itself”*.

RP06 shared a different opinion and said that they did not feel a void of not doing any practical's: *“Not being able to do any lab sessions because of online learning hasn't affected my understanding of the relevant topics. In fact, I believe It was better not to have any as they prove to be a waste of time. If any stage during the semester, you needed to understand how something was done in the lab, there are countless lab sessions recorded and posted on YouTube for us to look at and go through”*.

4.4.4 Objective four: “To assess the adaptability perception and transition of UKZN engineering students in acquiring a curriculum within RTL dissemination platform”

Table 4.4 Dominant and emerging themes associated with objective four

Dominant theme 4	<i>The impact of using pedagogical resources to facilitate blended learning</i>
Emerging theme 1	The assessment of lecturers' skillset, training and digital resourcefulness
Emerging theme 2	Ensuring that technology-enhanced learning was simple, engaging, transferable, and comprehensive for students
Emerging theme 3	The contribution of lecturers to increased access to pedagogical transformation and capacity building

Source: author

The main goal of this objective is to establish the impact of using pedagogical resources to facilitate blended learning. This was done by assessing lecturer's skillset, training and digital resourcefulness. This was addressing objective four of this study, which is aligned to dominant theme four, indicated in table 4.4.

4.4.4.1 The impact of using pedagogical resources to facilitate synchronous learning

According to (Mahaye, 2020) three pillars must be considered when developing a pedagogy for learning aided by technology: firstly, the learner, then the learning environment, and thirdly the pedagogical tool used to carry out the activities. Different platforms and tools were utilized throughout the pandemic to assist online learning and teaching (Bozkurt & Sharma, 2020). Educators were challenged to become more innovative in their instructional approaches, through the openness, agility and flexibility in educational use (Sandanayake, 2019). According to Bloomberg (2018) educators during blended learning era should develop social interactions using adaptive creative methods like peer-facilitated discussion boards, video-based course materials, group-based assessment activities that require learners to use their analytical skills, hands-on practical experience for learners (especially for engineering undergraduates), and learning activities that enhance learners' capacity for self-learning (Bokolo, et al., 2019).

4.4.4.1.1 The assessment of lecturers' skillset, training and digital resourcefulness

According to Garrison and Kanuka (2004) technology which refers to physical hardware, internet access and required software entails the platform that supports teaching and learning between lecturers and student. For instance, BL systems such as Moodle/learn2 offer an open learning platform where lecturers can collaborate with students (Fleck, 2012). This is corroborated by Edward *et al.*, (2018) who states that these technologies can be utilized by the lecturer to disseminate knowledge and upload course materials. Lecturers can integrate different interactive technologies and systems such as multimedia technologies and applications for teaching and learning processes (Fleck, 2012). Thus, the effectiveness of BL for teaching and learning inevitably relies on lecturers' equitable use of technology (Bowyer & Chamber, 2017).

RP12 and RP15 mentioned that it was quite a challenge in the first year but things got better:

RP12: *“In the first year I would say we were not digitally resourced and trained for online teaching and learning. It was quite challenging at first but it has improved and I have personally gained confidence”.*

RP15: *“I must say it was a bit of a challenge at first because the way in which we didn't have the facilities where we could deliver the lecture remotely immediately, so it was a steep learning curve to adapt to some software packages that we available.*

RP15 further gave insight that most part time lecturers struggled more:

“Speaking as the head of the program, I can say it was more challenging for part time staff as most of them are not even used to working on Moodle so it was learning curve for them too. In the end, there is always room for improvement and a skill to learn every day”.

RP11, RP12 and RP14 stated that they had been to training which enabled them to digitally resourceful:

RP11: *“There was training and continuous online support to use the tools that have been provided to staff. Lecturers have been able to use a variety of methods to present course material to students”.*

RP12: *“We have been taken to various training, where we are exposed to various programs and methods of teaching to enable to deliver a good lecture. I do however believe the university can do more”.*

RP14: *“For me I would say, before the lockdown the university afforded us an opportunity to choose and attend courses through extended learning program. Even though it was not targeted for online but somehow some of the courses came in handy. So, in general was quite sufficient”.*

RP13 shared a different opinion of the age difference factor where he mentioned that: *“Yeah, the skill set of particularly our cluster is above average in my view, so most of the lecturers did not struggle much to apply this kind of technology or platform to deliver the content in lectures, maybe apart from one or two. And in my view, it all has to do with age and maybe the elderly ones that are about to retire, I think they had a few challenges but they managed because of the support they had around them. The younger academics I worked with had suggestions on how to apply technology in our teaching methods and that assisted a lot”.*

4.4.4.1.2 Ensuring that technology-enhanced learning was simple, engaging, transferable, and comprehensive for students

The design adopted by the lecturer should facilitate teaching and aid the delivery of knowledge to enhance students' learning outcomes (So & Brush, 2008). This practice involves academic staff employing appropriate course design style for successful BL teaching. Consequently, lecturers should adopt the most applicable instructional strategies that support teaching objectives, where such strategies facilitate the transfer of learning and ensures that the learning objectives are achieved (Poon, 2012). Moreover, online course materials provided must be prudently selected to assist effective teaching and learning process. Accordingly, Edward (2002) maintained that a distinct course structure should include course schedule, purpose of course activities and specifically mention the online and offline mode of delivery to improve students' performance.

RP11, RP12 and RP13 mentioned that they felt students were logging in but not attending as there was little participation and no engagement:

RP11: *"No, I don't think students engage with online lectures as comprehensively as face to face because I think what's missing on the online, like from my point of view as a teacher is some kind of feedback. OK, when you teach online, particularly the pre-recorded lectures, you do not get feedback from the students whereby if you are in a class you get like certain nonverbal clues like for example body language"*.

RP12: *"It was absolutely horrible; the students were not engaging. We were basically talking to blank screens most of the times, they used to login then disappear. When you ask questions, no one is there. It was not easy to get them to engage as we wanted, but if the students don't participate, you know there's nothing we can do"*.

RP12 also stated that: *"They also didn't want to switch on video so you can at least read their interactions. Online teaching and learning were terrible, I hated it, I hope we will get back to normal physical lectures soon, our students are missing out on so much"*.

RP13: *"I think that the lecturers did their best to make sure that the technology used or applied was as simple as possible. This is due to the fact that for example, during our*

staff meetings we engaged on using different platforms which of course were proposed by the university”.

RP13 continued that: *“It might not have been as engaging as we expected but we tried our best, by using breakaway rooms and kept asking questions. The engagement was not the same during face-to-face lectures, it was far less with online learning which is not ideal for engineering students. Some students just logged on and you would never hear from them afterwards”.*

The approach for RP15 complemented the views of Kaur (2013) who stated that academic staffs should employ instructional practices and best strategies that engage their students learning and also deploy required changes in respond to the students’ academic needs:

“Yeah, this again depended on the individual and what tools they could use. Some people prefer maybe to make videos and then get the students to watch them. Initially it worked a bit, but overtime I think one had to find creative ways in order to keep the students engaged. So yeah, that was a bit of a challenge, but personally I had to find ways to be innovative. For instance, I did assessments within certain lectures where we would do an activity within the online lecture and I award marks for participation. In that way, it forced students to attend online lectures and also to engage and participate”.

RP14 narrated that *“It is very difficult to answer this question but I am going to be brutally honest. The issue of simple and engaging was quite a challenge, maybe transferable would be easily applicable, I will explain why.*

Simple: “No, it was not simple but possible. At first, we had many different challenges with students at many levels. Some of the issues was getting students to be online on time. We have some students that come from previously disadvantage background where there is no adequate network connectivity. Things became much better in 2021 when students could be accommodated at residence and could be on campus with adequate network coverage”.

Engaging: “Once we covered the connectivity part was covered, we then struggled to get students to engage. The issue of engaging the student was quite a challenge because you

literally have to push them around to make sure that they understand, get them to follow what you're doing now”.

Transferable: “in that way I was able to transfer the knowledge and information effectively to students”.

4.4.4.1.3 The contribution of lecturers to increased access to pedagogical transformation and training

The rapid advancement of information technology (IT) has significantly changed the method used by academicians to deliver course materials (Baboolal-Frank, 2021). A transformative pedagogy is an innovative pedagogical approach that empowers learners to critically examine their contexts, beliefs, values, knowledge and attitudes with the goal of developing spaces for self- reflection, appreciation of diversity and critical thinking (Farren, 2016).

RP11 mentioned that innovative transformation does not substitute physical presence: *“Engineering is a domain where you have to be physically onsite and you cannot have the same experience without it, even with virtual reality tools it’s not the same, there is no substitute for it and students are coming short due to that”.*

RP12 and RP15 indicated that the university allowed them to explore alternatives that suits them:

RP12:” *Yeah, definitely, they provided us with a broad sort of guideline, and they've basically left how we run the modules up to us. So, I think that that has been great from the university side”.*

RP15: *“I think so, especially with the fact that it was difficult to conduct the practicals in some instances, so one had to do some simulations or things like that. So, we were given more or less leeway to find ways in which we could enhance. The landing aspect, without necessarily being the office”.*

There is now an opportunity to use a variety of online environments to enhance student learning, which has altered the way students learn by utilizing cutting-edge mediums like

digital books, mobile devices, videos, social media, etc (Fernandez, Ramesh, & Manivannan, 2022).

RP13 concurred with this view: *“I believe being one of the lecturers that was teaching a practical module, we had to get innovative. We learned to use different channels, programs and so on. I had to create, run scripts and demonstrate that during an online lecture which got students interested. I also recorded videos and played the video clips in class. In my modules I definitely explored widely interactive and innovative teaching methods, even though I would have done should there have been prior planning and a proper budget for it”*.

RP14 shared a different opinion where she mentioned assessments, limitation and budget constraint:

RP14: *“This part of teaching and learning called for us to learn to adapt, be creative and innovative. There were materials provided for staff on how to conducting lectures but the greatest challenge for me was assessments. Much of the tasks, especially for the School of Engineering, where, for example they need to submit drawings, figures, and etc. That became quite a challenge. How do you access that? And those are some of the components which could not easily be removed from the curriculum. Otherwise, you start interfering with the quality of your program. There were a lot of limitations to this as there was no budget to fully be innovative but we used what we could”*.

4.5 Chapter summary

This chapters' primary purpose was on the presentation, analysis of results and discussion attained from fifteen (15) participants, which were then connected to four (4) objectives of this study. The cogent dominant and emerging themes were also encapsulated to make provision of the salient features in the discussion of the results that is predicated on the thematic analysis utilisation. To clarify the literature support offered, the participants' comments compared and integrated the literature review and concomitant theoretical underpinnings described in chapter 2 of this study. According to their knowledge and expertise, the participants were able to respond to questions that presented by the researcher to the study participants in soliciting the comprehensive and robust analysis,

application and identification of the results. The next chapter explicate on the recommendations, findings and limitations of the study.

Chapter 5

Findings, Recommendations and Conclusion

5.1 Introduction

The preceding chapter highlighted findings from the interviews and a theory-based analysis. The research problem and the study's goals are reviewed in this chapter; where the summary of the research methodology is then followed by a summary of the research's findings; along with recommendations and conclusions; the chapter offers ideas for additional research. The recommendations are made up of suggestions offered by participants during the interviews as well as the researcher's opinion; this is accomplished by drawing conclusions from earlier chapters and applying the theoretical frameworks that chapter two used to categorize this study. The study only looked at engineering students at the university of KwaZulu-Natal and it has no bearing on other students or institutions.

5.2 Purpose of the study

The core mandate of as an educational institution, is to provide advancement of knowledge through teaching, scholarly research and to promote access of students to higher education institutions. Some of UKZNs' goals are to "achieve excellence in teaching and learning; achieve excellence and high impact in research, innovation and entrepreneurship". The way in which a lecture is carried out plays a critical and crucial role in any institution, given students backgrounds, in ensuring the set of an institutions vision and goals are achieved as planned (Bozkurt & Sharma, 2020). Baboolal-Frank (2021) concurred with Bozkurt and Sharma (2020) that due to a variety of variables, including the teaching approach, the lack of resources like computers and internet connectivity as well as the interaction process in the RTL platform, RTL negatively affects students' willingness to learn. Therefore, the purpose of this study was to assess the impact of RTL on engineering students at UKZN amid COVID-19 pandemic and

lockdown, where students had to abruptly shift from traditional face-to-face method of teaching to adapting to remote teaching and learning.

5.3 Consolidation and Summary of Key findings of research findings

The questions addressed to the many participants in this research study are contextualized by a summary of the research findings in the paragraphs that follow. The preceding chapter's highlighted themes and categories are also covered.

The COVID-19 pandemic has immensely impacted how the academic environment respond to the effects and influence it has caused in the educational sector, locally and globally (Adnan & Anwar, 2020). As a result, the academic authorities' strategies, tactics, and activities for disseminating the pedagogical curriculum and the associated platform for effective teaching and learning delivery have changed paradigms (Baboolal-Frank, 2021). This necessitated adjustment of methods used to deliver an academic programme, causing a shift from face-to-face to online / blended learning (Bozkurt & Sharma, 2020). Additionally, the students' cognitive impact has triggered a systemic and logical intervention in the delivery of RTL programs (Ferri, Grifoni, & Guzzo, 2020).

5.3.1 Objective one: “to critically explore the impact of RTL on UKZN engineering students during the COVID-19 pandemic”

While the effective of use of blended learning is dependence on technology. Having a conducive home environment, access to study materials, interactive and effective participation in blended learning is paramount for assessing the impact of RTL on UKZN engineering students amid COVID-19 pandemic (Tremblay, Lalancette, & Roseveare, 2012). According to Fabriz, Mendzheritskaya and Stehle (2021), blended learning is an interplay between how the students interact with one another, the lecturer, and even the other students in the class. Moreover, inadequate network connectivity and not having appropriate resources is some of the challenges that students were faced with which hinders their participation in online learning (Bate, 2021).

This links to what was revealed during the interviews, that most students (RPs) had transitional challenges that did not allow them to participate in blended learning effectively. Some of the challenges they narrated related to not having adequate access to study materials on time due to either network connectivity and/or load shedding. Further to that, some RPs articulated that they usually had internet connectivity issues but other than that they could hear the lecturer clearly and they were able to interact with the lecturer and the entire class even though the interaction was not the same during face-to-face classes.

Key Findings Summary for Objective One

While the impact of the paradigm shift to the RTL has been a rather headwind experience for the respondents, the main challenges were associated with both external and internal factors that could be described as transitory rather than fundamental which depict the agility and the nimbleness nature of amongst other things self-directed learning mantra that the students inherently possess.

According to Fabriz *et al.*, (2021), a good study environment is one that encourages us to focus on our duties because, otherwise, it could lead to distractions that make it difficult for us to stay on track. The environment in which students learn and study has an impact on their productivity Kadir *et al.*, (2022).

The study found that most of the students (RPs) that indicated that they did not have a conducive environment at home mentioned that they had to change their daily routine, and / or move from their homes to residences in order for them to be in a conducive environment for online learning.

5.3.2 Objective two: “to analyse strategies that could be applicable during COVID-19 crisis that can be used to close the gaps of practical work and simulations for UKZN engineering students”

Computer, information and internet literacy is a necessary skill nowadays (Herring, 2009). Through remote desktop access, walk-in support, student computer laboratories, and classroom technology support, faculty and staff can access systems (Lau & Yuen,

2014). On the other hand, the role of adequacy of network coverage plays a major role as every activity in BL requires technology (Bokolo, et al., 2019).

The findings revealed that students (RPs) had sufficient digital skills to participate seamlessly and effectively in BL. The findings further revealed that there was suitable support from ICS staff / LAN Manager where students had access to systems remotely which they didn't have access to. Further to that, the findings exhibit that the lack of adequate network coverage or connectivity issues emanated from either unavailability of electricity (load shedding) or general internet connectivity problems either at their homes or residence. This affected them greatly as some missed lectures because of this.

Key Findings Summary for Objective Two

The summary of the key findings that integrate the literature overview and the empirical data depicts the contingency oriented interventionist strategy that the educational authorities had to adopt and execute in an effort to navigate during the turbulent and force majeure realization that had not only engulfed the academic and the pedagogical sector but the broader society and the global fraternity at large. The sudden surge of the online platform usage due to hybrid learning and interaction put a strain on the virtual gadgets and devices but the changing experience has been more manageable than plain catastrophic.

5.3.3 Objective three: “to determine the extent of the level of pedagogical and academic resources required in facilitating RTL on the UKZN engineering students”

A person's living environment has a significant impact on how they respond to adversities and go on to acquire self-determination. How productive students are is influenced by the environment in which they study and learn (Farren, 2016). The study revealed that students had to change their daily routine, their mindset and others had to buy new computer devices and accessories to create a conducive environment for themselves. The use of group work in the classroom is one of the most researched and practiced teaching methods in the world. Numerous research studies have shown the benefits of

collaborative learning on student academic performance, communication skills, and confidence (Viegasa, et al., 2018).

The findings revealed that the unavailability of adequate resources impeded students' (RPs) progress when completing assignments/projects. They further stated that even though they managed well with individual assignments but they faced more challenges with group work as it needed more from them, in terms of risk of complacency, unequal workload, disagreement between fellow group mates, and a loss of concentration on the task at hand, which was not the case when they had access to a computer LAN and adequate meeting space.

Computer labs let students' study, use software, complete tasks, and interact with their peers and one's aptitude in the lab and adherence to the rules of laboratory operations define who is considered an engineer (Singh, Steele, & Singh, 2021).

The findings of the study revealed that engineering is a practical module, therefore the importance of laboratory work or practical training in some of the modules is vital and some students (RPs) felt robbed of this opportunity as they did not have practicals for other modules. On the other hand, LS students (RPs) indicated that this is not so important as they either had an opportunity to do some practical's a year before or would have to do it the following year. In essence, the findings suggest that there are no adequate strategies to close the gap of practical laboratory work.

Key Findings Summary for Objective Three

The summary of the key findings reveals the fundamental consideration in the towards the investment into educational technological resources that goes far and beyond just the learning management systems (LMS) but also that take cognisance of the ever-increasing e-commerce nature of the new dawn of the 4IR and beyond. This is to accelerate the recovery and rebound should a technological paradigm shift surface as exhibited by both the TAM 1& 2 theories elucidated. The educational authorities had to strike a delicate equilibrium given the practical nature of the engineering curriculum with its dependency on apparatus for pragmatic and rational academic and pedagogical offerings to not only the students but the entire engineering community of practice.

5.3.4 Objective four: “to assess the adaptability perception readiness and transition of UKZN engineering students in acquiring a curriculum within RTL dissemination platform”

Throughout the pandemic, a variety of platforms and techniques were used to support online teaching and learning (Bowyer & Chamber, 2017). For the purposes of teaching and learning processes, lecturers can incorporate various interactive technologies and systems, such as multimedia technologies and applications (Fleck, 2012). Therefore, the efficient use of technology by lecturers is essential for BL for teaching and learning (Bozkurt & Sharma, 2020).

The findings revealed that for most academics it was quite a challenge in the first year (2020) as they were not well prepared and not digitally resourced to deliver a remote lecture and it was a steep learning curve. However, things got better in 2021 where we had gained confidence through training. It was further revealed that part time lecturers struggled more as they do not benefit the same due to their unavailability for training.

Academic staff members should use teaching methods and best practices that motivate students to study while also implementing the necessary adjustments to meet the academic demands of the students (Affouneh, Salha, & Khlaif, 2020). In cases where such tactics help with the transfer of learning and guarantee that the learning objectives are met, lecturers should employ the most appropriate instructional strategies that support teaching objectives to ensure effective engagement with students (Shin & Hickey, 2020).

The findings revealed technology-enhanced was not simple, not engaging but the academics did their best to transfer comprehensive lesson to students. It was also revealed that students were logging in but not attending as there was little participation and no engagement with online lectures as comprehensively as face to face due to lack of feedback from students.

The way academics distribute course materials has changed dramatically as a result of the rapid progress of information technology. The purpose of a transformational pedagogy is to create places for critical thinking, self-reflection, and an appreciation of diversity by empowering students to critically analyze their contexts, beliefs, values, knowledge, and attitudes (Farren, 2016). Due of the openness and flexibility of educational use, educators

were pushed to develop more creative instructional methods (Sandanayake, 2019). Teachers should use innovative techniques to foster social interactions in the blended learning era, such as peer-facilitated discussion boards, video-based course materials, group-based assessment tasks that demand analytical thinking on the part of the students, practical experience for students and learning activities that improve students' capacity for self-learning (Bokolo, et al., 2019).

The findings revealed that no amount of creative and innovative transformation substitute physical presence, in this case laboratory or practical work. The findings revealed that there was a lot of limitations to this as there was no budget to fully be innovative.

Key Findings Summary for Objective Four

The summary of the key findings indicated that while the ubiquity of the winds of technological change is an existential and contemporary phenomenon, the creativity or the inventiveness that is provided by the disruption from the previous academic business model of curriculum delivery is a challenge but not beyond solution agility and the adaptability of both the students, academic and the professionals service personnel. The changing dynamics corroborate what the respondents provided which has also been supported and corroborated by the elements of the ADKAR model and the strategic impetus that could be consolidate in the strategically academic balance scorecard of financial (monetary resources), internal process (hybrid learning, internet access, LMS, practical laboratory adjustment to TRL scenarios), knowledge and growth (the epitome of curriculum acquisition) and customers (the very same engineering students who are future engine of the society and the broader economy).

5.4 Recommendations of the study

5.4.1 Objective one: “to critically explore the impact of RTL on UKZN engineering students during the COVID-19 pandemic”

While assessing engineering student’s ability to participate effectively in blended learning, it was discovered that engineering students at UKZN are faced with numerous challenges i.e., access to study materials, effective interaction and participation during

online classes and nonconductive home environment which hinders effective participation in blended learning. In order to deal with these challenges, the researcher recommends that the said institution ensures that:

- a) All engineering students have adequate access to internet and data in order for them to be able to access study material on time; interact and participate effectively in blended learning.
- b) All engineering students that do not have a conducive environment at home be moved to residences, prior proper background checks to be done.

5.4.2 Objective two: “to analyse strategies that could be applicable during COVID-19 crisis that can be used to close the gaps of practical work and simulations for UKZN engineering students”

The level of digital resource-sufficiency is paramount in facilitating seamless participation in blended learning. This was examined through assessing students’ level of digital skills, availability and support from support staff i.e. ICS staff / LAN Manager and assessing the role of adequacy on network coverage.

The study found that students only had issues with the latter, hence the researcher recommends that:

- a) The University of KwaZulu-Natal should apply to the Department of Higher Education and Training to add Remote Teaching and Learning (RTL) as another permanent mode of teaching in all its campuses.
- b) The researcher recommends that the UKZN officially adopt contemporary blended learning, to allow the same students in the same course to experience both synchronous engagements, where participants are doing the same thing at the same time, and asynchronous engagement, where students are learning together separately at different times. This will allow students to be able to catch up where they missed a lecture, it could be due inadequate network coverage and / or due to load shedding.

5.4.3 Objective three: “to determine the extent of the level of pedagogical and academic resources required in facilitating RTL on the UKZN engineering students”

It has been recorded that there were some constraints in home or learning environment that hindered some students to successfully participate in blended learning. An investigation to check what changes students made to create a conducive environment for themselves; what challenges they had with completing individual and group assignments and lastly the importance of laboratory work on their studies.

In order to deal with challenges faced by engineering students at UKZN, the researcher recommends that the said institution ensures that:

- a) All engineering students that do not have a conducive environment at home be moved to residences, proper background checks to be done
- b) All engineering students have a computer device (desktop or laptop) with the right specification to allow them to run all the powerful engineering software they require for their studies, including a camera and microphone for desktop users
- c) In absence of item one, the necessary engineering students have access to adequate use of remote software that allows “end users to run applications and desktops independently of the device’s operating system and interface” eg citrix
- d) All engineering students have adequate access to internet and data in order for them to be able to interact and participate effectively in blended learning

5.4.4 Objective four: “to assess the adaptability perception readiness and transition of UKZN engineering students in acquiring a curriculum within RTL dissemination platform”

In order to make appropriate use of innovative resources, the university's infrastructure should make sure that employees have the chance to perform at their jobs and support students' teaching and learning. The following is recommended:

- a) The University of KwaZulu-Natal should apply to the Department of Higher Education and Training to add Remote Teaching and Learning (RTL) as another permanent mode of teaching in all its campuses.
- b) RTL should be introduced to complement and additional to the traditional form of teaching which is face-to-face interaction. The introduction of RTL would give students and prospective students a choice to either enroll for face-to-face or RTL format of teaching and learning in pursuit of their studies.
- c) The university has adequate hybrid teaching facilities, in terms of hardware and software infrastructure that accommodate both face-to-face and remote attendance.
- d) UKZN to hire more lecturers, professional and support staff with the introduction of RTL as permanent mode of teaching – thereby, helping to reduce the country's triple challenge of unemployment, poverty and inequality.
- e) The academics to be vastly trained to be able to enforce engagement with students during online lectures to ensure that learning is simple, engaging, transferrable and comprehensive
- f) Academics to be given more leeway to use pedagogical resources and the appropriate budget to complement this

5.5 Limitations to the study

The choice of selecting research participants was challenging because it depended on their availability and willingness to participate in the sampling that I was after. Despite their eagerness to comply, several respondents were unable to honestly answer the questions that were asked. I observed that the respondents made an effort to provide responses that they believed would satisfy me as the researcher. I constantly reminded the respondents that they were allowed to react whatever they saw fit in order for their own (many) opinions and experiences to be gathered and presented objectively. The way ICT policies are implemented in different educational institutions may vary from how it is done at UKZN. Since this study was conducted on engineering students at UKZN, its conclusions

are specific to them and cannot be extrapolated to the entire field of educational institutions.

5.6 Managerial implications and the key insights of the study

- a) The institution might consider a pilot project of some engineering studies as a dry run to test market suitability, sustainability and incrementally increase with time as a medium to long term objective, which might require the institutional leadership buy in, in terms of execution and monitoring and evaluation of its efficacy and viability. The key insights is the application of the contingency plan during turbulent environment which is ordinarily force majeure.
- b) UKZN would attract a far greater number of students should it also offer RTL as an option for studies because there are potentially many prospective students who are willing to pursue their studies but are rendered unable to because of the face-to-face mode of teaching and learning. There are people who are working, running businesses or involved in many activities which render them unable to attend classes during the day. The key insight is the agility that an institution of higher learning should take into account incorporating the latest and state of the art cutting edge transition to an online and blended learning and not wait for a catastrophe to happen.
- c) There is a big pool of potential students locally – within the nine provinces in the country – who can consider to pursue their studies at UKZN should RTL be made a permanent format. This is because unlike the face-to-face mode; they would not be compelled to migrate to KZN province or specifically, Durban or Pietermaritzburg to attend classes. They can log into a lecture anywhere in the country and access the study materials online including recorded lectures, if they had missed it. The key insight is that the role of technology advancement has become an indispensable tool and tactic not only to address a crisis but also to expand the institutional bottom line of sustainability.
- d) The number of international students would increase as well because of the RTL format. Students can access lectures and study materials online anywhere they

may be in the world. The key insight centers around enrolment target that could be improved as the wider reach is not restricted by in person learning.

- e) As the number of students that UKZN attracts increases; the number of students that graduate would also increase, thus improving the stature of UKZN as an academic institution both domestically and globally. The key insight is a widened labor market absorption that contributions to the broader economic stimulus of the society as a whole.
- f) UKZN could choose to phase-in RTL by firstly introducing it permanently at specific schools and courses e.g. School of Social Science, School of Accounting and Economics, School of Religious Studies and School of Education etc. where migration from face-face to RTL is not a big challenge because there is not much practical work that is needed by students. The key insight will be to make a thorough research and development budget accessible in the anticipation of future catastrophe's such as those experienced during COVID-19.
- g) The introduction of RTL as an independent format of teaching would bring much needed revenue to UKZN as they it would attract a number of students that would enroll. The key insight is that RTL could make provision for a plausible and credible legitimate way of widening the institutional footprint as a result of blended technology in the mode of T&L delivery.

5.7 Contributions to the body of knowledge

Access to adequate use of remote software that allows a student to access a computer on campus remotely, access to a computer device, access to data, adequate network coverage, and a conducive home environment is some of the things that enable engineering students to effectively participate in RTL or BL. The university should focus on addressing issues faced primarily due to students geographical and socio-economic environments, such as inconducive environment, poor network coverage, lack of internet connectivity, lack of electricity, and their socio-economic impediments.

5.8 Recommendations for future research

There are other dimensions that this study does not address because they are not its main focus. Future research studies could focus on how to assess the impact of remote teaching and learning on all students in other institutions as well. Instead of concentrating on just one department in one institution, this study might be broadened and enhanced by including a larger group of participants from several institutions and from all students. There are studies on blended learning (BL) adoption, but there are few that focus on how well BL works in teaching and learning; this gap has to be filled. For instance, there are insufficient research that looked at whether BL practice can encourage students to do better in class. Furthermore, there are few researches that examine the effectiveness of BL in teaching, despite the crucial role lecturers play in BL.

5.9 Conclusion

The results in this study indicated the main constructs that informed the research phenomenon of RTL insights and views of the students and the academics in their navigation of the turbulent environment that affected the business-as-usual interactions, transitions, operations and the broader academic and stakeholder academics and pedagogical ecosystem within the remote teaching and learning that they had to adopted and executed. The was able to unpack the constructs that revealed the evolving and challenging constraints, barriers and the accomplishments that has been experienced within these VUCA times that took all and sundry including the stakeholders in the pedagogical and academy fraternity and specifically with the engineering school and faculty.

Various literature sources were overviewed and the associated theoretical underpinnings were part of the study discourse that support the conclusions drawn from the participants' contributions were analysed, integrated and synthesised. The findings conclusion that can be drawn from this study is that a conducive environment is paramount in effective blended learning. It is evident that adequate network connectivity resources and cognate educational technological oriented gadgets and devices is a basic right to participate in

blended learning within the evolving and changing scenarios. It was revealed that more could be done in terms of creating an appropriate financial resource in the form of investment in technological budgets to compliment digital sufficiency and pedagogical resources. Recommendations have been made for further research that supports engineering students at University of KwaZulu-Natal.

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Appendix A: Gate keepers' letter



25 August 2021

Ms Sijabulile Oliver (SN 219073752)
School of Engineering
College of Agriculture, Engineering & Science
Howard College Campus UKZN
Email: 219073752@stu.ukzn.ac.za Oliver@ukzn.ac.za

Dear Ms Oliver

RE: PERMISSION TO CONDUCT RESEARCH

Gatekeeper's permission is hereby granted for you to conduct research at the University of KwaZulu-Natal (UKZN), towards your postgraduate degree, provided Ethical clearance has been obtained. We note the title of your research project is:

"The impact of remote teaching and learning on engineering students at University of KwaZulu-Natal."

It is noted that you will be constituting your sample by conducting interviews with Engineering students within Cluster of Civil, Land Surveying and Agricultural Engineering (Taking in account the regulations imposed during lockdown ie restrictions on gatherings, travel, social distancing etc. Zoom, Skype or telephone interviews recommended) on the Howard College Campus.

Please ensure that the following appears on your notice/questionnaire:

- Ethical clearance number;
- Research title and details of the research, the researcher and the supervisor;
- Consent form is attached to the notice/questionnaire and to be signed by user before he/she fills in questionnaire;
- gatekeepers approval by the Registrar.

You are not authorized to contact staff and students using the 'Microsoft Outlook' address book. Identity numbers and email addresses of individuals are not a matter of public record and are protected according to Section 14 of the South African Constitution, as well as the Protection of Public Information Act. For the release of such information over to yourself for research purposes, the University of KwaZulu-Natal will need express consent from the relevant data subjects. Data collected must be treated with due confidentiality and anonymity.

Yours sincerely

Dr KE CLELAND: REGISTRAR

Office of the Registrar

Postal Address: Private Bag X54001, Durban, 4000, South Africa

Telephone: +27 (0)31 260 7971 Email: registrar@ukzn.ac.za Website: www.ukzn.ac.za

Founding Campuses: ■ Edgewood ■ Howard College ■ Medical School ■ Pietermaritzburg ■ Westville

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Appendix B: Informed consent letter

Informed Consent Letter
UNIVERSITY OF KWAZULU-NATAL
GRADUATE SCHOOL OF BUSINESS AND LEADERSHIP

Dear Respondent,

Master of Business Administration

Researcher: Sijabulile Oliver (219073752) 081 4554 357

219073752@stu.ukzn.ac.za / Oliver@ukzn.ac.za

Supervisor: Dr Tony Ngwenya (031 260 7825)

Ngwenyat2@ukzn.ac.za

Research Office: HSSREC (031) 260 8350/3587

Email: hssrec@ukzn.ac.za

My name is Sijabulile Oliver. I am an MBA student at the Graduate School of Business and Leadership of the University of KwaZulu-Natal (Student number: 219073752). You are invited to participate in a research project entitled:

"The impact of remote teaching and learning on engineering students at University of Kwa-Zulu Natal (UKZN)".

The aim of this research is to describe and identify the effect and the influence that has been created by the COVID-19 pandemic on the student's curriculum acquisition which has resulted in galvanizing not only the safety protocols but also the persistent quality teaching and learning delivery. The study will aim to unpack the pertinent strategies and execution deliverables for the seamless undertaking expected by the students. The academic environment has not been immune in consolidating and synthesizing its resources from an asynchronies and synchronise mode of curriculum delivery. The study will evaluate perceptual variables that the students are encountering in an attempt to mitigate the transitory shock.

I volunteer to participate in a research project conducted by Sijabulile Oliver from the University of KwaZulu- Natal. I understand that this research project is designed to study **The impact of remote teaching and learning on engineering students at University of Kwa-Zulu Natal (UKZN)".**

As a student and/or employee at **University of Kwa-Zulu Natal (UKZN)**, I understand that I am being invited to take part in an interview. I understand that in agreeing to participate:

- My participation is voluntary. I understand that I will not be paid for my participation.
- The interview will last approximately 30 minutes. Notes will be written during the interview and/or an audio taped. I can decline to be recorded.
- I understand that if I feel uncomfortable in any way during the interview, I have the right to decline to answer any question or ask to leave the interview session.

- I understand that the researcher will not identify me by name in any reports using the information obtained from the interview. My confidentiality as a participant will remain secure. Subsequent uses of recordings and data will be subject to standard data use policies which protect anonymity of individuals and institutions.
- Administrative and other teaching staff at (UKZN) will neither be present during the interview nor have access to raw notes or transcripts of the interview. This precaution will prevent any of the findings having personal negative repercussions for me.
- If I choose to be interviewed, I have the right to view and comment on the transcribed interview data before the findings are analyzed.
- I have read and understand the participant information sheet provided to me. I have had all my questions answered to my satisfaction, and I voluntarily agree to participate in this study.
- I have been given a copy of this informed consent form.

Your participation in this research project is voluntary. You may refuse to participate or withdraw from the project at any time with no negative consequence. There will be no monetary gain from participating in this survey/focus group discussion. Confidentiality and anonymity of records identifying you as a participant will be maintained by the Graduate School of Business and Leadership, UKZN.

If you have any questions or concerns about participating in this study, you may contact me or my supervisor at the numbers listed above.

Sincerely,

Researcher/Investigator's signature:  Date: 06/10/2021

CONSENT

I.....(full names of participant) hereby confirm that I understand the contents of this document and the nature of the research project, and I consent to participating in the research project. I understand that I am at liberty to withdraw from the project at any time, should I so desire.

Audio Recording: Yes / No

SIGNATURE OF PARTICIPANT

DATE

.....

.....

Appendix C: Interview questions / schedule

An interview schedule for the research

Interviewee Name:

Date of the interview:

1. Transitional challenges that you need to take into consideration to enable you to effectively participate in remote learning lectures

- 1.1. How do you deal with any challenges you encounter when trying to access study materials on time to enable you to participate effectively in all the synchronous classes?
- 1.2. What is your experience when you are logged in to join online lectures, hear the lecturer clearly, follow the lecturers' screen and interact with the lecturer during online lectures?
- 1.3. What makes the environment at home conducive to enable you to effectively participate in synchronous learning?

2. The extent of the digital resource-sufficiency in your household in facilitating your seamless participation in remote learning

- 2.1. Why would you consider yourself to have sufficient digital skills to enable you to participate effectively in an online lecture?
- 2.2. To what extent is the ICS staff available to assist you to successfully engage in a remote lecture and to optimally use the resources available to you?
- 2.3. What role does the adequacy of network coverage or lack thereof in your home play in enabling you to participate in RTL activities?

3. Constraints on your successful preparedness and participation in RTL in your home or learning environment

- 3.1. What are the changes that you had to go through to create an environment and space that can be described as conducive and ready for remote learning?
- 3.2. What are the challenges and constraints that one encounters when completing an individual or group assignment or a project without having access to a computer LAN and / or laboratory?
- 3.3. How important is laboratory work or practical training in any of your modules and how does RTL affect that part of training?

4. The impact on students of UKZN lecturers using different pedagogical resources in facilitating lectures in an online platform

- 4.1. How would you describe UKZN lecturer's skillset, training in terms of resourced digitally to optimally deliver a successful lecture online to students?
- 4.2. To what extent do lecturers ensure that technology-enhanced learning was simple, engaging, transferable, and comprehensive for students?
- 4.3. How does UKZN RTL and online lectures contribute to the facilitation of increased access to pedagogical transformation and training?

Appendix D: Ethical clearance approval letter



08 October 2021

Sijabulile Happiness Oliver (219073752)
Grad School Of Bus & Leadership
Westville Campus

Dear SH Oliver,

Protocol reference number: HSSREC/00003397/2021
Project title: The impact of remote teaching and learning on engineering students at university of KwaZulu-Natal
Degree: Masters

Approval Notification – Expedited Application

This letter serves to notify you that your application received on 14 September 2021 in connection with the above, was reviewed by the Humanities and Social Sciences Research Ethics Committee (HSSREC) and the protocol has been granted **FULL APPROVAL**.

Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through the amendment/modification prior to its implementation. In case you have further queries, please quote the above reference number. **PLEASE NOTE:** Research data should be securely stored in the discipline/department for a period of 5 years.

This approval is valid until 08 October 2022.

To ensure uninterrupted approval of this study beyond the approval expiry date, a progress report must be submitted to the Research Office on the appropriate form 2 - 3 months before the expiry date. A close-out report to be submitted when study is finished.

All research conducted during the COVID-19 period must adhere to the national and UKZN guidelines.

HSSREC is registered with the South African National Research Ethics Council (REC-040414-040).

Yours sincerely,



Professor Dipane Hlalele (Chair)

/dd

Humanities and Social Sciences Research Ethics Committee

Postal Address: Private Bag X54001, Durban, 4000, South Africa

Telephone: +27 (0)31 250 8330/4557/3587 Email: hssrec@ukzn.ac.za Website: <http://research.ukzn.ac.za/Research-Ethics>

Founding Campuses:  Edgewood  Howard College  Medical School  Pietermaritzburg  Westville

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Appendix E: Turnitin report

Dissertation: The Impact of RTL		
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3	Ahmad Farit Mazlan, Maslawati Mohamad, Aishath Reesha, Rosnani Kassim, Zarina Othman, Saadiyah Kummin. "Challenges and Strategies to Enhance Online Remote Teaching and Learning by Tertiary Institution Educators: A Literature Review", Creative Education, 2021 Publication	<1 %
4	Lydia Mavuru, Oniccah Koketso Pila, Anesu Gelfand Kuhudzai. "Pre-Service Teachers' Levels of Adaptations to Remote Teaching and Learning at A University in A Developing Country in the Context of COVID-19", International Journal of Higher Education, 2021 Publication	<1 %



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THE IMPACT OF REMOTE TEACHING AND LEARNING
ON SUBMITTING TEACHERS AT UNIVERSITY OF
KwaZulu-Natal

Author:
Sijabulile Oliver

Dissertation

1. Introduction

2. Literature Review

3. Methodology

4. Results

5. Discussion

6. Conclusion

7. References

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