DURBAN UNIVERSITY OF TECHNOLOGY

ADOPTION OF DIGITAL TOOLS FOR BLENDED LEARNING BY LECTURERS AT THE DURBAN UNIVERSITY OF TECHNOLOGY: THE DIFFUSION OF INNOVATION THEORY.

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ABSTRACT

This research study investigates the adoption of digital tools for blended learning by lecturers at the Durban University of Technology (DUT) through the Diffusion of Innovation theory. Blended learning is a pedagogical approach that combines face-to-face instruction with online technology, has gained prominence in contemporary higher education settings. However, understanding the factors influencing lecturer adoption of digital tools within this context remains critical for successful implementation.

The primary aim of this study is to identify the key factors that impact the adoption of digital tools for blended learning among lecturers at DUT. The research employs the Diffusion of Innovation theory, which offers a framework to comprehend how and why innovations are adopted. The theory's key constructs, such as observability, complexity, compatibility, trialability and relative advantage, are utilised to assess the adoption behaviour of lecturers.

Furthermore, the study explores how these identified factors may influence lecturers' attitudes towards using digital tools for blended learning. The research provided valuable insights into promoting positive attitudes towards integrating digital tools into blended learning practices.

The study's objectives encompass applying the Diffusion of Innovation. The research seeks to enhance the understanding of how this theory can effectively support and inform the adoption of innovative technologies in higher education settings.

Moreover, the research endeavoured to ascertain the attitude of lecturers towards digital tools for blended learning at DUT. Gaining insight into lecturer attitudes is crucial for fostering a positive teaching and learning experience, enabling students to benefit from the best educational practices.

The research methodology involved a quantitative approach using the purposive sampling technique through surveys. This approach ensured a comprehensive understanding of the complex dynamics that shape lecturers' adoption of digital tools for blended learning.

Ultimately, this study's findings contribute to the existing body of knowledge on blended learning adoption, offering practical implications for educational institutions, lecturers and policymakers in enhancing the successful integration of digital tools for effective blended learning experiences at DUT and potentially beyond.

Keywords: Blended learning, Digital adoption, Diffusion of innovation, DUT

DECLARATION

I, Gabriella Govender, hereby declare that this dissertation submitted for a Master of Management Sciences Business Administration, Faculty of Management Sciences at the Durban University of Technology, is my original work and has not been submitted to any other institution.

I further declare that the references that are cited have been acknowledged in the References List.

Signature: ____ _

Student Number: 20918479

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ABBREVIATIONS

MML Multi Modal Learning

MOOC Massive Open Online Courses

TFL Technology for Learning

DUT Durban University of Technology

BL Blended Learning

SCT Social Cognitive Theory

ZPD Zone of Proximal Development

IBM Integrated Behavioural Model

DOI Diffusion of Innovation

TPB Theory of Planned Behaviour

TRA Theory of Reasoned Action

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CHAPTER ONE: OVERVIEW OF THE STUDY

1.1 BACKGROUND OF THE STUDY

Higher Education is undergoing a rapid transformation in the teaching and learning process with the introduction of blended learning, which combines in-person and online learning and further introduces digital tools specifically designed for the blended learning environment. The technological evolution has created, developed and changed the way educational content is delivered in the Higher Education space, creating a diverse and innovative praxis (Goncalves and Pedro 2012: 105), The rapid expansion and limited budgets within institutions as well as the social demands which requires improved access to resources in higher education has given rise to institutions now investing in online learning programmes and digital tools. Adopting publishers' resources for teaching and learning has been the norm for decades in universities around the world, each developing a strategy around how it can be implemented. The methods of accessing publisher content have evolved over the years towards the introduction of electronic books, online learning platforms, course material, instructor and learning resources, and the importance of using digital tools within higher education has in recent years become the responsibility of not just lecturers but academic libraries (Omarsaib et al. 2022: 1-13). With universities taking a blended approach to teaching, learning and assessment incorporating digital tools in their everyday teaching and learning, libraries have also taken on the responsibility to give students access to adopted available resources, recommended electronic resources and additional support tools. The introduction of technology could also create policy changes in institutions, which may impact the way in which teaching and learning are conducted (van Blerk 2019)

During the Covid -19 Pandemic and lockdown globally, people were placed on a level 5 lockdown and only required to travel if necessary. This applied to universities as well, which were required to move to emergency remote teaching and learning and move students from face-to-face to online classes. In the case of the Durban University of Technology who had started implementing the Multimodal approach to learning before the 2020 Covid-19 pandemic (Omulando and Osabwa 2021: 12), lecturers were ready for the shift into emergency remote teaching and learning, which involved integrating their content and pedagogy into the online environment (Ally, Pillay and Govender 2022). Historically, traditional methods of using print textbooks and other learning materials were preferred by lecturers at the university, with traditional learning methods being researched. However, with the introduction of multimodal learning at the Durban University of Technology in 2020, the blended approach (traditional printed teaching and learning resources and electronic resources) being adopted throughout the university showed the progress being made in the transition towards the digital environment. In higher education institutions, the

application of multimodal teaching approaches like blended learning, flipped classrooms, interactive activities, collaboration and new assessments is becoming increasingly crucial because of the digital environment (Cabanero 2022: 63–67).

One of the key factors in blended teaching and learning is technology and the use of digital tools in the higher education space, according to Wieland (2020: 84-92). Lecturers historically did not have the flexibility or affordability to be able to use innovative techniques and technology to address issues within the learning environment (DUT Celt 2020:1). The introduction of the Multimodal and Remote Approach included the following:

- Microsoft Teams – access, support and training;
- Review of the modules to support online learning;
- MOOCs and webinars being set up;
- Online Assessments; and
- Technology for Learning.

The Technology for learning included: Moodle, Microsoft Teams, the DUT Facebook page, the DUT Instagram page and a WhatsApp group being set up to support students.

1.2 FOCUS OF THE STUDY

The adoption of digital tools has brought about advancements and innovations in e-resources and digital access with the changes in the method of learning. Lecturers' adoption of digital tools and their preference for resources now needs to be considered. With lecturers being required to adopt digital tools and with the growing number of products available, acquiring information on lecturers' adoption process when it comes to digital has become important. According to La Morte (2019: 2), researchers have discovered that an early adopter of an innovation has very distinct characteristics compared to adopters at late stages. As a result, it is crucial to understand the traits of the target population when considering an innovation to promote to them. In this case lecturers, which may assist or become a disadvantage in the adoption of the innovation, especially if one is not addressing the specific customer need or understand what type of adopter the customer is. In this study, the innovative product is digital tools used for blended learning. Schiffman and Wisenblit (2018: 99),explains the five established adopter categories that the Diffusion of Innovation theory focuses on namely: **innovators**, who are first in line to try the new products. Innovators take risks and often want to be the first to develop or try now products and consider new ideas. **Early adopters** are the thought leaders. They are the adopters who embrace the use of new innovations and are always aware of changes taking place in their industry and are the most comfortable with adopting new ideas. The next two categories are the **early and late**

majority respectively. The early majority very rarely adopt new ideas because they need to see evidence that it works before adopting, whereas the late majority are apprehensive about making changes and only adopt if it has been tried by the majority. Lastly, the **laggards** are traditional and the hardest to get on board to adopt a new product.

The adoption stages for digital tools vary according to the lecturer's abilities, capabilities, experience and preferences for using digital tools. According to Msomi and Bansilal (2019: 287), lecturers in universities of technology need to have the necessary skills to be able to successfully integrate digital tools into educational practice, especially in developing countries like South Africa. Therefore, the study identified the attitude of lecturers towards the adoption of digital tools for blended learning at the Durban University of Technology. The Diffusion of Innovation theory, defined as a process of embracing an innovation over time by members of a social system by Rogers (2003), was used as the key theory of innovation. Using the DOI Theory as the basis for this study and taking into consideration how lecturers preferred to access resources and how they will continue to access resources, consideration is given to the attitude of lecturers using digital tools in a blended learning environment and those who prefer more traditional methods. In the context of DUT, the focus is on the factors that influence the adoption process.

The theory used for this study is Everett Rogers' Diffusion of Innovation Theory, which was first published in 1962, as a framework that explains how new ideas, products and technology are expanded within a population or social system. It was adapted in 2003 (Rogers 2003), Rogers' (2003) Theory suggests that the adoption process is constantly changing as different categories of adopters engage with technology and new ideas and disseminate them in different ways.

In South Africa, eLearning has become an essential component of efforts nationally to enhance higher education quality (Qwabe and Khumalo 2020:3). Goncalves and Pedro (2012), identified that an eLearning approach like Multimodal learning, which is used at the Durban University of Technology, is aimed at promoting the use of digital tools in teaching, learning and research. There are challenges in the implementation of eLearning technologies, as highlighted in Israel, Olarewaju, Wing, Naicker and Jali (2021), Universities are often not prepared in terms of systems in place, staffing matters and support staff, there is also a lack of integrating the traditional approach with the online approach (Singh and Padayachee 2017: 28), understanding lecturers challenges at the Durban University of Technology will be able to guide those implementing policies and making changes to improve eLearning. The introduction of blended Learning is allowing for its utilisation more often in higher education as it has the advantage of both a traditional and online teaching approach (Poon 2014: 155). Through blended learning, students can access material and resources on the internet that align with their interests and level of understanding, which provides a chance for professional development and allows lecturers time to enhance their skills. It also plays a role in enhancing the classroom environment (Guillén-

Gámez, Mayorga-Fernandez and Alvarez-Garcia: 2020; Owston, York and Malhotra: 2019: 30). Lectures have historically encouraged face-to-face learning in the traditional learning environment, as demonstrated by Maor (2017: 71–86), by using pencils to let students jot down concepts, take notes and do exams. The pencil is a well-known tangible instrument that is essential to learning. In the context of online learning, a range of digital tools, such as laptops, smartphones, tablets, software and online platforms, have a big impact on how students learn and teach. There are countless opportunities to engage with students online while using digital tools as facilitators during the learning process, still at students' fingertips just like the pencil.

Before the COVID-19 pandemic, academics were not obligated to expand their teaching strategies to include digital technologies and blended or hybrid learning approaches in face-to-face settings (Singh et al. 2022: 309). However, during the pandemic, academics had to give up on conventional teaching strategies to adjust to the digital age in an instant and as a result, research shows that digital pedagogies were acknowledged as a reality before the pandemic. This gained traction during the pandemic and was established as necessary for incorporation into multimodal teaching and learning techniques (Sappington and Bedford 2017: 798-799).

1.3 RESEARCH PROBLEM

Traditional printed textbooks have always been the first point of reference for lecturers. Lecturers prescribe the textbook, and students purchase based on the curriculum requirements (Landrum, Gurung and Spann 2012: 17-24). A study conducted by Bringula (2017: 2), found that students preferred printed textbooks over e-books. Presently, students belong to a technology-driven generation known as Generation Z, which has created significant changes in the publishing industry. Due to the advanced thinking and large changes with a focus on being digital, publishers will need to adapt to meet the generation's needs of being digital natives and social networkers (Hill 2017:350). Many publishers have adapted creating digital platforms, much like their print books, before however understanding and addressing the need and the pace of the lecturer using the product is vital (Lee and Lee 2023).

Although students and lecturers use printed textbooks, these are now complemented with electronic resources such as test banks, questions and answers, PowerPoints and online learning laboratories, which are considered when textbooks are prescribed by academic personnel at higher education institutions. The traditional model of publishing books has changed in the last century, with publishers changing their approach in the creation of content for Higher Education. Publishers had to come up with more cost effective, student facing approaches with the top academic publishers such as Pearson, Cengage, McGraw Hill and Macmillan Learning who have now enhanced their digital approach partnering with universities to offer tailor made digital

solutions for their tech-savvy students (Charkin and House 2023). According to McGraw-Hill (2019) as one of the publishers who embraced technology, their 2019 report showcased that their digital sales had overtaken print and Cengage Publishers developed a product called Cengage Unlimited, allowing students an unlimited subscription to their eBooks and online learning platforms (Cengage 2023). Until 2020, the Durban University of Technology was still conducting face-to-face lectures with the use of the Learning Management System, Moodle. However, in March 2020, South Africa was placed on level five lockdown (DUT Celt.2020:1), due to the Covid-19 pandemic in South Africa and throughout the world. Consequently, DUT had to adopt a multimodal platform of instruction for all courses to facilitate the transition from face-to-face contact teaching to Multi-Modal Learning (MML).

MML includes the use of Microsoft Teams, Massive Open Online Courses (MOOC), Webinars, Technology for Learning (TFL), and social media. The use of traditional textbooks needs to be revisited in the present online environment. One method of addressing the situation is the use of digital tools by lecturers to facilitate learning. The problem is also understanding lecturers' attitudes towards adopting and what type of adopter they are. After searching for topics in the proposed study using various search engines including Google Scholar, ProQuest, Emerald, and DUT Summon, the researcher found that there was information available on the adoption of digital tools by universities with a focus on the student perspective, adoption rate and Diffusion of Innovation. However, a knowledge gap was observed from the instructor's perspective. This is the basis for conducting the study looking at the lecturers' views on the adoption of digital tools for blended learning. According to Dintoe (2018: 56), current literature shows that accessibility and the use of available digital tools are low in developing countries. In South Africa and around the globe, the Covid-19 pandemic has brought about challenges to society in the form of job loss, lack of access to technology for learning, lack of facilities available at home to cater to online learning and the financial and emotional impact on families across the world. Before the pandemic and lockdown, the use of digital tools for blended learning was not emphasized at the university.

1.4 RESEARCH OBJECTIVES

1.4.1 Aim of the study

The aim or goal of this study is to determine the factors that influence the adoption of digital tools for blended learning by lecturers at DUT using the Diffusion of Innovation theory. In addition, the study strived to determine the attitude towards digital teaching and learning tools of subject lecturers at DUT.

1.4.2 Objectives of the Study

i. To determine the factors that influence the adoption of digital tools for blended learning at DUT.
ii. To apply the Diffusion of Innovation theory to using digital tools in a blended learning environment at DUT; and
iii. To ascertain the attitude of lecturers towards digital tools for blended learning at DUT.

1.5 RATIONALE FOR THE STUDY

A survey was conducted at the Durban University of Technology to determine the factors that influence the adoption of digital tools for blended learning by lecturers, as well as to understand their attitude, towards using digital tools with the Diffusion of Innovation theory, focusing on adoption, the theory was used to compare the adoption process and the adopters, based on their engagement with digital tools. This research is critical for DUT to know what lecturers need in order to succeed in their digital journey.

1.6 SCOPE OF THE STUDY

1.6.1 Delimitations

The study included full-time lecturers from the Durban University of Technology to participate, from both the Durban and Pietermaritzburg sites.

1.6.2 Limitations

The study questionnaire was sent out to lecturers listed on the DUT Staff Directory. One of the limitations was that lecturers did not respond to the questionnaire. It took a year to collect 182 out of the 247 responses required.

1.7 OVERVIEW OF THE RESEARCH METHODOLOGY

A quantitative approach was used for the study and the research was conducted as a descriptive study. According to Burns, Veeck and Bush (2017:143), quantitative research refers to survey research, which is quantitative research involving the administration of a set of structured questions with predetermined response options to many respondents. Maree (2020), explains that questionnaire design is an important part of the research process which requires data to be generated.

1.7.1 Target Population

The target population for the study is all lecturers at the Durban University of Technology identified using the DUT Address book. The population comprised 686 lecturers at the Durban University of Technology. The researcher collected responses from 182 of 247 lecturers from various DUT campuses through a questionnaire. McMillan and Schumacher (2014: 118), defines a population as an entire group of individuals from which a sample is drawn.

1.7.2 Sampling Technique

According to Salkind (2022: 179), there are two types of sampling techniques: probability and non-probability. A purposive sample of 247 lecturers across all seven DUT campuses was required to participate in the study. A non-probability sampling technique was used (McMillan and Schumacher 2014: 119). The selection of participants was based on the lecturers' experience with using digital tools and their attitude towards them.

1.7.3 Measurement Instrument and Questionnaire Design

A questionnaire that was created based on the literature review served as the research tool used for gathering the primary data required. The questionnaire consisted of open-ended, long and short questions and Likert Scale questions, which were all developed based on the objectives and the framework developed by the researcher.

1.7.4 Data Collection

Primary data sources were utilised. The term 'primary data' describes facts that a researcher has gathered or collected, especially for their current research (Burns, Veeck and Bush 2020). The respondents' email addresses were obtained from the DUT Staff Directory.

1.7.5 Pilot Study

The questionnaire was self-administered to 50 respondents, in the Durban Region. According to Burns, Veeck and Bush (2017 144:), a pilot involves conducting a dry run of the survey on a small set of participants. By doing this, one is pretesting the list of questions, making sure they are clear to participants. A pilot study was conducted at another university of technology in Durban using a self-developed structured questionnaire. A quantitative study was conducted as it is a popular method that can measure various characteristics, for example, actions, views and attitudes from large populations and draw conclusions or generalizations (Vijayendra, Fantone and Shehryar 2023: 23).

1.7.6 Validity and Reliability

According to Adu and Miles (2024:58), a good research instrument needs to be valid and reliable and needs to answer the proposed questions without bias. Validity is assessed by conducting a factor analysis and reliability is tested by using Cronbach Alpha tests. Validity and reliability are vital for assessing research measured in a quantitative study.

1.7.7 Anonymity and Confidentiality

Permission was requested from the Durban University of Technology to conduct the study on the campuses. Participants had to consent to completing the questionnaire before starting. Participants were informed of the nature of the study and that participation was voluntary. They could withdraw their participation at any time. Participants were also informed that the results would be processed anonymously, and all information would be kept confidential and only used for the research.

1.8 STRUCTURE OF THE CHAPTERS

Chapter One: Introduction

In this chapter, the focus of the study, research methodology, aim and objectives, and the rationale of the study were discussed.

Chapter Two: Literature Review

The chapter offers an extensive literature review, conducted on the Diffusion of Innovation theory, related literature on blended learning, digital tools, the university of technology and the adoption of digital tools.

Chapter Three: Research Methodology

This chapter presents the research design, research process, population and sampling methods, the sample, data collection methods, administration of the questionnaire, reliability and validity of the study.

Chapter Four: Results/Findings

Chapter Four focuses on an analysis and description of the results presented from the data collection. The data is presented in tables and graphs, with an explanation of information and findings.

Chapter Five: Conclusions/Discussion

In this chapter, the objectives are revisited, a conclusion is drawn from the results and the recommendations for further research are made.

1.9 SUMMARY

This chapter focused on a description of the parameters to be covered in this research. It includes the problem statement, aims and objectives, research methodology and the structure of the dissertation. The next chapter will review the literature that other researchers have analysed in order to determine the factors that influence the adoption of digital tools by lecturers. The theoretical concerns about the adoption process, lecturers' attitudes towards the adoption of digital tools and the link to the Diffusion of Innovation will be discussed.

CHAPTER TWO LITERATURE REVIEW

2.1 INTRODUCTION

Chapter One presented the focus of this study, it further highlighted the aim and objectives and stated the structure of the study. In this chapter, the following areas will be covered and explained by the researcher, blended learning, the adoption of digital tools, lecturers' attitudes and the Diffusion of Innovation theory. Having background knowledge is essential when framing the structure and relating it to the research problem. The theoretical framework guides the literature. Similar studies as well as studies conducted at the Durban University of Technology are provided to add context to the study. The use of printed textbooks is still important today. Asghar, Afzaal, Igbaal and Sadia (2022: 2), conducted a study that stated that face-to-face learning approaches were preferred over online learning. However, there has been an increase in universities making access to content online with both paid and free content and resources available for students, lecturers and researchers.

According to Charkin and House (2023), eBook service providers have updated their online websites, and mobile apps or mobile-friendly platforms, VitalSource and Kortext has implemented online and offline capabilities, and a greater emphasis is being placed on the university using digital. Hill (2017:350), identified the following factors were identified when looking at the growth of publishing in education and technology, namely: the cost of textbooks and learning materials, the gap in pricing which would provide a positive impact on digital textbook sales, having the easy availability of digital textbook content as compared to statistics but putting this into context. Reynolds (2011: 179), identified that the print demand was being addressed by using digital content and digital tools. The last decade has brought about significant change in publishing regarding digital tools and teaching and learning resources. Academic publishers are at a crossroads to decide whether to take the digital-first approach or remain largely print-based. According to Rosenblatt (2020), the process for writing for a publisher has adapted, initially an author is contracted for a few years to write up a new and updated edition of a book that will be purchased by students and subsequently sold to a second-hand market later however, the launch of e-books has changed the scenario. With the implementation of eBooks, students are now able to purchase perpetual or lifetime eBook access at a fraction of the cost, which contributes to the digital approach.

IGI Global (2020), defines digital tools as applications, programs or software that are available on a digital device (Laptop or smartphone). Digital tools in the context of a university could include but not be limited to massive open online courses (MOOC) Eli et al. (2018). The use of Blackboard or Moodle, Webinars, publisher hosted digital or online platforms including content all of which

require training and facilitation to incorporate into learning. According to Wookji, Michaelis and Waterman (2013), the introduction of technology, political pressure and high costs for resources have led to higher education institutions following the trends of using electronic resources. The use of tablets appears to be a substitute for smartphones and desktop computers as they have the potential to encourage purchases of a greater range of goods (Apergis 2019: 1), Smartphones now enable users to acquire information from non-store sources allowing for easier access to online searches, connection to Wi-Fi, camera and downloadable applications (Bhatnagar and Papatla 2019: 90).

Laptops are mostly used in lecture venues often not equipped with the connectivity for laptops whilst students use cell phones and tablets. Resources that don't need internet. According to the 2018 ANC Conference, there has been an ongoing debate around the lack of infrastructure in South Africa as a whole but also in Higher Education. Taking this into consideration, the Universities implemented professional development in the form of trainings as they upgraded their digital resources and as the infrastructure is being updated these professional development trainings are a way of upskilling their staff on the changes and advancements, (Teane 2024: 426). In the study by Langegard (2021: 23), 18% of students reported that there were technical limitations using digital tools. The most common technical issues is the limitation of lack of internet availability with the main limitation for lectures being the way lecturers use digital tools. According to Teane (2024: 427), the inadequate lack of infrastructure and availability of resources negatively impacts lecturer's efforts to implement technology. The Durban University of Technology is a Public University of Technology in Durban KwaZulu-Natal, founded in April 2002 with the merging of ML Sultan and Technikon Natal. With over 33000 students they are considered a first choice in Higher Education in KZN, prioritising quality teaching and learning. DUT is at the forefront of technological training as well as research and innovation. They are also an institution using multimodal learning methods, which include using Moodle, Microsoft Teams and various other tools to enhance learning. (Neerputh 2016: 45).

2.2 THEORETICAL FRAMEWORK WITH TECHNOLOGY ADOPTION

Higher Education Institutions were previously resistant to using the online environment for teaching and learning (Houlden and Velesianos 2020), but now there is an increase in opportunities and models available to be used for universities to develop their strategy supported using digital tools. Technology acceptance has been crucial in universities as they adapt to the change in environment. Theoretical Frameworks such as the Theory of Reasoned Action, Technology Acceptance Model, Theory of Planned Behaviour, UTAUT, Perceived Usefulness, Perceived Ease of Use and Diffusion of Innovation all can aid in reflecting on the adoption of digital tools for blended learning. There are several different theories and models on the

acceptance of technologies. (Theory of Reasoned Action, Technology Accepted Model, Theory of Planned Behaviour, Unified Theory of Acceptance and Use of Technology, Perceived Usefulness, Perceived Ease of Use and Diffusion of Innovation).

2.2.1 Theory of Reasoned Action

The Theory of Reasoned Action is one of several theories and models employed over the years to study users' technology adoption behaviour. The theory of reasoned action was developed by Martin Fishbein and Icek Ajzen in the late 1970s, TRA, according to Hagger (2019: 2), has since become one of the most influential approaches to understanding and predicting human behaviour.

According to Otieno (2016:1), Theory of Reasoned Action is commonly used as a foundation or a theory used to help build other theories, it was formulated by Fishbein (1979: 66), and was derived from attitude research using the expectancy value. The expectancy-value looks at the motivation, the relationship between an individual's expectations for success and the subjective task value (Wigfield: 1994: 50). It can be used to explain behaviour about to the use of technology.

The Theory of Reasoned Action has three general constructs, namely:

I. Behavioural Intention
II. Subjective Norms
III. Attitude

In this study, the Theory of Reasoned Action was used as a foundation to address our objective on attitude and social norms. The Theory of Reasoned Action also ties in well with our chosen theory of Diffusion of Innovation as attitude is an important element of Diffusion of Innovation Ajzen(1980:19), However, the limitations of TRA in this study is that it only relates to the behaviour or intention of the user and we need to understand other factors as well.

2.2.2 Technology Acceptance Model

The Technology Acceptance Model (TAM) examines the expression of interest in technology innovation. It was originally developed by Davis in 1986 as an adaptation of the Theory of Reasoned Action by Fishbein and Ajzen (1977). The adoption of digital tools and other technologies is explained in the Technology Accepted Model, which is commonly impacted by characteristics such as perceived usefulness and perceived ease of use. Perceived Usefulness, according to Al-Shami, Aldahmani, Kamalrudin, Al-Kumaim, and Al Mamun (2022:), is positively associated with the adoption of digital tools. Teo et al. (2019) proved that perceived usefulness had a significant impact on determining lecturers' attitudes towards using computers for teaching and learning. Furthermore, Perceived Usefulness had a direct effect on the intention to use newer technologies for teaching purposes. According to Davis (1986), Perceived Ease of Use is defined

as the expectancy of effortless and smooth usage of a system or technology. It is the continuous intention to use a specific digital tool and show the significance of effect and ease of use (Wu and Chen 2017). Over the last 20 years, a number of studies have been conducted on the use of technology and is the acceptance of digital tools for the purpose of improving knowledge in education. For example, Rubaai and Hashim (2019: 115), examined how lecturers accepted and used digital tools such as Massive Open Online Courses (MOOCs) for teaching English as an additional language. Similarly, Zhang, Yin, Lou and Yan (2017: 115), conducted a study on the implementation of blended learning in higher education using TAM, while Chan et al. (2018: 1079), explored attitudes related to the use of digital tools in MOOCs.

A study by Lazar, Panisoara and Panisoara (2020: 1), examined the use of digital technologies as a learning resource in a blended learning context using an extension of the Technology Accepted Model (TAM). The extension of TAM explains the potential factors that influence an individual's selection of digital tools in the context of blended learning in higher education. Furthermore, TAM also explores the use of technology in the workplace. TAM is embedded in the Theory of Reasoned Action and it centres on the adoption and usage of technology. According to Sobhanmanesh, Beheshti, Nouri, Chapparo, Raj and George (2023:155), the Technology Acceptance Model (TAM) focuses on two critical theoretical constructs namely, Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) as well as the user's perception which determines their intention to use a digital tool. Numerous studies have employed TAM as the theoretical foundation for explaining the adoption and use of ICT. However, the organisational and social elements that influence the adoption of technology are not taken into consideration in the TAM Model. Limitations for TAM in this study are that it needs to consider more factors that influence the adoption of digital tools and that there needs to be a social element when looking at lecturers' attitude.

2.2.3 Technology Acceptance in Higher Education

Technology has advanced so rapidly that lecturers around the world now interact with "digitally savvy" students who are used to using new technology every day and adapt to changes in technology relatively quickly. Apergis (2019: 2), conducted a study on the technology savviness of younger and older individuals. The study found that younger individuals preferred smartphones whilst older individuals are more inclined to use tablets, and the technological innovations give people the opportunity to learn more about and delve deeper into new concepts, ideas and objects or optimised processes. Individuals accept technology innovations based on their ability to demonstrate how effective their learning is. Dintoe's (2018: 56), Qualitative Study, discussed the Southern African landscape in using digital tools in Botswana. Digital tools at universities are adopted and diffused(included) in the Higher Education systems to improve access and allows

for development in infrastructure and education. Technology makes it easier to create, gather, store and use knowledge and information. It also makes it possible to collaborate on the development of knowledge, distribute knowledge products, and connect people globally (Spector, 2008: 249; von Davier, Hao, Liu and Kyllonen, 2017: 63). The Higher Education system in South Africa has historically grappled with a dual role: one of ensuring continuity and the other of fostering creativity and change. In this context, technology introduces new challenges and pressures for educational institutions (Romeo, Lloyd and Downes, 2013: 4).

The extent to which lecturers integrate technology into teaching and learning activities has been a subject of inquiry. Research has shown that integrating technology is a complex process of educational change, and the use of technology in Institutions varies significantly (Savelyeva (2015); Fraillon, Ainley, Schulz, Friedman and Gebrandt 2014). Despite the increasing use of educational technology in recent years, technology acceptance and usage have remained challenging for educational institutions (Berrett, Murphy and Sullivan 2012; Straub 2009: 626).

According to Durovic,Dlab and Hoic-Bozic (2019: 636), the factors that influence the use of a technology or digital tool in the education environment has had many questions raised. One way to assess lecturers' intention to incorporate a new digital tool into their teaching styles is to measure their use of adoption. A number of models including the Technology Acceptance Model and the Unified Theory of Acceptance and Use of Technology (UTAUT) have been developed and researched over a number of yeas to explain the mechanisms and variable that influence the adoption of digital tools and technology. These models have been based on well-known psychological theories, such as the Theory of Planned Behaviour (Ajzen 1991), and the Theory of Reasoned Action (Fishbein 1979: 66). The Unified Theory of Acceptance and Use of Technology (UTAUT), for example, considers performance, effort expectancy, the social impact and facilitating conditions are the four main factors that determine user intentions and actual technology use (Venkatesh, Morris, Davis and Davis 2003: 425). Gender, age, experience and the voluntary use of technology are considered to moderate the factors in UTAUT (Williams, Rana and Dwivedi 2015: 143) The UTAUT and TAM Models have similarities (Nistor and Heymann 2010: 143), and despite being more challenging to test, UTAUT is regarded as a strong model for measuring technology acceptance. Several Extensions and alternatives have been developed over time, with TAM and UTAUT being just two models of technology acceptance (Taherhoost 2018:1), However, the Technology Accepted Model does not explain the way technology is included and embraced in the classroom. The model does not specify the types of professional expertise lecturers need to integrate technology meaningfully (Scherer 2019: 15).

2.2.4 Unified Theory of Acceptance and Use of Technology

Venkatesh, Morris, Davis and Davis (2003), developed the unified theory of acceptance and use of technology (UTAUT) theory. According to Taherdoost (2018: 961). UTAUT identifies a user's intention to use a digital tool and looks at the usage behaviour in parallel, it was developed by consolidating several Technology Accepted Model theories including (Ajzen, 1991; Compeau et al. 1999; Fishbein and Ajzen 1977; Moore and Benbasat 1991; Thompson et al. 1991). These theories included Davis (1989: 320), Taylor and Todd (1995).

According to Or and Chapman (2021: 99), popular key terms from UTAUT are as follows:

- Effort Expectancy;
- Performance Expectancy;
- Social Influence;
- Facilitating Conditions.

All of the above areas were adapted from TAM Models. Perceived ease of use became effort expectancy, perceived usefulness became performance expectancy and social norms became social influence. UTAUT has also one additional construct which is facilitating conditions. Moonsamy (2015: 36), stated that to better utilise the UTAUT Model, one needs to understand the factors influencing lecturers' adoption of technology. The study further found that perceived ease of use and social influence did not have a huge impact on a lecturer adopting technology whereas perceived usefulness, user experience and facilitating conditions were found to highly influence a lecturer's decision to adopt. Facilitating conditions (FC) is the extent to which an individual may believe that there is an existing technical and organisational infrastructure to support the use of a system (Or and Chapman 2021:100). In the same way, experiences are the deciding factor rather than knowledge or ability when deciding what technology to use and how to use it. If the adopters' experiences and beliefs are not compatible the innovation will not be adopted. Although the Diffusion of Innovation Theory is the focus of the study and needs to be applied to the study as an objective, it includes all the theories listed when looking at the adoption of digital tools and lecturers' attitude towards blended learning so we will further discuss them as well.

2.2.5 Diffusion of Innovation Theory

According to Singhal (2012: 848), Rogers was a prominent figure in the field of social science, and he was widely known for his work on the Diffusion of Innovation theory. He passed away in October 2004, but his theory has lived on in contributions of research by Alhashem et al. (2023), Singhal (2012: 848), Venkatesh et al. (2003: 425) and Teo and Zhou, Wu and Chan (2014: 124),

to name a few. According to Kee (2017), research on the Diffusion of Innovation dates back 200 years, relationships in Diffusion are determined by the way individuals reacted to an innovation. It also suggests that individuals can influence a social system and introduce new ideas from outside of the social system.

Green (2011:1) derived that the Diffusion of Innovation Theory was developed by Rogers, the theory explains how new ideas and technology are spread within a social system. Rogers' 1962 Diffusion of Innovation Theory explores how new concepts, products or technical developments extend within a community or social structure. The adopters are classified into five categories: innovators, early adopters, early majority, late majority, and laggards, based on their willingness to accept innovations. There are four main elements in the Diffusion of Innovation: Innovation or idea, the channels of communication, the social system and time, each has a significant impact on the adoption of digital technologies. Rogers (2003), states that people who can adopt new technologies go through many stages: knowledge is the time a new user becomes aware of a technology. Persuasion is the process the user decides what he thinks of the technology. The decision is when the technology is potentially adopted by the user. Lastly, confirmation is when the person using the technology is looking for evidence to support adopting the new technology or he may decide to stop using it. There are several stages in the Diffusion process: evaluation, trial, adoption, awareness, and interest. Adoption rates are influenced by social systems, communication routes, and the perceived benefits and compatibility of innovations. Rogers (2003) The Diffusion of Innovation Theory, according to Rogers and Shoemaker (1971), has been extensively utilised in multiple areas, such as public health, technology adoption, and marketing, offering significant perspectives on the complexity of innovation adoption procedures. The Diffusion of Innovation theory by Rogers (2003), is most suited to understanding the adoption decision process of lecturers who have adopted digital tools.

2.3 ADOPTION PROCESS IN DIFFUSION OF INNOVATION

According to Rogers (2003), Diffusion is the way in which new ideas or innovations are communicated through channels and adopted amongst a social system over time. Haces and Macia (2024), define Diffusion of Innovation as a framework of analysis for examining the adoption and use of new ideas, techniques, or technology. DOI shares insight on how innovations are disseminated amongst diverse groups and countries and provides perspective into how innovations are accepted.

In the context of the adoption of digital tools and the adoption of technology, the following adoption categories in the Diffusion of Innovation according to Rogers (2003), apply and are discussed

below: Relative Advantage, Complexity, Trialability, Observability and Compatibility. These adoption categories are used to measure an innovation.

2.3.1 Relative Advantage

This explores the adoption of products. They would only be adopted if they are better than any other technology. Junglas, Goel, Ives and Harris (2019:318), describe relative advantage as having the advantage to use one technology over another technology with relative advantage being one influencing factor in predicting behaviour related to technology adoption. A study by Kim and Crowston (2011: 2), analysed the constructs of Diffusion of Innovation and relative advantage was found to have a positive relationship with attitude and intention to use. Perceived usefulness, Perceived Ease of Use and attitude influenced by compatibility, and complexity were found to have a negative relationship with intentions to adopt a new technology. Relative Advantage is the degree to which an innovation is perceived as being convenient or showing the benefit over another (Min et al. 2019: 6).

An innovation must be seen as better than another product to draw attention of new adopters. The advantage for the new adopter could be social, financial gain or other perceived gains. The notion of relative advantage is that it includes convincing someone to make a shift from their existing product to a new one. In the same way, a key predictor of technology adoption is perceived usefulness. Perceived usefulness can be seen as the potential user's evaluation or the possibility that they will implement a new technology which enhances their performance, offering a reward for meeting a KPI in their performance discussion (Kee 2017). In the context of agriculture, technology 4.0 refers to a development that aims to change from traditional to technological. In the process of adopting new technologies, the advantage of cost and efficiency are the benchmarks in the technology adoption process. Digitising agriculture can boost productivity, and output and preserve resources. In this study the conclusion derived was that technology had a relative advantage over traditional agriculture (Dewi, Cahyani and Megawati 2023: 303).

2.3.2 Complexity

According to Rogers (2003), if a product is easy to use, it is more likely to be adopted. Dryden-Palmer, Parshuman and Berta (2020: 2), found that innovations make it difficult to make changes where there are several groups, teams or stakeholders and steps involved. Complexity is a term used to describe how challenging it might be for a lecturer to use blended learning both in person and online, the study by Anthony et al. (2022: 531-578), highlighted that an element affecting this is how difficult and time-consuming it is to learn how to use blended learning. According to Kee (2017), the complexity of an innovation is harder to adopt if it is perceived as hard to use and

understand. Significant levels of complexity can result in the innovation being rejected, discontinued and misused which has left from the frustration. Complexity can be seen as the opposite of simplicity the notion of simplicity is the idea of perceived ease of use, which is the degree to which a technology is effortless and free of frustration when being used. Both simplicity and perceived ease of use are required for the likelihood of an innovation being adopted. According to Ayodele, Nwatu and Chiqbta (2020:14), the complexity of a smartphone is lower due to the ease of use, mostly attributed to the touch screen which was a new feature for the industry when it was introduced and was adopted by many as it replaced the keypad phones.

2.3.3 Trialability

A product is often adopted faster if the innovation has been through a trial or had previous experiments conducted. According to Banerjee (2012), it was discovered that trialability is necessary in translating the intention to adopt a technology. In the case of Dewi et al. (2023: 303), a higher rate of adoption is connected to the ability to trial or test a product, additionally, in Technology adoption it is expensive, especially in agriculture and farmers need to be sure before adopting. According to Kee (2017), trialability is important when an adopter tries out an innovation, it reduces uncertainty and risks.

2.3.4 Observability

Rogers (2003), states that observability is the extent to which an innovation's output or results are visible and can reflect the benefits of an innovation unnoticed by others. An innovation's visibility encourages word of mouth and contributes to an increase in the adoption rate of technology (Ayodele, Nwatu and Chighatu 2020: 14), One of the main drivers of technology adoption, according to Megawati (2023), is that the university needs to promote digital tools for blended learning for word of mouth to spread amongst the university community and boost observability of available digital resources. Dewi et al. (2023: 303), suggest that observability has a direct correlation with innovation acceptance, it relates to visible and positive results derived from the use of an innovation. The benefits of an innovation are seen in how easy it is to use (Ayodele et al. 2020: 15).

2.3.5 Compatibility

A product needs to be compatible with the user's needs, beliefs and norms. (Alhashem et al. 2023), Compatibility of a product or innovation influences the intention to adopt or purchase (Menon and Sujatha 2020: 1), previous research according to Sahin (2006:15), claims compatibility and Relative Advantage as similar. Compatibility is the degree to which an innovation

is thought to be in line with the needs and values of possible adopters. The use of a digital tool may be negatively influenced if it is not compatible with digital tools and does not satisfy a specific need. On the other hand, Dintoe (2018:55), maintains that if an adopter's beliefs are not compatible or aligned with an innovation it will not be adopted. Wang (2015:44), asserts that compatibility of using digital tools will promote the acceptance of using electronic resources. According to Kee (2017), for an innovation to be integrated into a social system it needs to be aligned with the cultural norms, it is yet to be seen if the adoption is due to the awareness, or the adopter's sense of need of an innovation.

According to a study by Booc et al. (2024), the behavioural intention of a lecturer to use blended learning was not significantly influenced by simplicity or trialability. However, behavioural intention to adopt innovative digital tool strategies were significantly increased when blended learning approaches were compatible with lecturers' instructional strategies, existing lecturing practices, and values. Compatibility is the degree to which an innovation is thought to be compatible with adopters. Any innovation is accepted more slowly when it is not compatible with the adopter's needs, values and experiences in a collaborative study conducted in 2014, which looked at the usability and compatibility of eBooks platforms and discovered that online or electronic books for more easily disseminated in a library setting because of compatibility with students accessing (Wang 2015: 45). According to Moonsamy (2015: 33), Rogers (2003), is a well-suited model when trying to understand a lecturer's adoption decision process but not well suited when trying to understand the reasons why lecturers may not adopt a digital tool.

2.4 ADOPTION OF INNOVATION

Moyo (2019:48), defines adoption as the decision to fully use an innovation and defines an innovation as anything new that is successfully incorporated into a social or economic process, which concurs with Rogers's (2003) definition thereof. Allan's (2020:4), analysis of the adoption of online assessments outlined two approaches: migration and transformation. In migration, technology is seen as the primary instrument moving from a traditional format to online; while in transformation, technology is positioned as a disruptive transformation which sets out to redefine the way Institutions approach assessment and testing (Allan 2020: 4). Adoption of innovation is the degree to which an innovation is now used. In the context of the technology and cell phone industry, it is based on the following constructs: Depth, Breadth, Diversity, and Volume. Depth, Breadth, Diversity, and Volume. According to Ayodele et al. (2020:15), there are two types of work that might result from the use of digital tools: the breadth, which measures how much the adoption of digital tools has improved interactions with lecturers, and the depth, which measures the degree of usage of digital tools in lectures. The academic experience gained from using a digital instrument could be the volume. Whilst universities look at adopting digital tools, Moyo (2019:44),

makes mention of the challenges faced and differences between developed and developing countries. Factors such as support staff or lack thereof, irregular Internet connection, and curriculum would need to be repackaged and in recent years load shedding has been a disadvantage. According to Kee (2017), a new product is said to have reached critical mass when it draws a sizeable number of users for the product to take off. To reach critical mass is to reach the point of having enough adopters of an innovation to make an impact and start widespread acceptance by others in the social system. Adoption happens when the threshold is reached the more adopters, the more the non-adopters will want to adopt. Rogers (2003), mentions that there are 5 stages that adopters go through when considering a new technology: knowledge, persuasion, decision, implementation and confirmation of the innovation that might be influenced by adopters' views on the innovation's attributes (Wang 2015: 65).

2.5 TYPES OF ADOPTERS

According to Sobhanmanesh et al. (2023: 155), the Diffusion of Innovation theory is focused on the way people adopt new technology, five adoption categories: Innovators, Early Adopters, Early Majority, Late Majority and Laggards. This study found that demand for innovation follows an S-shaped curve where the early minority, first the growth of innovation slows and reaches a saturation point.

There are five categories of adoption within Rogers' Theory of Diffusion of Innovation (Sahin 2006: 15), namely:

2.5.1 Innovators

New technical products, scientific knowledge, application techniques, and instruments that help solve problems for possible adoption are referred to as innovations (Ayodele et al. 2020:15). There are stages in innovation. According to Rogers (2003), states that Innovators are open to trying out new ideas. They come into the social system not being the most respected but are willing to take risks. Innovators are the first to accept an idea, willing to take leaps of faith, and ready to explore the newest trends which are essential to innovation because they spread it to others (Porter and Graham 2016: 749). Innovators, according to Kee (2017), are bold. They can comprehend complex technological information and have a high tolerance for working with technology, and they are seen as technology enthusiasts.

Innovators are those who take the initiative to try something new, taking a risk. At a certain age, according to Tshabalala et al. (2014), lecturers wonder if they want to try something new and fail. Ali (2022) concurred with Tshabalala et al. (2014), as lecturers may not want to try new technologies when they are unsure if they are capable.

2.5.2 Early Adopters

Early adopters according to Rogers (2003), are usually leaders within their organizations and others may come to them for advice or information. Thus, attitude is often looked at in reflection of early adopters once early adopters put their stamp of approval by adopting it others are likely to follow. Dintoe (2018:56), attributed experienced users of technology as being early adopters and their experience affects their attitude as they believe they are more technologically advanced (Wang, 2015:7). Furthermore, According to Rogers (2003), compatibility refers to the extent to which an innovation is considered consistent with their values, prior experiences and the needs of the adopters. Early adopters and the adoption rate within the parameters of Diffusion of Innovation. Early adopters were chosen as they are potential role models, and agents for change and may influence their peers.

A study by Dintoe (2018:54), explored compatibility in the context of early adopters within a social system and identified challenges identified by lecturers were infrastructure issues, lack of technology uses due to availability, lack of time to introduce anything new due to short syllabus and inadequate training. It also looked at the lecturers' attitudes, as they felt unsupported and rushed to implement, which caused resistance, and they could not participate in training. They needed support in professional development and training on how to use digital tools. In a comparative study, Dintoe (2019: 1), found that African countries still predominantly use print when compared to UK, US, and AUS universities. Early adopters have the capital to invest, are trendsetters and are regarded as thought leaders, they participate and identifying them in a group is critical in increasing technology adoption (Dewi et al. 2023: 304).Early adopters evaluate and accept an innovation after consideration, after adoption, they put a stamp of approval and others will come to them for guidance on both technical and pedagogical support.

According to Rogers (2003), those who embrace innovation are early adopters and assume leadership roles or serve as role models for others in technology sharing their guidance and expertise. Innovators are essential to the innovation process from the conception to the expectation stage. Participants in a study by Dintoe (2018:57), were not involved in the initial stages of innovation and felt their leadership roles were not acknowledged. Aspergers (2019), states that the basis for young people's early embrace of technological innovations is due to the social cognitive theory which recognises that an individual's knowledge is related to what they observe within social surroundings and that is what lecturers need to use to their advantage (Islam et al. 2023:1), Early adopters are more experienced in their use of technology for teaching and learning. Their attitude is based on their experiences according to (Dintoe 2018: 57). Research indicates that early adopters have a more positive attitude towards technology they are

experienced in using. The way lecturers feel about technology affects how well they integrate it into their lectures.

2.5.3 Early Majority

According to Cakiroglu et al. (2022: 88), although the early majority generally maintain relationships with the majority of the impacted society, they are reluctant to accept an innovation until there is strong evidence supporting its usefulness and value, as well as reliable recommendations from other adopters. The early majority, interact well within the social system as described by Rogers (2003). They are neither the first nor the last to adopt an innovation. Kee (2017), describes the early majority as the adoption process that takes place before average members in a system. They are in communication with the majority but are mostly hesitant to adopt an innovation until they receive facts to support why they should adopt. This is done largely due to peer pressure (Cakiroglu et al. 2022: 88).

2.5.4 Late Majority

The late majority will wait until their peers have adopted to do so, they are sceptical of innovation usually persuaded by peers, due only to pressure from peers and increasing economic pressure, the late majority members adopt an innovation after the early majority group. They are not willing to embrace innovations until the vast majority of the social system does, as they are having trouble with the technology and need assistance (Cakiroglu 2022: 88).

2.5.5 Laggards

According to Sahin (2006: 16), Laggards are more traditional and want to make sure, an innovation works before they adopt it, they only decide after looking at whether an innovation is successful. Laggards are generally suspicious of innovation and any technological change. Sceptics and far behind in being aware of innovation. (Kee 2017), Laggards also have constraints in terms of resources, they want to make sure an innovation works properly (Dewi et al. 2023: 304).

2.6 APPLYING DOI TO ADOPTION

The adoption of advanced technology, such as robotics and artificial intelligence, is rapidly increasing around the world (Sobhanmanesh et al. 2023: 156). According to McTavish (2019:76), there is a noticeable lag in academics understanding of the adoption of digital tools, educational technologies and pedagogy and it is important for universities as the higher education sector’s core business is teaching and learning. Virani et al. (2020: 1060), asserted that there are massive

open online courses (MOOCs) in the context of adoption, previous studies found that lecturer engagements with students with an online resource are adopted. However, the professional development for example, in using it is not considered enough. Tseng et al. (2019: 2), revealed that a lecturer's behavioural intention for example to adopt a digital tool was facilitated by social influence. Social Influence refers to the phenomena known as "social influence" describes how a person's actions, viewpoints, or beliefs change because of their relationships with others, frequently making them more like the people they are related to (Tierney, Rizvi and Ercikan 2023). It is important to note that the adoption of digital tools for blended learning could be strengthened by institutional policy and this will help the institution improve its pedagogical practices (Drysdale, Graham, Spring and Halverson 2013: 91).

The Department of Education (DoE), requires tertiary education institutions to set themselves apart from global benchmarks (DUT, 2008:2), and offer a combination of academic qualifications that will enable the University of Technology to develop the necessary skills in alignment with South Africa's national developmental needs and frameworks. Consequently, as described in Mistri (2016:79), eLearning was implemented at DUT. According to Philpot (2013:87), lecturers should be entrusted to lead themselves and their team of collaborators to select a digital tool that is appropriate for adoption at Institutions, and which will be put to good use and the digital tools implementation or experimentation should be pursued to boost learning. Online learning is an approach used to increase the availability of access to education and core learning at a reasonable cost (Zungu and Walji 2022:106). Online learning, a strategic objective and focus area at DUT, was not yet at full-scale implementation when the COVID-19 pandemic emerged in 2020. The Institution was forced into emergency remote teaching (ERT) rather than the planned eLearning strategy that DUT had proposed. The launch of the Learning Management System, initially Blackboard (Qwabe & Khumalo, 2020: 4), was subsequently changed to Moodle, called the Think Learn Zone and Microsoft Teams became a medium of communication and space where online lectures take place. Due to the emergency remote teaching, some students were not prepared for online learning at the University due to numerous challenges including “lack of laptops and network challenges especially in rural areas where data shortages, household chores, space constraints, noise and lack of supportive environment” (Hlengwa 2021:3433).

Consequently, significant socioeconomic implications occurred during the shift to online or blended learning in higher education where both lecturers and students had to retrain themselves to be able to adopt the newly integrated digital learning environment. The university had been working to gradually adopt and deploy online learning before COVID-19. Until then, professors had been employing a mixed or blended approach. Once students returned to university DUT adopted a mixed learning strategy once again. The university encouraged blended learning, through the Centre for Excellence in Learning and Technology (CELT), offering professional

development for teaching online. CELT used a MOOC approach –as the source of course content and learning activities which were supplemented by traditional interaction with an instructor to enhance the experience (Bruff, Fisher, McEwen and Smith 2013: 187), was an example used to prepare lecturers for online learning course design and teaching. The study by Zungu and Walji (2022: 106), revealed that the institutional plan for adopting online learning enabled staff to transition to ERT more easily. DUT was able to provide funding for data bundles for staff and students during the transition as well as to support them. According to Ali (2022), knowledge about the adoption of innovation and Diffusion of blended learning at a university level is limited, an important factor in influencing lecturers' adoption of digital tools is the student experience. According to Tshabalala, Ndeyu and van der Merve (2024: 101), students in this age are very interested in using technology and want to use it in and out of their lectures for teaching and learning. These students exhibit the aptitude, attitude and beliefs that are influenced by using technology. As a result, there is increased pressure on lecturers to use innovation in their delivery strategies, and blended learning has become the new medium for most universities globally.

The reason lecturers may resist changing the way they lecture from traditional to online according to Qwabe and Khumalo (2020: 3), is due to the pressure to manage an increase in administrative and teaching demands, finding the balance between learning and teaching activities, managing with the workload and flow of content, which is everchanging, students' questions and an increased demand for better cognitive learning. A study by Albrahim (2020), demonstrated how demanding, difficult and uncomfortable conducting online lectures is as it involves a lot of administrative work.

2.7 TRADITIONAL LEARNING

Historically, print material was instrumentally used in the traditional face-to-face learning environment. The term "traditional learning" refers to in-person lecturers in a traditional classroom setting (Baker and Unni 2018:40). Ren et al. (2020: 425), state that most of a course's instruction consists of instructor lectures delivered in the traditional face-to-face manner, and learners utilising the remaining time in class for collaboration and hands-on activities. Traditional learning is a term used to describe an approach which is not online nor digital for example face to face, lectures, reading print books and discussions in lecture venues. According to Spilski (2020: 5), although traditional learning may present limitations, in-contact lectures, time and space being an issue, new modes make it possible to learn regardless of time and space barriers. It improves the learning experience and a different type of collaboration but not without it challenges as eLearning

has disadvantages such as high costs for maintenance, platforms that require more frequent training.

Evaluation in face-to-face learning is subjective and is typically carried out methodically under the guidance of lecturers. Recent studies have shown it limits the students' potential skills and impacts their way of thinking. Students from the Asian region prefer traditional classroom learning over online and offline instruction, according to Baker and Unni (2018: 42). Vallee et al. (2020), refer to traditional learning as any non-blended learning, including face-to-face lectures, reading assignments, group discussions in the classroom, and non-digital interaction. Whilst students heavily relied on printed resources to access course content and conduct research, the University library was a central hub for accessing the required printed material and students submitting handwritten essays and reports to demonstrate their learning. Many students still prefer the handling of physical books for learning, the texture of pages, the ability to make notes in columns and highlight has always created for a sensory rich experience accompanied by a lecturer standing in front of the lecture venue and going through the content.

The use of printed material has been associated with better comprehension, cognitively students demonstrate better retention of information and reading is easier on the eyes (Clinton 2019: 288). Kong et al. (2018), corroborated this and found that student’s comprehension was better when using print versus online screen time. However, according to Stiegler – Balfour et al. (2022: 176), there has been a significant shift taking place over the last 15 years, electronic devices such as tablets, computers and smart phones were becoming commonplace. Delgado et al. (2018: 24), referred to the accessibility created by using devices as a stepping stone in more information being consumed daily than before, one of the requirements of traditional learning is that it requires the teachers' and students' physical presence at a set location and time (Kemp 2014). This is seen as a disadvantage and the reason students gravitate to blended learning for the flexibility. Face-to-face sessions were seen as more comfortable for students since they provide quick response to questions and practical experience. According to Tratnik et al. (2019: 37), in-person instruction contributed to higher levels of student satisfaction than online instruction. Research has also revealed, in contrast to the current findings, that students were happier with online learning than with in-person instruction (Kreth, Spirou, Budenstein and Melkers 2019: 356), and one has seen that students' use of digital technologies has increased when since switching from traditional in-person instruction to online learning, which incorporated technological advancements (Checa-Morales et al. 2021: 820). To adjust to the realities of the shift to blended learning and a digital environment, the roles of the teaching staff, administration, and services staff have changed.

Wookji, Michaels and Waterman (2023), discovered that most college students participating in blended learning courses had the understanding to switch between print and online text but

preferred printed text. More than 80% of students in a Canadian study on eLearning stated that they preferred reading print material over screen time. To cater to the different needs of their students, the majority of institutions must essentially adapt and combine traditional teaching methods with modern digital platforms (Smith and Johnson 2020:113). As a result, online learning has presented significant difficulties for students in Ghana (Barrot, Llenares and del Rosario 2021: 1). The purpose of effective teaching practices has been impacted in the Philippines where challenges of overcrowding in classrooms and a lack of supplies needed are of higher priority. The transition to online learning has presented learners with new obstacles that increase the already-existing issues in education. Furthermore, when technology develops rapidly, it becomes more complex, which has an effect on students' mental health (Manalo et al. 2022: 90). According to Tinashe (2021: 1) newer lecturers were more likely to embrace the use of technology compared to lecturers using the traditional methods for many years and now must diversify into using and offering students options to use digital tools. According to Ramroop (2021: 5), in the context of South Africa, a negative attitude towards technology is due to a lack of awareness, many universities struggle to use technology to improve their teaching and learning because they try to replicate the processes instead of changing it to suit their needs. The evolution of print based traditional learning and the shift to blended learning signifies the transition taking place in Higher Education. Whilst print and face-to-face learning still plays a significant role, blended learning has opened new possibilities in teaching and learning at universities. As the blended learning approach is being embraced more, educators continue to create an inclusive learning environment and more creative ways of engaging with students. According to Anthony et al. (2022: 531-578), the perception that traditional learning is more efficient than blended learning could create a negative attitude towards blended learning.

2.8 BLENDED LEARNING

With the implementation of blended learning in universities, there are several changes that will take place to ensure that universities and students are able to transition. Blended learning is often implemented with institutions using a Learning Management System. According to Ali (2022), despite the widespread use of blended learning, universities generally make decisions individually and not collectively whereas the actual adoption of a digital tool is achieved at subject level by lecturers, more importantly research suggests that we have little understanding about aspects of institutional implementation of blended learning such as the implementation of strategies and processes. Universities are using blended learning as a mixed approach, which allows both online learning and traditional learning to take place. We have seen the trends shift towards blended approaches in the last decade. Lecturers embrace teaching methods that align with their teaching needs (Ali 2022), establishing critical infrastructure, reliable internet and adequate software and

hardware improve Institutions approach and readiness to use digital tools and allows students to embrace online and blended learning. According to Anthony et al. (2022: 531-578), lecturers that have prior computer knowledge and experience with using it are more likely to be less anxious and favour the use of digital tools for blended learning. In Tshabalala (2021: 20), the lecturers felt the university had done enough in facilitating eLearning services and that colleagues that took the initiative to enhance the use of digital tools for teaching and learning encouraged others, the leverage off of interacting with the digital platforms and learning from colleagues. According to Danushka and Weerasinghe (2021), Blended learning incorporates both in-person and online training to provide students a greater flexibility and continuity in how the classes are delivered. Blended Learning involves a combination of face-to-face and online learning. This approach allows students to access course material at their own pace, engage in online discussions, and participate in collaborative learning activities (Graham, Allan and Ure 2005: 2), a 'thoughtful blend of in-person and online learning experiences'(Hill and Smith 2023). Albiladi and Alshareef (2019: 232), attribute the motivation for learning English can be enhanced and developed, and the interest of learners to study the language is all possible to improve through the usage of blended learning. The introduction of electronic textbooks and the limitations in just focussing on eLearning led to the development of blended learning, a learning process where both face-to-face learning and online learning is combined with specific digital tools (Alammary 2019:2).

2.8.1 Significance of Blended Learning (Importance and Relevance)

Researchers recommend that a more strategically led approach to blended learning and its implementation be championed to achieve institutional adoption and the benefits that this can bring. According to Hill and Smith (2023), committed and collaborative leadership that establishes strategic direction and commits to implementation is essential. A study by Apergis (2019: 2), identified that compared to more experience users, the younger generation known as the millennials are the first to have grown up in a digital environment with greater digital exposure and can identify with it more effortlessly. Research in blended learning suggests that little is known about blended learning and Diffusion of Innovation at an institutional level (Ali 2022). This becomes problematic because a lack of blended learning knowledge at institutional level could lead to difficulties with implementing policy and supporting lecturers, without these measures in place lecturers and students may not have a favourable experience in using digital tools.

Wang (2015: 10) and Bond et al. (2018:6), maintain that the importance of the Centre for Teaching and Learning is in supporting lecturers at a university faculty in developing their skills and assisting them with the use of digital tools as methods for blended learning. When looking at the lecturer's attitude towards using digital tools for blended learning the cognitive presence of a student's needs to be taken into consideration Garrison, Anderson and Archer (2001: 8), define cognitive

presence as the extent to which students understand and constructs their understanding through reflection. According to Akyol and Garrison (2011: 235 - 237), there are frameworks designed to create a more meaningful experience for students in online learning, taking this into consideration lecturers need to purposefully interact with students and collaborate with them to attain a meaningful outcome in the online learning environment. The use of Information and Communication Technology (ICT) In various processes to support and enhance learning in higher education institutions is known as eLearning and it includes using digital tools to supplement traditional learning instruction. (Akorful and Abaidoo 2015). A study by Amhag, Hellstrom and Stigmar (2019: 203), showed that 87% of respondents felt that they need medium or extensive training to support students who are moving to a blended learning approach and working online.

2.8.2 Historical Background

As technology and teaching approaches continue to advance, blended learning has been implemented in more universities globally (Booc, Liporada, and Galo 2024). Most universities have adapted their traditional teaching practices and are incorporating digital tools to meet the diverse needs of students (Smith and Johnson 2020: 113). Arkorful and Abaidoo (2015), investigated the effectiveness of using eLearning in teaching higher education. It was interesting to note eLearning models like the blended learning models and defined blended learning as the delivery of course content and course delivery which is shared between traditional learning method and online methods in the classroom setting. Formal learning is classroom-based, structured, and supported by institutions (Deng and Tavares 2015: 1). Innovations such as blended learning require alignment with institutional objectives, simplicity of use, and early evidence of benefits to succeed in educational settings (Ali 2022). Blended learning has been an increasingly popular topic, Hooshyar et al. (2019: 2366), looked at the impact Open learner models have on enhancing self-regulated learning in higher education. Open learner models (OLMs) are designed for use by learners to enhance and support them in online learning (Bulk and Kay 2006). Although not directly related to the study it has been found to have a positive impact on students' learning process and promote active thinking.

2.8.3 Key Milestones in the Development of Blended Learning for Universities of Technology

Within the academic community, and especially at the University of Technology (UoT), the Diffusion of Innovation theory provided a framework for understanding how new ideas spread both inside and outside of the academic ecosystem. With guidance from Rogers' groundbreaking work, "Diffusion of Innovations.", academics at the University are able to carefully navigate the phases of innovation adoption, starting from the innovative actions of innovators and early adopters and

ending with the acceptance by the early and late majority and laggards. Through the integration of these varied viewpoints, UoT can work towards fostering an innovative culture by carefully navigating through the stages of Diffusion to accelerate the uptake of cutting-edge technology within its academic community and in the larger society. Whilst lecturers have had to adjust to online learning and reports indicate that student and learner experience to learning online during COVID – 19 were not ideal, whilst prior to COVID-19 many students would have resisted taking online courses we now see that they find the flexibility, convenience and are pleased with learning anywhere and at any time (Lowenthal and Trespalacios 2022: 60). Higher Education institutions are undergoing a transformation period in their teaching and learning procedures, with the main goal of giving students the skills and capabilities they need to grow as individuals in a complex and uncertain society. These capabilities or skills are referred to as 21st century skills (Liesa-Orus et al. 2020). According to a study by Dintoe (2018: 55), South Africa has advanced in the ICT agenda in a manner which is like that of North Africa where users in higher education have a greater access to bandwidth and resources. A study by Omarsaib (2022: 2), stated that prior to the pandemic digital pedagogies were being taught in the blended and face to face setting. Blended Learning is seen as one of the most viable methods of delivery of training to remote areas and for students to access materials. Whilst most professional development programs have concentrated on technology usage when implementing blended learning techniques rather than linking it to pedagogical approaches. When it comes to understanding blended learning lecturer training programmes that combine technology use with pedagogy and subject knowledge that their courses perform better when assessed in over courses that only focused on technology usage (Asghar et al. 2022: 3).

Lecturers using blended learning for their lectures have classes that pay better attention as blended learning focus on a learner centric approach, several issues impacting blended learning were insufficient training of lecturers, the inability to use cutting edge technology and the lack of financial support (Vaughan, Reali, Stenbom and Mcdonald 2017:103).

2.9 THEORETICAL FRAMEWORKS

2.9.1 Learning Theories Supporting Blended Learning

The Diffusion of Innovation model was the theory chosen as it offers insight into how new innovations, much like integrating technology into the lecture room in Higher Education can spread amongst individuals in the environment considering factors like perceived usefulness, compatibility, complexity in implementing opportunities to run trials. Innovations like blended learning require alignment with institutional goals, need to be user-friendly and demonstrate the benefit for them to succeed (Booc, Liporada and Galo 2024).

2.9.2 Models of Blended Learning

One enhanced learning model used in blended learning is the rotational mode. The three main factors are compatibility, observability and relative advantage. The findings of a study by Booc et al. (2024), suggested that the focus should be on making sure that an innovation being adopted is in line with users and is seen as a preferred option. In order to help lecturers and students see the advantage and use the technology, in this case digital tools are required for adequate training and support.

The second Model is the Flex Model, according to Asghar et al. (2022: 3), the core focus of the flex model is using digital tools with lecturer supervision; this model enables lecturers to include instructional resources in a flexible way.

2.9.3 Pedagogical Approaches and Strategies

The Durban University of Technology uses the multimodal learning approach which was brought into full effect in higher education during the COVID-19 pandemic. According to Alameri et al. (2020: 21), digital tools such as Moodle, Microsoft Teams and Zoom platforms became the way lecturers interacted with students for teaching and learning. According to a study by Omarsaib (2023:149), 76% of Respondents indicated they always or often use digital tools in their online environment to lecture.

A study by Ally, Pillay and Govender (2022: 1), found that regarding gender and learning preferences, majority of men and women that took part in their study showed a preference for multimodal learning. According to Cabanero (2022: 63), In higher education institutions, the adoption of multimodal teaching approaches, like blended learning, flipped classroom, interactive activities and collaborating online is becoming important due to the digital environment. Technology has been the main factor in digital teaching and learning.

2.9.4 Implementation of Blended Learning

The use of digital tools is not just seen as a choice within higher education for blended learning, but according to Archibald et al. (2019: 2), using digital tools like Zoom and Microsoft Teams is an option for researchers conducting interviews to be able to reach participants. Zoom is seen as a collaborative cloud-based video conferencing tool which offers features including chats and online meetings (zoom video conferencing inc 2016). In the African context, although the cell phone is a compatible device for online learning, the connectivity and data cost were a deterrent for lecturers and students (Dintoe 2018: 55). Academic, research and cultural resources are now more easily accessible because to digital libraries like ITSI, VitalSource, Ebsco and ProQuest (Bharat and

Rahul 2020).These platforms provide a multitude of knowledge and a broad variety of multimedia resources, surpassing geographic boundaries (Bharat and Rahul 2020).These digital libraries now include e-books as a main component, especially interactive ones that provide rich information and customised learning experiences (Kesim 2017: 9824). Different user groups utilise electronic book library (EBL e-books)—like those in ProQuest—differently; undergraduates, for example, prefer print materials (Lewellen, Bischof and Plum 2016: 151).

Students' engagement through e-textbooks allows for a more seamless, portable, transferable and searchable experience with enhanced features available today. The capabilities have the potential to transform teaching and learning in the future by increasing student engagement and deepening their understanding of how content is accessed (Wang 2015: 7), According to Aithal and Aithal (2020: 337), online resources for prescribed textbooks offer a better alternative in comparison to the traditional textbooks, for example a student may forget to bring their textbook but if it is digital they will have access to it off their handheld device. DUT invests in an online library, Library/CELT prepare webinars, greater awareness about available digital tools for lecturers. Students today use online resources in a variety of methods to enhance their learning, according to Gledhill (2017: 693). A study by Teane (2024: 426), shows that lecturers using Microsoft Teams platform recognised its efficiency and the ability to use virtual engagement, their ability to join meetings and workshops remotely was a contributing factor in them wanting to use it as a digital tool. According to Apergis (2019: 2), generally males and females have different decision-making processes when considering the digital tools or technology they will adopt and use, which makes having a higher confidence rate in using technology compared to females. According to Wang (2015: 15), those who support the use of e-textbooks feel more confident with the increase in adoption of online resources, in Higher Education all the characteristics of e-textbooks presented in a digital format represent the importance and willingness of users. Hsu and Lin (2020: 1) noted that lecturers today are confident in using technology but less confident in designing content to support using technology. With this, Hsu and Lin (2020: 1), highlighted that there was a lack of confidents and competence which needed attention and directly resulted in the levels of technology adoption being lower.

A skills program run by the University of South Africa (UNISA) aimed to improve the confidence of teachers in using online tills and adopting a blended learning approach. The feedback from lecturers in this qualitative study was that the technological skills UNISA had equipped them with had built their confidence in using online tools and platforms (Teane 2024: 427).

2.9.5 Design and Structure of Blended Learning Environments

The Blended Learning Adoption and Implementation Framework was created by Graham et al. (2013). The Framework employs Rogers' (2003), Diffusion of Innovation model to identify stages

of adoption process, namely awareness/exploration, adoption/early implementation and mature implementation/growth, and then compares these stages to three broad categories of institutional strategy, structure, and support that illustrate the evolution of blended learning implementation.

According to Tshabalala (2021: 21), when considering the teaching style of a lecturer for teaching and learning in a digital environment, the lecturer's connection to the instructional design needs to be connected to the experiences, circumstances and cognitive levels. In short, the teaching and learning process in an educational setting reflects the lecturers' experiences, emphasizing the need for clarification within the teaching environment. Van Blerk (2019), considered a mixed or blended approach when looking at technological tools to enhance teaching and learning.

2.9.6 Benefits of Blended Learning

Student engagement and motivation is a key factor in the use of blended learning, Law and Tar (2018: 79) state that blended learning not only has a positive impact on student positivity, but it influences learning performance, and student satisfaction is higher than in a traditional learning environment. A workable solution that merged eLearning with in-person learning methods was blended learning. According to Bariham et al. (2021: 52), both in-person and online learning environments provide the chance to test out different learning methods to improve students' engagement and performance. To maintain student motivation, the use of digital tools needs to be highlighted within the educational setting (Langegard 2021: 23). The complexity of online learning can be demotivating if not used correctly. For this reason, it is important to have a strong motivation and time management skills to reduce this from happening as online learning allows students to interact with others and lecturers can eliminate barriers by creating an open collaboration through these online channels (Arkforful and Abaidoo 2015). An advantage of eLearning is that it creates an effective interaction between lecturers and students using emails, discussion boards and the chat features (Qwabe and Khumalo 2020::4). To ensure the effectiveness of eLearning, students need to be educated on how to use it to enhance their learning.

According to Ali (2022), student engagement is the time and energy that students may put into their learning. In both face to face and digital learning environments, learner engagement is considered to be an essential factor for students' success (Bond et al. 2022: 2). Xu et al. (2018: 91), states that there are opportunities that blended learning with digital technology creates for student collaboration and interaction which optimises learner engagement and improves student success. Greater flexibility with blended learning allows students to personalise their learning process by removing the limitations of time being an issue, needing to be on campus in a specific

place, and at the pace at which they work (Ali 2022), The demand for flexibility comes with the digitally savvy or digital society who are more enabled.

A benefit of blended Learning is that it provides students with flexibility and the freedom to choose the content, scheduling, delivery approach and structure of their assigned tasks (Shand and Farrelly 2017: 6). According to Virani et al. (2020:1060), better teaching environments are created by incorporating digital tools which lead to better adoption. Integrating digital tools like Massive Open Online Courses (MOOCs) offer many benefits such as students receive access and exposure to high quality material. Although it allowed for flexibility in teaching and learning the challenges were just as glaring, data costs, lack of correct device, no internet connectivity everything required had to be done via WhatsApp email or via Microsoft Teams chats or meetings. Pearson Publishing (2013), states that digital content reduces the cost of higher education for students, offers flexibility in terms of time and place, improves participation in learning activities and improves accessibility to resources for learning. Increasing access to critical resources is necessary for many students who struggle to receive a quality education, especially those from rural areas. Online resources have allowed for more access for students even from home. Technology enhanced learning can be instrumental in allowing quality resource's to be accessed by students from a distance (Ali 2022). A lecturer's presence was found to be associated with creating a sense of community amongst students and engaging and connecting with them. According to Lowenthal and Trespalacios (2022: 60), a lecturer that has a strong and active presence with students can directly correlate with an improvement in student satisfaction, perceived learning and can enhance the online learning experience. Ramroop's (2021:105), study showed positive results as majority of lecturers who respondents felt that orientations and training on digital tools can improve pass rates, which is further supported by Roddy et al. (2017: 3), who confirmed that workshops, training and orientation programmes increase student confidence and help them get ready online.

Sahni (2019:2), maintained that teachers play the role of facilitators and students can participate, learn and question even outside the classroom, which is more engaging for both the teacher and the students. The choice of teaching and learning approach directly influences the student's learning experience, engagement and overall achievement.

2.9.7 Challenges and Barriers

Students experience various challenges in using blended learning, the first being internet issues, technical support challenges and travel costs if travelling to campus, the benefits outweigh the challenges (Ali 2022). According to Tshabalala et al. (2014: 101), students are very interested in using technology both inside and outside of the lecture room for teaching and learning. As a result, it requires lecturers to use more digital tools in their lecturing and planning. Blended Learning has

become popular amongst institutions as a method of teaching and learning. The blended learning approach has offered several advantages, including accessibility and of information, connectivity. However, it must be noted that lecturers' negative perception can affect the adoption of blended learning. These include a negative attitude towards innovation and change, allocation of time for preparation, workload, institutional support and infrastructure concerns.

Ramroop (2021: 109), states that barriers to the use of technology in Higher Education Institutions are forced by a lack of adequate infrastructure or lack of access to devices used to access online tools, lecturers are most likely to resist innovation. The ability to access resources online is a contributing factor to the adoption of digital tools for blended learning, Studies on eLearning revealed that teachers' opinions on Information Communication Technology-Based Education varied widely, from approval to rejection (Bailey and Johnson, 2014). Scott (2016: 583), responded that students had to exercise more self-direction when doing courses online. As a result, instructional strategies that held students' attention in a traditional classroom did not hold the same appeal for an electronic audience. Even though this change puts more obstacles in the way of teachers and some non-traditional students, it also made ICT more accessible, which raised students' confidence in using it generally (Neville et al. 2015: 76). In a study conducted by (Arkorful and Abaidoo 2015: 30), on blended learning, they concluded that the adoption of digital tools in some institutions has/had increased both faculty and learner access to information. Ramroop's (2021: 109), study highlights time as a challenge, whereby lecturers have a limited time to work on preparing online learning with heavy workloads. Time constraints with increasing workload impact the conversion to the use of digital tools for blended teaching and learning from the more traditional approach which further impacts how lecturers may perceive teaching with technology. According to Miller (2019: 635), lecturers are under pressure to do more research, engage in lecturing to students, do administrative work as well as supervise students. Further to this, lecturers need to be encouraged to use digital tools to avoid them resisting to the additional workload as using digital in the lecture comes with more responsibility (Ramroop 2021: 179), Internally, systems were found to be a challenge in the adoption of technology by lecturers. A study by Ramroop (2021: 207), which highlighted internal systems issues such as registration issues, email issues, copyright issues delaying work and large classes. In addition to needing support staff, it is also important to create a training program to boost lecturer computer self-efficiency, lecturer education should also be given special consideration if this is the method required to lecture to students. This will help lecturers build their evaluation techniques and allows them to focus on the online teaching and learning and creating an environment where these tools are used (Amhag et al. 2019: 203). Training of lecturers to be able to facilitate blended learning in paramount for the student and lecturer success. Asghar, Afzaal, Iqbal and Sadia (2022: 3), found that training lecturers on how to use technology that only addressed technology usage skills

was less successful in helping lecturers understand blended learning than teacher training programmes that combined training in pedagogy, content knowledge and technology usage.

As shown by Moreira et al. (2017:253), challenges faced in eLearning in Portugal had two factors which needed to be considered, firstly the public regulation when it comes to higher education and secondly a lack of professional training. Blended learning, according to Halverson and Graham (2019:146), emphasises a student-centred strategy that gives students control over their academic choice and learning pace. A lack of intensive training influenced the implementation of a new digital tool (innovation). As a result, the lecturers at Central University of Technology were reluctant to implement the E-Thuto platform. eThuto is a digital software useful for learning new skills (Moyo 2019:48).

2.9.8 Impact on Teaching and Learning

Dumford and Miller (2018: 454), explored the advantages and disadvantages of engaging with digital tools and in 2020, due to the (COVID-19) pandemic, and found that many universities that were looking for ways to move their delivery of course content online using digital tools (emails, learning management systems (LMS), discussion boards and video conferencing) were forced into Emergency Remote Teaching. Ferri et al. (2020), defined Emergency remote teaching as a temporary shift of teaching methods to another due to crisis situations. This includes using any means of access to make content available to students and be able to contact them, emails, WhatsApp groups and Microsoft Teams being most popular.

In March 2020 South Africa was placed into level five lockdown as part of the National Disaster with the COVID-19 Pandemic. The university model of teaching, learning and assessment shifted from blended learning to the emergency remote teaching model, from face-to-face contact teaching to online teaching. According to Hodges et al. (2020: 1), this demonstrated the flexibility and challenges of digital tools used in higher education. In recent years, Blended learning included many facets of disseminating information, taking into consideration that it’s not just blended learning in higher education but also machine learning in Education. Education 4.0 is the innovative model that uses MOOCs and Internet of things (IoT) based digital technologies. This allows for a more visual presentation for students which is more engaging. Education 5.0 uses more ICCT underlying technology including artificial intelligence, virtual reality and is moving towards nanotechnology (Aithal and Aithal 2020: 335-351).

2.10 DIGITAL TOOLS

The introduction of digital tools according to Haleem, Javaid, Qadri and Suman (2022:1), such as mobile devices, smartboards, MOOCs, tablets, laptops and other simulators, have altered

education within Institutions. Online classrooms now offer a faster evaluation, an immediate learning environment and more engagement for students than the face to face or traditional classroom offered. Smartphones and other wireless devices are popular, and Institutions can take advantage and make efficient use of this technology in the classroom. According to Svendsen and Svendsen (2021: 332), digital tools are software that is not produced for educational purposes, but which may be used to support learning. Langegard (2021: 23), states that the use of digital tools is important as they facilitate and change how students learn, although there is the perception that the introduction of digital tools may create conditions that are less favourable in the higher education learning environment, the importance of adapting learning activities, clear instructions and course structure will improve the way digital tools are used. Online learning helps in reducing printing costs and protecting the environment (Aithal and Aithal 2020: 335-351). Adopting digital tools has become increasing important as technology evolves and advances. According to Akorful and Abaidoo (2015:34), the use of digital tools enhances the efficacy of knowledge and the adoption of digital tools has played a vital role in enhancing communication, increasing efficiency and improving productivity. The term 'digital tools' includes a wide range of products used for access to technology, including smartphones, tablets, computers, online platforms and software applications. Digital tools can be defined as the use of electronic technology to deliver, support, and enhance both learning and teaching and involves communication between learners and teachers utilising online content (Langegard et al. 2021:2), according to Tshabalala (2021), there is a difference in preferences in the use of technology by males and females. This study found that depending on the age, men's and women's intention to adopt or utilise digital is influenced by factors such as performance, expectations and attitude towards technology. The aim of introducing digital tools in blended learning is to create more digitally literate citizens who can cope with the increased digital presence and fourth industrial revolution. Scherer et al. (2019: 15), note that for the inclusion of digital tools to work, it must be meaningful. According to a study by Leisa-Orus et al. (2020: 5339), gender and years of lecturing experience could also predict the perceptions and attitudes of a large sample of Higher Education lecturers toward digital tools.

Universities must have the learning agility to supply quality education in the growing market and part of this process is learning how to do this for the first time. According to a study by Bond et al. (2018: 3), In the context of the German Higher Education environment: A case of the University of Oldenburg enlisted their Centre for Teaching and Learning to support their faculty members at the university with a variety of professional development courses with an emphasis on student-centred learning. Some of these courses are related to the use of digital tools and techniques for blended and online learning. In the study by Bond et al. (2018: 3), the university administrators views were use digital tools to improve and enhance learning. The adoption of digital tools can be

looked at in many different sectors, in healthcare, sport, shopping, corporate and education just to name a few. The adoption of digital tools in the context of Sport, top level management were interviewed and analysed by Best, Sibson and Morgan (2021: 2), although there were benefits to using digital tools in their operations which would increase their efficiency and productivity, the cost to adopt digital tools and the capacity of staff to utilize complex technologies were a deterrent. In using digital tools for blended teaching and learning as examined by Arkorful and Abaidoo (2015:34), it has been maintained that eLearning compensates for scarcities faced by lecturers at Institutions. According to a study by Leisa-Orus et al. (2020: 5339), conducted at the University of Zaragoza in Spain, gender and years of lecturing experience could also predict the perceptions and attitudes of Higher Education lecturers toward digital tools. A quantitative study which included 345 University professors concluded that professors recognised positive use of digital tools amongst students and the improvements or positive effect it has on the teaching and learning environment. According to Tshabalala (2021: 41), the idea of socio-technology is prevalent in various cultures when applied to technology and includes the classification of gender. Tshabalala in his study used the UTAUT model and considered age, gender and experience of lecturers and the impact it had on their technology usage. The study concluded that eLearning systems use is influenced by age, experience and gender. The findings are consistent with the findings of Juan and Bellonch (2021:174), and Leisa-Orus et al. (2020:5339), more weight is given by female professors to all skill attributes. Some lecturers tend to only use digital tools in the lecture after receiving exposure to it through demos, workshops or training sessions (Dintoe 2018: 55).

Dintoe (2018: 56), discussed the Southern African landscape in using digital tools in Botswana, digital tools at universities are adopted and diffused(included) in the Higher Education systems to improve access to allow the development in infrastructure and to educate. Rogers (2003) notes the importance in knowing and doing which impacts the way digital tools are utilised. What is also important to note according to Dintoe (2019: 2), is that not all universities in African countries are in the same stage in analysing their digital tools usage using the Diffusion of Innovation. Whilst South Africa, Mauritius, Ghana, and Botswana focus on implementation, there is still a digital divide in terms of infrastructure in city and rural areas. A study by Tinashe (2021: 1), focused on the use of ICT at the great Zimbabwe University. Questionnaires sent to respondents stated that only 35% of lecturers used ICT in their courses, with 65% of them not making use of it. They expressed the frustration of lack of knowledge of available digital tools, lack of technical and material support as factors for their non usage. Data suggests that lecturers are more likely to utilize a digital tool or system when they feel supported.

Several researchers (Lupton 2019; Rich and Miah 2014; Roderick 2016; Williamson 2015), emphasise that digital technologies, including digital tools, are complex phenomena that embody and reconstruct values, relations and discourses. Following this line of thought, consider digital

tools and the websites in which they are integrated as significant discourse mediators that influence knowledge formation in educational environments. Hill (2017: 350), in her publication on embracing digital, noted something which largely impacts digital tools being used today and that is the demographics of the end user have shifted. Lecturers' and students' opinions on technology use, face-to-face interaction and learning differ. Baby boomers or early adopters of technology aspire for the ideal work life /technology balance with the Generation X preferring face to face. During the Covid-19 pandemic, lecturers had to make rapid changes to include digital resources into a course that was previously intended to be for the traditional teaching and learning environment (Langegard 2021: 2). When considering the type of digital tool to use, the efficacy, competence in using technology, support available and ease of use of a digital tool need to be considered. An important element in influencing the adoption of digital tools is maintaining student and lecturer support. A study by van Blerk (2019), highlighted the challenges faced by lecturers, including a lack of technical support, difficulty in navigating the platform and an everchanging digital environment.

2.10.1 Digital Innovations

Howard (2015), explored the innovation in education when students had to be able to access the latest technologies and real-world scenarios to be able to demonstrate these skills, the design of the courses required hands-on experience, and it had to be online, and since then, lecturers are increasingly teaching through non-traditional methods. According to Nunez Canal et al. (2022: 1), there is no longer a debate about the need for digital competence as it is an accepted fact. The main competences that need to be taught in higher education are interpersonal skills, skills to enhance digital innovation, the use of digital tools and professional development to name a few. Due to the capabilities of innovation, universities were able to survive during the pandemic restrictions and adapt in the educational community. The use of digital technologies has been identified by the United Nations in their Sustainability Development 2030 Agenda as a goal to achieve and ensure inclusive and equitable quality education for all (Haleem et al. 2022: 276).

It can be assumed that digital tools may offer an opportunity to better approaches and new techniques to teaching and learning (Mhlanga et al. 2020: 180). Tshabalala (2021: 41), stated that a sense of online presence is critical for the use of digital tools and found that designing and preparing material that enhances this are beneficial. His study further shared that lecturers need a minimum of 90 minutes to prepare for their lessons that are now online. The last 10 years has seen how digital innovations have changed in the context of higher education, as follows.

2.11 TYPES OF DIGITAL TOOLS

Amhag et al. (2019: 203), emphasizes that mobile digital tools can complement a range of lecturing approaches. However, it is critical to plan how to use them in various settings where learning takes place to generate learning and development opportunities.

According to Kay (2016: 19), a laptop is a versatile tool that can be used for both academic and non-academic activities in, as well as out of, the classroom. In this age of globalisation, education needs to make use of the quickly developing technology. According to Sudarsana et al. (2019), both lecturers and students can benefit greatly from the use of laptops and desktop computers in the context of learning. With a range of sizes available, laptops are portable and can be carried everywhere. Two of the most widely used mobile operating systems are Android and iOS, each with a distinctive design and set of functions (Jaiswal 2018:). In addition, most students and lecturers have personal cell phones which support their digital orientation at the Durban University of Technology, Laptops are provided by the University With the increasing availability of tablet computers, also referred to as tablets, in recent years, lecturers and students have had more access to these technologies than in the past(Narayan and Naidu 2020: 220).

A quantitative study by Apergis (2019: 3), looked at 1500 households across the United Kingdom and their device usage. From this study, the most frequently used device was smartphones and tablets with (52.16%). A study conducted by Amhag et al. (2019: 203), through a survey with 405 lecturers across two universities in Sweden over email, noted that the majority of their lecturers used laptops, with half using tablets as an additional device. There are four ways in which lecturers use digital tools: for research, teaching, communication and administration. The study showed that the use of digital tools to enhance instruction was not the sole purpose for their usage.

Web Assign is a platform used to create engineering and mathematics problem to allow students to answer through application online. According to Skromme et al. (2022), commonly used systems that provide an online e-text and platform for questions and answers based on specific content by commercial publishers such as Pearsons my Labs and Mastering, McGraw-Hills Connect and Wiley Plus by Wiley. Pearsons My Lab and Mastering, specifically My Math Lab, provides real time feedback, videos, tutorials and step by step examples, it is an adaptive study plan that focuses on the strengths and weaknesses of each student Skromme et al. (2022).

Web Assign was created in 1997 by Doctor John Risley as a flexible word-based system listed to improve student learning and assist lecturers. With Web Assign Students can easily assess their assessments and performance, practice through the customized web-based platform and work on assignments numerous times (Skromme et al. 2022). Sam by Cengage is an interactive Information Technology (IT) digital tool that allows for interactive content training, within

assessment tool that has built-in integrity violation checker, and it works well when integrated to an LMS (Singh, Havangee and Prinsloo 2022: 2).

McGraw-Hill's Connect platform enables educators to manage and monitor students' progress while offering personalized learning experiences to them. McGraw-Hill created the Smart Book adaptive Learning experience within the connect platform to offer a more individualized experience catering to each learner's needs. (Alamri, Watson and Watson 2021: 62) According to Amhag et al. (2019: 203), Zoom was amongst the digital communication tools used by more than 40% of the lecturers in a study conducted in Sweden. Moreover, 93.1% of lecturers agree that they used digital tools for teaching and learning in the study by Ali (2022), with 89.7% stating that they were happy to use digital in their teaching and learning. Some participants/lecturers in the study by Tshabalala (2021: 175), felt that platforms used to access eLearning resources were user-friendly, as easy as the normal use of cell phones. According to Israel et al. (2021: 100), digital tools risk not being used if they are not user-friendly.

2.11.1 Learning Management System

A learning management system can be described as a system that supports the delivery of content to learners (Aparcio, Bacao and Olivieria 2016). Various institutions adopt different types of learning management systems. This has evolved in the last 10 years. It was just a support tool used to access content, but lecturers would still print for the students' attending classes. Lecturers need to be efficient in digitally mediated education and access to a LMS is one way. At the Dublin University of Technology Blackboard was the learning management system used for many years which changed to Moodle in 2020(Omarsaib 2023:175). A study by Bond et al. (2018: 3), focused on the use of the learning management system (LMS) by lecturers at the University of Oldenburg. The results showed that 80% used their LMS Institution wide. According to Dintoe (2018: 56), even with major obstacles faced in using technology in Botswana, the choice to use an LMS is considered as Innovation. Moodle is an open-source learning management system. It stands for Modular Object-Oriented Dynamic Learning Environment, and it aids universities in managing their online courses using blended learning. Moodle is a helpful tool for educators as they are able to create course content per module, deliver online lectures in synchronous and asynchronous modes, and track students' performance. (Kumar et al. 2021: 1), Blackboard is another LMS that aids managing online resources. It caters for the online classroom setting and is designed to be interactive for students and lecturers to exchange updates and their efforts can be assessed using specific exams and homework. (Kumar et al. 2021: 1)

Moonsamy (2015:56), found that 82% of the DUT lecturers did not use blackboard. This was within the age group of 35 to 60 years old and could have been because the academics were not willing to embrace new technology at the time. One has seen how this has changed at the domain

university overtime and according to Sharifov and Mustapha (2020:168), Moodle has more than 78 million active users, whereas Blackboard only has 4 million active users by the time their study was concluded, there are a host of other LMS integrations, which include Desire to Learn, Canvas, Pearson Learning Studio and Sekai. Whilst the Blackboard LMS is used to power virtual learning environments, The Moodle (LMS) is free to use, whereas the blackboard comes with a fee (Munyanyi 2021). Massive open online courses (MOOCs) Verani et al. (2023), define MOOCs as being derived from various concepts in electronic learning. Haleem et al. (2022:279), noted that students improved their credentials by benefiting from MOOCs, it gives students access to skills based courses and students are more likely to enrol as it has no cost attached to, the risk associated with using MOOCs, according to Dwivedi et al. (2019: 1501), Is that there is a huge dropout rate in online courses in India due to a feeling of impersonality when communicating online.

2.11.2 Virtual learning environments

Globally, cutting edge technology is emerging, such as augmented reality and virtual Learning and Virtual learning environments. The type of VRE would be Google Classroom. Hill

and Smith (2023: 290), stated that institutions decisions to use Digital Tools via LTE can be a driver for it to be adopted and for institutions to ensure infrastructure can cater to the technological needs. VLE is promoted by access to an LMS (Haleem et al. 2022: 280) and lecturers can interact with students in real-time online.

2.11.3 Virtual reality and augmented reality

According to Axellson (2017), Virtual reality takes students to an imaginary space surrounded by an engaging environment. VR uses computers to simulate reality into a digital format. (Guiterrez et al. 2017), Augmented reality converts artificial Features into real world images and requires 3D software. This is likely to change the way lecturers teach students in the future. At the Durban University of Technology (DUT) in South Africa, there has been an increasing adoption of digital tools for blended learning by lecturers. As DUT aims to transform into a leading university of technology, blended learning has become a key component of its 2018-2022 strategic plan (DUT, 2018). However, the adoption of digital tools for blended learning by lecturers at DUT has been slow and uneven, with some lecturers enthusiastically embracing it, while others remain reluctant to change their traditional teaching methods. According to the DUT Envision 2023, they plan to adopt integrated digital systems and processes that enable their people to deliver optimally but it does not make reference to changes which will be made for digital learning.

There are a variety of technology or digital tools available to help lecturers enhance teaching and learning (Borboa, Joseph and Spake 2012: 158). The use of technology in higher education if not used correctly, can create frustration, the use of a Learning Management System (LMS) such as Blackboard or Moodle gives lecturers the ability to use the functionality available to create an in and out of class learning experience for their students.

Kumar et al. (2021:23), defined the Learning Management System (LMS) as an Open-Source tool used by universities as an aid in managing online courses and it can be accessed from a mobile device. Moreira et al. (2017; 254), established that teaching and learning processes in the study were based on the principles of flexibility of access to learning with no space or time constraints. Arkorful and Abaidoo (2015:34), Qwabe and Khumalo (2020:3) and Wang (2015:7), concur that the advantages of using digital tools for teaching and learning is the flexibility where issues of time and place are considered.

2.12 EFFECTS OF DIGITAL TOOLS

To distinguish between traditional and online methods, one can look at textbook and eBooks purchases as an example (Bringula 2017: 2), when discussing or characterising textbook purchases and usage, looked at textbooks as a commodity where students are the final consumers. Textbooks are purchased by students as part of a study requirement for a module. The perceived ease of use and usefulness also influence textbook usage as eBooks and online material use and preference gives lecturers and students flexibility in access, use, and allows students to control the time and place of learning. Where eLearning is more complex the requirement of lecturers to have technical skills could pose a challenge as they require careful consideration, theories and pedagogies that combine the technological and disciplinary experience (Tshabalala 2021:181). eBooks allow students and lecturer online access to content that can be used to enhance their experience, the benefits of using an eBook are its convenience, accessibility and a reduced timeframe in accessing content as compared to print copy. Caaseselden and Pears (2020), explain eBooks are available 24/7. The content is searchable, can be highlighted and notes can be kept for later. The advancements to technology and usage have both grown exponentially, arguably the familiarity of using a print textbook makes for a more comfortable read page through feel and touch of the textbook. According to Aithal and Aithal (2020: 9), students attending universities today are members of Generation Z, and they are accustomed to utilising mobile devices for online gaming, financial transactions, and information sharing. They use mobile devices for information and communication technologies, online literature, and Internet-based resources. As a result, university-provided higher education must adapt its curricula, pedagogy, and models to better serve the needs of Generation Z.

Tinashe (2021: 3), looked at demographics and found that only 32% of lecturers over 56 years or older had a positive attitude towards teaching with digital tools. The way that lecturers view and feel about digital tools appear to have an impact on the usage of technology. According to Amhag et al. (2019: 203), a lecturer's intention to include digital tools in their lecturing are due to two factors that they can relate to, usefulness and motivation. Anthony et al. (2022: 531-578), states that the experience gained from using digital tools to enhance students learning has shown to improve student engagement and success. Hsu and Lin (2020:4), identified that a key barrier involving lecturers was the low levels of adoption of digital tools after training due to a lack of confidence or competence, lecturers would need to be confident when using digital tools to be able to effectively share knowledge with students. Feijoo et al. (2021:15), suggested that further research is required in looking at the confidence of lecturers in using digital tools to promote learning and Wang (2015:89), emphasized that for lecturers to be confident in accessing or adopting a digital tool, they need to know the benefits or results of using it.

According to Aithal and Aithal (2020:1), an objective of higher education is to build confidence in the students of today by enhancing their skills, knowledge, and experience in using technology, with the constant change in technology and support in technology changing with time, attitude, and perception of integrating digital technologies into higher education becomes an important factor. According to Tshabalala (2021: 189), lecturers should engage in reflection when addressing the personal needs of students during the teaching and learning process, it is believed that this understanding reflects the awareness in the choice of appropriate digital tools and methods used to teach content to diverse students.

2.13 ATTITUDE

Attitude can be defined as a psychological construct, Teo and Zou (2014: 124), found that attitude is a powerful indicator of intention to use a technology. A study by Spilski (2022: 6), discovered that lecturers' attitude towards technology generally has a considerable impact on how useful, easy to use, and enjoyable or fun it is to use. With perceived use having a significant influence on lecturers' attitude in using technology. Some university lecturers' heavy tendency to adopt technology in lecturing when they have previously been exposed to it through trainings and webinars. In the African city, lecturers prefer using digital tools that are compatible with their experience in lecturing (Dintoe 2018:60). A lecturer's attitude towards using digital tools has become more crucial as the behaviour has been proven to impact the decision-making process and how a task is handled. It is essential to understand attitude towards using digital tools at an Institutional level as it impacts what is used and how the information is disseminated. A study by Asghar et al. (2022: 3), found that lecturers had a positive attitude towards face-to-face learning when compared to online and preferred on online learning approach to offline learning.

Investigations have been done in the context of universities of technology and the lecturer's attitude towards using digital tools. A study by Qwabe and Khumalo (2020: 5), assesses the student's usefulness and the lecturer's usage of digital tools to promote learning and from a study of four hundred and six questionnaires only thirty percent of the students were instructed by their lecturers to login to their learning management system and only 27% of those agreed that lecturer notes uploaded helped them revise for exams. Only 19% of those students said that their lecturers upload everything they lecture to the learning management system. (Krishnakumar and Rajesh 2011), identified that lecturer's attitude towards using eLearning differed based on whether the lecturer understood computers, a lecturer's experience has a positive effect on their usage, and they recommended the institution have a program which focuses on developing a positive attitude amongst lecturers towards e learning and information and communication technology (ICT). Given that lecturers are employing more tools which make learning more exciting, capturing the attention of students, making education more fascinating, using tools relevant to the environment (Ramroop 2021: 116). Lecturers and students who see the excitement and show interest in using digital tools are more likely to encourage others to use them as well. Using a blended learning approach is advantageous in showing efficiency and time saving (van Blerk 2019). According to Spilski (2022: 6), no matter how fun or easy a digital tool is to use, the attitude and intention to use it will be high as long as the digital tool is seen as useful. Avidor-Ungar and Forkost-Barush (2018:188), believe that a positive attitude regarding the usefulness and integration of technology as well as the promotion and acceptance are integral in disseminating it to students. Lecturers need to be passionate about using digital tools to be able to motivate and influence colleagues and the larger organization. Avidor-Ungar also mentioned the time taken to prepare online content can be time consuming according to Omarsaib (2023:191), 25% - 50% of lectures spent time on preparation and 25% - 50% of the time in lecturing online. According to Booc, Liporada and Galo (2024: 19), behavioural intention can largely influence the adoption decision of lecturers, it's important to focus on why lecturers choose to adopt blended learning, addressing challenges and allowing for a successful integration. According to van Wyk (2022), the adoption and use of additional technology in teaching and learning by lecturers indicates they have a positive attitude toward technology and teaching with digital tools.

Attitude towards an innovation is related to the desirability, which could predict the likelihood of adoption (Jahanmir and Cavandas 2018:338). Hsu and Lin (2020:13), are of the view that lecturers today are more confident in using technology but are not as confident when designing supporting learning material. Amhag (2019:212), found that when considering the need for training those lecturers with low competence when using digital tools needed more training in preparation of their online lectures and that their attitude influenced the adoption of digital tools and Wang (2015:77), highlighted that a factor affecting lecturers' use of digital tools is limited support from

the Institution. Dintoe (2018:55), stated that where Institutions offer the right knowledge to lecturers through their support and development, lecturers will be more skilled, and it will positively impact the adoption of digital tools. Moreira et al. (2017:260), established that the strength in pedagogical design (way in which lecturers prepare and add their content online) is related to how students engage with content as well as the importance of how resources are organised and made available for students to access online. Wang (2015:10), concurs that the use of electronic textbooks increases students' engagement and deepens their understanding of learning which will change the future of teaching and learning.

According to Yusuf et al. (2018: 1), in their study a positive attitude towards digital tools was reaffirmed regardless of Zubairu et al. (2017: 1), finding that awareness of the usefulness attributes negatively to the adoption. A lecturer's attitude and beliefs can influence how they will use digital tools in a blended learning setting. (Ali 2022). Although attitude influences the use of digital tools Olafare (2017: 2), noted that qualification and experience are also factors associated. Taking into consideration the Fishbein Model (Ajzen 1991: 179), which suggests that a lecturer's attitude towards something is a function of their belief. In the case of lecturer and students engagement with digital tools a study by Dwivedi et al. (2019:1509), found that students over lectured by the traditional method with minimal engagement online share the same behaviour as their lecturer who chooses this method, however the controlled group from the study that were participating in face-to-face lectures but had a lecturer also interacting online with them online were still engaging. This essence reflects two different types of lecturers, and two different methods used to lecture.

Lecturers attitude, according to Amhag et al. (2019:207), on perception of using digital tools also influences adoption. Lecturers just require constant training to keep up to date with the constant changes. Virani et al. (2023:1065) define attitude as a psychological construct with reference to attitude in the context of massive open online courses (MOOCs) found that there was a positive correlation between attitude and self-efficacy when using digital tools. A positive attitude towards using digital tools can be enhanced by increasing or showcasing the benefits such as enriched learning. Attitude was looked at by various researchers and can be summarised as follows, according to Fishbein and Ajzen (1977), which looked at the affective attitude as the emotional state of mind and feeling of an individual using digital tools including their emotional reaction and preferences. Davis (1989: 320) looked at behavioural attitude, the use of digital tools by individuals can be characterized by their behaviour and intention represents their readiness, willingness, and their past behaviour in adopting a digital tool. Ajzen (1991), stated that cognitive attitude refers to an individual's beliefs, perceptions, and knowledge about using digital tools as well as their mental orientation or mindset when using them.

Venkatesh, Morris and Davis (2003: 427), stated that Utilitarian Attitude refers to the instrumental value of using digital tools, their true perception of using them and how these digital tools can assist them in reaching their specific goals or contribute to a specific task. Acquisti, Brandimarte and Loewenstein (2015: 509), stated that the social implications of using digital tools, including consideration of privacy, impact of digital tools and society and ethics is referred to as the Social Attitude. Lastly, according to Wolf et al. (2020), attitudes are an evaluation of individuals, groups, concepts, and other items that show whether people like or dislike them. Studies of attitude are a component of social psychology. In higher education today the use of digital tools has become essential, the generation of student has grown up in a world surrounded by all types of technology and they are capable and enthusiastic to use new types of digital tools (Derbel 2017: 270), with the learner's needs being intertwined with technology it requires lecturers to have the necessary competencies to assist in the learning process. A study by Tatli et al. (2019: 2), looked at the lecturer's attitude towards using digital tools before and after a training course designed for lecturer and noted a significant increase in the attitude of lecturers post the training course, the study also stresses the need for lecturers to have support to be able to present their expertise in a pedagogical way using technology.

2.13.1 Theoretical Foundation

The cognitive process of an adopter and their attitude contributes towards whether they have a negative or positive perception of adopting a specific technology. Comprehensive research conducted by Kai-ming and Enderwick (2000), identified that adoption is hypothesized and influenced by six internal beliefs: **perceived difficulty, adoptive experience, suppliers' commitment to the firm, compatibility, and enhanced value.** This will further be adapted to look at the attitude of lecturers towards the adoption of digital tools for blended learning.

2.13.2 Social Cognitive Theory (SCT)

The Theory of Planned Behaviour, Technology Accepted Model and Diffusion of Innovation all assume that's major variables in these models have casual relationships and are not bi-directional (Moonsamy 2015:46). SCT explains how individuals' behavioural patterns are acquired and learned from others. Studies conducted assessing SCT in the context of usage of digital tools, it found significant relations between adoption and usage. Self-efficacy positively influences adoption including Perceived Ease of Use, Perceived Usefulness, and perceived enjoyment.

2.13.3 Theory of Planned Behaviour

Theory of Planned Behavior (TPB) is the most influential model cited. It is an extension of the Theory of Reasoned Action (TRA) that looks at human social behaviour (Ajzen 1985). According to Ali (2022), this theory could help identify factors that influence behaviour in blended learning. According to Montana and Kasprzyk (2015:231), TPB focuses on the individual motivation factors, and rests on an assumption that intention is the best predictor of behaviour, with attitude being the determining factor that impacts the perception of social norms. TRA and TPB are similar in theory, the only difference is that TPB includes an additional construct which is perceived control. TPB stands out in addressing adoption of technology, however it is dependent on the context it is used in as it focuses on a user within a community (Otieno, Liyala.Odongo and Abeka 2016:5).

2.13.4 Vygotsky's theory

Vygotsky's theory (1987), presents that students can learn when they support structures in place to bridge the gap between what they know and what must be learned. This is done within a zone of proximal development (ZPD). Bond et al. (2020:2), states that digital technology has become an integral aspect within higher education, there is increased attention on student engagement and globally the importance of being digitally literate is growing. Using digital tools has the potential to make teaching and learning more intense, improve student efficiency, efficacy, participation, and involvement in courses in the wider university community. COVID-19 merely accelerated and forced academia into a space to truly utilize digital tools for teaching and learning (Bonk 2020: 590). It was previously something universities were gradually introducing and did not diversify fully to include blended learning into the face-to-face environment (Singh et al. 2022: 309). During the COVID-19 pandemic. according to Hermas (2020), online learning was not supposed to be the future, the previous studies had confirmed this, on the contrary, Darby (2020), at the North Arizona university felt that online was here to stay and taking those into consideration in the early stages we see how right he was. Chaudhury and Holder (2019), also noted that in looking at the cognitive and social aspects of students, one of the factors is seeking help in academia. It is found that high achievers are more likely to be able to ask for help than lower achievers. It is not just the responsibility of lecturers in the digital focus of institutions, the university has a responsibility in the use of it, including the library as the process can largely impact student's experience. A study by Corrall and Jolly (2019:13), explains the impact libraries can have in bridging the gap in innovation for teaching and learning, being inclusive in the way information is shared to students , development of digital focused workshops which allows students opportunity to experience a professional online environment, align the institutional activities with what is conducted in the library and collaborate, partner and offer their knowledge to students.

2.14 ATTITUDES AND THEORIES USED FOR ADOPTING DIGITAL TOOLS

Olufemi (2012), refers to attitude as an individual's belief, reaction, or personal feeling towards something. Attitude is based on the individuals' feelings at a specific time. Attitude has three components according to Wood and Wood (2005), namely; cognitive, behavioural, and emotional or effective essentially attitude is seen as a social philosophy. The theory of planned behaviour as an extension of Fishbein Model notes three components of attitude behavioural, belief, perceived behavioural control and subjective norm. According to Ajzen (2011), these components are expected to influence intentions. Subjective norms refer to individuals' thoughts on how others would like them to behave, perceived behaviour control is perceived ease or difficulty of performing and beliefs are outcome based on perception. The lecturer's attitude towards using digital tools varies significantly. Arundel and Adetimin (2017:74), cited that lecturer's attitude towards teaching and learning is integral and that uptake for students is largely on the lecturers' personal feelings, attitude and skills when using a technology.

2.14.1 Examples of lecturer's attitude towards using digital tools

A study by Splilski et al. (2022), found that individual's attitude towards technology influences ease of use, usefulness, and enjoyment of innovations. According to Alina and Dangwal (2017: 130), in India where the use of blended learning is being explored, the lecturers often use digital tools as a support function in the teaching process, but traditional methods are used. Muhayyang (2021:150), felt that the right attitude was needed to motivate lecturers and students to create a blended learning implementation that is successful and with the appropriate attitude digital tools could be the educational system of the future. Attitude plays a role in lecturers' acceptance or resistance to adoption of a digital technology, which impacts the student's experience. A study by Muhammad and Ibrahim 2019 found that Lecturers were largely aware of existing digital tools, lecturers were positive and felt that introducing digital tools allows them to engage students into meaningful discussions. In terms of attitude 92.31% of lecturers had a positive attitude towards using digital tools but did not share enough with colleagues on how to effectively use digital tools.

According to reports by Elfaki, Abdulraheem and Abdulraheem (2019: 226), using electronic resources has greatly improved students' attitude, motivation and academic achievements. It also stated that students' motivation needs to be managed as motivation will not improve if they complete tasks at their own pace. The motivation behind a university in the United Kingdom transitioning to blended learning was making the most effective use of online learning to enhance the student experience.

2.15 SUMMARY

In this chapter, various literature related to digital tools, adoption, blended learning, Diffusion of Innovation and attitude were reviewed and discussed. The historical background of blended learning and how digital tools are adopted using the Diffusion of Innovation theory were also discussed in this chapter. The challenges of blended learning were stated and the ways digital innovations have advanced were expressed. In the next chapter, the methodology will be explained.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 INTRODUCTION

In the previous chapter, the literature review set the foundation for the study, which related to the adoption of digital tools at a university of technology and the lecturers' attitudes towards using digital tools for blended learning. This section outlined the methodological processes undertaken by the researcher. The purpose of this study was to share knowledge on the lecturers' attitudes towards using digital tools for blended learning, identify the knowledge gap and be able to share based on this. This chapter described the Research Methodology used to conduct the study. Research Methodology referred to the research tools used to complete a specific task in research. This specific research task was addressed by using research questions and drawing a conclusion (Adu and Miles 2023: 35).

Research was described as "one of numerous methods for gaining or understanding a process of systematic inquiry that was designed to collect, analyse, interpret and use data" by Maree (2020:16) This chapter covered the research design used, the sample and sampling methods, the data collection and the analysis, how the reliability and validity were tested, as well as the pilot study that was conducted before commencement of this study. The questionnaire served as the main method for data collection and was disseminated to lecturers. The gathered data was analysed using SPSS version 28.0. The results were conveyed through various descriptive and inferential statistics, showcased in the form of graphs and other illustrative figures, capturing the quantitative data collected. Inferential statistics, methodologies such as ANOVA, coefficient of determination, Regression and Chi-square tests were applied. These techniques were interpreted based on the p-values they yielded. In line with traditional standards for statistical reporting, a result was considered statistically significant if the p-value was less than 0.05. Lastly, ethical consideration and the procedure followed at DUT were outlined.

3.2 Aim and objective of the study

The aim of this study was to determine the factors that influenced the adoption of digital tools for blended learning by lecturers at DUT using the Diffusion of Innovation theory. In addition, the study sought to determine the attitude towards digital teaching and learning tools by subject lecturers at DUT. The aim was to develop a conceptual model that showed how Diffusion of Innovation s presented across types of adopters and discussed DOI in terms of digital tool adoption and attitude. Moreover, the study explores what the university currently adopts in digital tools and how lecturers use these available resources to interact with students.

The objectives of the study included:

- To determine the variables that influenced the adoption of digital tools for blended learning at the Durban University of Technology;
- To apply the Diffusion of Innovation theory to blended learning at the Durban University of Technology; and
- To ascertain the attitude of lecturers towards digital tools for blended learning at the Durban University of Technology.

3.3 Research Process

The Research process was a process of conducting research and was a methodical and structured way of looking into a particular topic or issue to produce new information, validate existing hypotheses, or deal with real-world problems (Garg 2016: 641). It usually involved several crucial stages, all of which were essential to the overall accomplishment of the research project. According to Singh (2021: 2), it was a set of several scientific procedures used to carry out the investigation. Every step was linked to each subsequent step. It involved several procedures, such as framing the research problem, carrying out a survey of the literature, coming up with a hypothesis, planning the study, gathering and processing data and presenting the findings.

The research process used was derived from various research processes (Leedy and Ormrod 2019:45-54; Bush and Burns 2014:68, Saunders et al. 2019:10; Struwig and Stead 2017:22).

It was constructed based on a multistage process:

- Finding the Research Problem: In accordance with Leedy and Ormrod (2019: 40), this first step involved identifying a particular problem or subject that needed to be looked at. Based on the result of gaps in the body of knowledge, real-world issues, or developing trends. After the issue was located, researchers can move on to the next phase.
- Formulation of Research Questions or Objectives: Bush and Burns (2014: 68), emphasised the significance of precisely stating the questions or objectives that would direct the investigation. These objectives function as a roadmap, describing the researcher's intended outcomes and the course of the investigation.
- Research Design Selection: Saunders et al. (2006), emphasised how important it was to choose a research design that fitted the study's objectives. This included deciding between mixed methodologies, qualitative or quantitative approaches, in addition to choosing certain research techniques and methods.
- Data collection was covered by Struwig and Stead (2017: 22), this step entailed obtaining information pertinent to the study's goals through a variety of techniques, including

surveys, interviews, observations and archival research. To preserve the integrity of the research, it was imperative to make sure that the data collection techniques used were ethical and thorough.

- Data analysis was necessary for the researcher to reach appropriate results after the data has been collected. In order to find trends, connections and insights pertaining to the research questions, this stage involved organising, analysing and synthesising the data.
- Interpretation of Results: Following data analysis, the researcher interpreted the results in the context of the study's objectives and body of previous research. This involved drawing conclusions, discussing the impact, taking into consideration any restrictions and deciding on fresh topics of research.
- Results Dissemination: Lastly, the researcher used papers, conferences or other means of dissemination to share their discoveries with the larger academic community. This made it possible for more people to assess the study, expand on it and enhance their understanding of the subject.

Research is an ongoing and continuous procedure that frequently involves switching back and forth between stages as researchers improve their approach and confront unanticipated challenges. Through commitment to established principles and processes, researchers can conduct strong and reliable investigations that contribute to the body of knowledge in their chosen fields by following a methodical approach.

3.4 Research Design

According to Wiid (2021:70), a research design was simply an overview, framework or plan for carrying out a research project that only included the most essential elements of the research. A research design, according to Saunders, Lewis and Thornhill (2019: 12), is the way that the project's objectives and research questions are put into practice. A research design is described by Bryman and Bell (2015), as a structure for gathering and evaluating data. A research design, according to Saunders, Lewis, and Thornhill (2019: 15), is a strategy or blueprint for carrying out the study. It is the logical flow that links the empirical data to the original research questions and, eventually, the findings of a study, (Creswell 2013: 5). One's research ideology influenced the research design (Saunders, Lewis and Thornhill 2016: 16). A methodological decision was made by the researcher while creating a research plan regarding the choice of a mixed methods, quantitative or qualitative study design (Saunders, Lewis and Thornhill 2016: 16). In focusing on the current objectives, a research design that is appropriate for the research is required. A research design, according to Yin (2018: 26), is a logical process that links the empirical data to a study's original research question, findings and to the study conclusion. Burns, Veeck and Bush (2020:72), define research design as the methodology utilised during the study to achieve the

study's goals lastly Mukherjee (2019:78), asserts that the research design needs to offer a comprehensive, yet adaptable framework for the many tasks involved in the research process. According to Dubey and Kothari (2022), a research design is essential as it makes different research procedures go more smoothly; hence the research design is crucial. When research is well-designed, it can yield high-quality findings with the least amount of time, money and effort. As a result, it may be claimed that design is crucial for organising research efforts. The research consisted of quantitative data. The decision to use a quantitative study was influenced by the need to determine the factors that influenced the adoption of digital tools at DUT, and the attitude of lecturers who adopt these digital tools. Quantitative research allowed for the use of questions to understand the lecturers' views.

There are several classifications of research design approaches: Exploratory, Descriptive and Causal Research. These are described below:

3.4.1 Exploratory Research

An exploratory study seeks to collect the data necessary to decide if and how to proceed with an in-depth effectiveness study (Hallingberg et al 2018:2). Exploratory research is usually done in a social science setting. There are two ways of conducting exploratory studies. According to Swedberg (2020:18), the first is by researching a topic that has never been done before and the second is by exploring an existing topic to produce new ideas. Exploratory studies are usually hypothesis testing (Schwab 2013:204), and provide a greater understanding of the problem a researcher may be investigating.

3.4.2 Causal Research

According to Salkind (2022:180), causal research collects evidence based on cause-and-effect relationships. Wiid and Diggines (2021:72), define causal research as showing causality between variables and occurrences.

3.4.3 Descriptive Research

Dubey and Kothari (2022), state that descriptive studies, in contrast to exploratory studies, fall under formal research, where the objectives are specified in detail. In descriptive studies, a researcher collects information about every facet of a research problem. Regardless of how difficult the problem is, an efficient study design is required. According to Burns and Bush (2017:98), it can be applied when one wants to know what digital tools lecturers use, or to anticipate a variable. According to Seidlecki (2020: 2), descriptive research is defined as the

conditions, individuals or events as they happen, and no variables are manipulated to obtain a result. There are two types of descriptive research namely qualitative and quantitative research. Within the range of research design, there are three general categories: exploratory, descriptive and causal research. Every kind of research design has a specific function and is used to address various kinds of research problems. The researcher used a descriptive research design.

This researcher fundamentally had three methodological options: the mixed methods research design, qualitative research design, and quantitative research design.

The descriptive focus was to ascertain the use of digital tools at the Durban University of Technology and the questionnaire was the approach considered. The participants were only required to fill the questionnaire once. The tool was a structured questionnaire to lecturers at the Durban University of Technology.

3.5 Quantitative, Qualitative and Mixed Method Research Designs

Jha (2023), categorised research design as quantitative and qualitative designs. Whilst qualitative research involves an understanding of the human behaviour and qualities, quantitative focuses on practical research, phenomena and quantitative terms.

3.5.1 Qualitative Research

According to Aspers and Corte (2019: 140), qualitative research is a continuous procedure that results in new, significant findings that are made because of getting closer to the topic being examined, which improves knowledge for those conducting research. The notion emphasises that a qualitative dimension is present in quantitative work as well and is intended to serve as a tool to aid and improve research ideas. It may also address criticisms of qualitative methodologies; improve communication amongst researchers; close the gap between qualitative and quantitative research; and serve as a benchmark for assessing qualitative research. The qualitative research design as adapted by Merriam (2009: 39), and Neuman (2016: 84), needed to have an appropriate theoretical framework to guide the research, an in-depth exploration of the phenomenon under the study, the interview process needed to be interactive and interpretive with participants and the data collection was flexible and repetitive.

3.5.2 Quantitative Research

Maree (2020:184-193), defined quantitative research as a process that is systematic and objective in its ways of using numerical data from only a selected sub-group of a universe (or population)

to generalise the findings. A quantitative research method was applied to this study to determine the attitude of lecturers towards adopting digital tools for blended learning. The quantitative research design, according to Creswell (2013), and Neuman (2016: 85), needs a clear research question and appropriate research design and sampling techniques were needed to ensure rigorous data collection and a systematic process with appropriate statistical methods to analyse the data. In some studies, both qualitative and quantitative research methods can be used to support the study.

3.5.3 Mixed Method Research

Mixed method was when a study employed both quantitative and qualitative research approaches, which are combined into a mixed methods design. It is essentially gathering and evaluating both quantitative and qualitative data for a study to contribute to the achievement of the study's objectives (Creswell and Creswell, 2019). According to (Johnson and Onwuegbuzie: 2016: 14), the mixed method approach requires a research question to be identified, a clear plan of how one will collect both qualitative and quantitative data and analyse it, how one will integrate the design and synthesize both types of data, and lastly, the interactive process in which data collection and analysis informs the subsequent analysis and collection of data. The researcher used a quantitative design because the focus of quantitative methods is on objective measurements and the statistical, mathematical or numerical analysis of data gathered via surveys, questionnaires and polls, as well as the use of computer technology for enhancing statistical data that has already been obtained. The goal of quantitative research was to collect numerical data, generalize it to other populations, or provide an explanation for a specific phenomenon. (Vijayendra 2023:23). On the 13 May 2021, the Durban University of Technology released a guide to assist students and lecturers during the National Lockdown due to the Covid - 19 Pandemic. The Durban University of Technology has a remote teaching quick guide created to assist academics when lecturing online during this period. This document was derived from a similar guide created by the University of Cape Town.

3.6 Sampling Strategy

3.6.1 Target Population

Wiid and Diggines (2021:400), stated that the target population was the total group of respondents or subjects that a researcher is interested in studying. According to Rahman, Tabash and Salamzadeh (2022: 43), the term target population referred to a group of individuals or things about which researchers hope to draw broad conclusions. Occasionally, a sample might have been drawn from a population of people known as the "target population". The population of a

study is the entire group one wants to draw a conclusion about and in the case of this study, the population consisted of academic staff/lecturers at the Durban University of Technology, DUT was chosen as it was a university which offers a blended learning/multi modal learning approach and was leading in KwaZulu-Natal as a University of Technology. The views of the lecturers on the use of digital tools were an integral part of how the University would grow in their implementation of new technologies. Lecturers had a deeper understanding of the work as they use the learning management system to share resources with students, Microsoft Teams as an online medium was used during COVID which requires preparation, and a different type of engagement is required with students. They were also able to share on the importance of training and support in using digital tools and how frequently they may used them.

3.6.2 Sampling

Researchers employ the concept of sampling in instances where it was not feasible to study the complete population. Researchers typically cannot observe every unit of the population they were investigating directly for a variety of reasons. Instead, they gather information from a sample of the population and use the results obtained from these observations to draw conclusions about the population (Dubey and Kothari 2022: 67). Wiid and Diggines (2021: 70), defined a sample as a subset of a population which a researcher would have liked to conduct a study on. The sample was the specific group of individuals that the data was collected from. A population was a collection of unique people, things, objects or any other unit from which measurements were made by taking samples (Dubey and Kothari 2022:67), from which a sample was chosen, which is a representation of the population. A survey was conducted amongst the six faculties, that is, Faculty of Accounting and Informatics, Faculty of Applied Sciences, Faculty of Arts and Design, Faculty of Health Sciences, Faculty of Engineering and the Built Environment, Faculty of Management Sciences and included Centre for General education, Centre for Excellence in Learning and Technology (CELT).

3.6.3 Sample Size

According to Dubey and Kothari (2022), the number of selected individuals from whom one gathered, the necessary data was known as the sample size. The sample was calculated based on the total population as per the Durban University of Technology Staff Directory, the sample size was 247 and 73% of questionnaires were collected from the total sample size.

The right sampling method was important in ensuring the validity of the research and essential to choosing the right method for the research question (Adu and Miles 2023: 211).

3.6.4 Sample Frame

According to Adu and Miles (2023: 240), a list that indicated each component of the population was called a sampling frame and it should have included every component of the population. The sample frame was selected from the Durban University of Technology staff directory. In this study, lecturers were selected based on the Durban University of Technology being a university which had adopted the Multimodal Approach and to understand the lecturer's attitude towards using digital tools. The purposive sampling method was used for this study.

3.6.5 Sampling Procedure

According to Wallman (2021), when sampling, it was impossible to acquire answers from every member of a big group of individuals. One option was to focus on a sample of them in the hopes that the information gathered was a representation of the entire group. A population was a group of possible participants to whom one intended, to generalise the findings of a study, according to Salkind (2022: 181). The population was broken down into the sample frame and a sample was then selected. Rahman et al. (2022: 44), stated that the main goal of sampling was to generate a representative sample made up of a few examples or units selected from a much larger population or group.

3.6.6 Sampling Designs

If resources such as money, time, skilled labour and other resources had not been an issue, researchers could have obtained the most precise data by surveying the whole population of interest. With limited resources the researcher resorted to sampling. The actual goal of the survey was to learn about the characteristics of the population. A large enough and impartial sample was required to guarantee a high degree of confidence that the sample accurately represents the population. The sample needed to be free of errors in order to be unbiased. Two types of approaches were available for selecting samples. The different sampling techniques were divided into two categories: non-probability, also known as non-random, and probability, also known as random (Dubey and Kothari 2022:69).

3.6.7 Probability Sampling Methods

The most popular sampling technique was probability sampling because participants were chosen at random. (Salkind 2022: 181), Probability sampling bases the sample selection on random sampling techniques (Wallman 2021). Probability sampling was defined as everything in the population had an equal chance of being selected for the sample (Adu and Miles 2023: 245). The advantages of probability sampling were that it approaches a lower possibility of systematic errors.

Secondly, the likelihood of sample biases is reduced by the probability approaches. Finally, probability sampling yielded a more representative sample and allows conclusions to be extended to the entire population (Alvi 2016), The disadvantage was if you began with probability sampling it was time-consuming and labour-intensive. It also has costs associated with it (Alvi 2016).

Maree (2020), defines the specific techniques used for selecting a sample from a population as the following:

- Simple random sampling - everyone had the same probability of being chosen to be a part of the sample requires an up-to-date sampling frame.
- Stratified sampling - a method in which the researcher divided the population into smaller groups called strata, which did not overlap but represent the entire population (Rahman et al 2022: 48).
- Cluster sampling - the researcher divides the entire population into sections which represent a population. This grouping may be done based on age, sex, location, demographics etc.
- Systematic sampling - The researcher chose the sample member of a population at regular intervals, required selecting a starting point for the sample and sample size determination that can be repeated at regular intervals (Taherdoost 2018: 961).

3.6.8 Non-Probability Sampling

Adu and Miles (2023: 226), defined non-probability sampling method as a sampling strategy where units of the sample were chosen based on personal preference or practicality, with no knowledge of the likelihood that any specific member of the population would be chosen. Simply stated, the non-probability sampling method was used to create an assumption that endeavoured to help with an immediate return of data and build a further base for research.

(Wiid and Diggines 2021: 67), stated that there were five common types of non-probability sampling:

- Convenience sampling: the method depended on the ease of availability to subjects, participants in the same place at the same time.
- Quota sampling: used census data to classify the population and pre-set standards for example based on age, location or income and was a faster method.
- Snowball sampling: referral sampling, used in cases where participants were not be easy to locate.

- Purposive (judgmental) sampling: selected subjectively and formed at the researcher's discretion, considered the purpose of the study along with the target population.

3.6.9 Purposive Sampling

Purposive sampling is a technique which allowed the researcher to use his or her own judgement or that of a knowledgeable person to identify who would be in the sample (Wiid and Diggines 2021: 222). Purposive sampling was used to send out emails to 686 DUT lecturers between August 2022 and August 2023 whilst the required sample was 247 questionnaires, A larger number of emails was sent out due to a low response rate. In January 2023, a field worker was used to visit departments to drop off questionnaires and collect which proved just as challenging. Due to a low response rate, only 181 lecturers responded by the end of August 2023 and completed the questionnaire and due to time constraints, this data was used for the statistical tests run. With 73% for the data collected, the statistician consulted for the study informed me that the sample size was sufficient for statistical analysis. Participation in this study was voluntary, before completing the questionnaire, lecturers were required to complete a consent form. For the pilot study, lecturers from external universities were invited to participate in a pilot test to develop the initial scale/questionnaire during May 2021 and May 2022, based on the findings of the pilot, IREC approved that the study could continue.

3.7 Research Measuring Instrument: Questionnaire

A self-developed structured questionnaire was shared with lecturers (respondents) through two channels by the researcher. The first was an email that was sent out to 686 Lecturers with two follow up emails sent to respondents to complete the questionnaire.

The Research Instrument

The research instrument consisted of 60 items, with a level of measurement at a nominal or an ordinal level. The questionnaire was divided into 9 questions which measured various themes namely: as illustrated below:

i. Biographical data
ii. Digital Tools
iii. Use of digital tools for teaching and learning
iv. Challenges that affected the use of digital tools for blended learning.
v. Type of Adopter
vi. Digital tool usage for blended learning
vii. Adoption Categories and the adoption process
viii. Attitude of the lecturer towards using digital tools

ix. Diffusion of Innovation Theory characteristics

3.7.1 Research Instrument

According to Wiid and Diggines (2021:79), a questionnaire was a commonly used instrument designed to collect primary data. In this study the questionnaire was the most appropriate data collection tool. Depending on the type of research there were two types of measuring instruments used, one was the questionnaire and the second was electronic equipment which includes cameras, tachistoscopes and electronic metre, to name a few. De Santos et al. (2021), described data collection as a critical point of any research. Questions used in the data collection were a tool to answer specific research questions.

Online data collection was a systematic process and involved clear distinction in the way the data was collected. According to Bush and Burns (2015:172), the internet was popularly used as a method to collect research which was historically collected in paper-based format it could be collected through text messages, emails and sent using mobile devices. There were a host of online survey providers which were used to collect data, including Microsoft Forms, Survey Monkey, Gizmo and Qualtrics Kotler et al. (2022:134). The research Instrument for the purpose of this study was a self-administered questionnaire to be distributed to lecturers at the Durban University of Technology who currently use the Multimodal approach to teaching.

3.7.2 Data Collection

Once the sample was clear to the researcher, the next step in the research methodology process was to determine how the data collection would take place (Wiid and Diggines 2021:401). There were two types of methods used in the collection of data, these were primary and secondary data collection. The most common type of data collection is a survey (Vaske 2019). The term "primary data" described facts that a researcher has gathered or collected, especially for the current study topic (Burns, Veeck and Bush 2020), whereas Secondary data is information that has already been obtained, either by someone other than the researcher or for a different reason than the current study effort. Researchers in the social sciences and humanities followed a step-by-step process while collecting primary data, which is original information that was first gathered for the purpose of the study (Khuc 2021: 1). Primary data is intended to produce fresh insights and enables the researcher to choose the setting in which the data will be gathered (Chikukwa 2017). The researcher gathered the primary data for this study using a structured, closed-ended questionnaire (Appendix A). Permission was requested from the Department of Research and Postgraduate Support to conduct the research study. (Appendix B). Thereafter the researcher sought permission to conduct the research study among the Durban University of Technology Lecturers. The researcher contacted the relevant departments within the university to contact

lecturers and used the DUT Staff Directory. Salkind (2022:123) outlined the process that follows once data is collected, and it needs to be prepared to be analysed. The first step was to create a datafile that would be used to input your data into the statistical software, SPSS Statistical Software Package Version 27 was used. The data needed to be coded which is an extremely important process, when coding the codes needed to be clear and easy for others to understand.

3.8 DATA ANALYSIS PROCEDURE

SPSS version 27.0 was used for the data analysis process. Descriptive statistics, such as frequency tables to show demographics and measures of central tendency and dispersion for continuous variables, were first used to summarise the data. For continuous variables, the mean and standard deviation and for categorical variables, the frequencies were given. Second, inferential statistics were used to summarise the findings. The three study topics were addressed using multiple regression analysis in order to ascertain the variations in group means. The multiple linear regression analysis (α =.01) was carried out by the researcher (Adu and Miles 2022: 375). Data analysis is defined as the process of cleaning, arranging, and analysing data to make informed decisions about the information. According to (Sudheesh, Duggappa and Nethra 2016: 632). The different stages of the data analysis should be presented, including the sample size calculation, steps adopted for coding, mention the statistician that assisted and the suitable software used and how it contributed to the data analysis and the sample calculation. Data was reviewed in various ways according to Nunkoo et al. (2021:250), through back-end software which allowed researchers to make sense of the data.

3.8.1 Questionnaire Development

When constructing a questionnaire, relevant literature and research on survey instruments were required to develop the questionnaire for the study. The questionnaire was created by the researcher and was based on the literature review, there is a mixture of questions which can be used in constructing a questionnaire like Open ended, Long, or Short ended questions and Likert Scale. Closed ended questions were most efficient and easy to quantify with specific answers.

3.8.2 Questionnaire Design

The questionnaire design consisted of sixty items, with a level of measurement at a nominal or an ordinal level. When collecting data, the questions could be Open-ended and Closed-ended (Nemoto and Barglar 2014:1), closed-ended questions were used for this study. The questionnaire was distributed to lecturers electronically through email. The questionnaire was divided into nine questions, which measured various themes as illustrated below:

3.8.3 Biographical data

In this study, Section One covered the biographical information of the lecturers. The questionnaire gathered information regarding gender, ethnic group, age, lecturer designation, lecturer experience, campus and faculty they worked within. Based on the demographic information gathered, the demographic data was very useful in supporting the descriptive statistics on the participants. Additionally, the data from the questionnaire was used to precisely characterise the individuals and their way of adopting. (Harold et al. 2019).

3.8.4 Digital Tools

This section looked at the types of devices most used by lecturers; their preference in application or software for teaching and blended learning; how often they used digital tools, the challenges which affected the use of digital tools for blended learning, and the types of adopters.

3.8.5 Digital tool usage for blended learning

This section contained a Likert scale and covered questions related to the digital tool usage by lecturers, looking at their confidence when using digital tools, access to digital tools, student engagement relating to digital tools and preferences.

3.8.6 Adoption Categories and the adoption process

This section highlighted the adoption categories and how the support, ease of use and awareness of digital tools and technology related to the adoption process.

3.8.7 Attitude of the lecturer towards using digital tools

This sub-section of the questionnaire consisted of questions aimed at evaluating lecturers' attitudes towards using digital tools for teaching and learning, respectively. As covered in Chapter 2 covers Davies (1989) who argued that ease of use and perceived usefulness are the two variables that had an impact on attitudes. This section looked at participants' views regarding the platforms' perceived usefulness.

3.8.8 Diffusion of Innovation Theory characteristics

This sub-section of the questionnaire consisted of questions on Diffusion of Innovation and relating them to digital tools.

3.9 PILOT STUDY

According to Burns (2017), a pilot study involved conducting a dry run of the survey on a small set of participants to reveal errors before the questionnaire was launched. By conducting a pilot study and pretesting the list of questions the researcher ensured that what they were asking is unambiguous and clear to participants. It helps to be able to correct any points of confusion before performing the study. A pilot study was undertaken by the researcher with a small group of lecturers at another University in Durban KwaZulu-Natal to test whether the participants would be able to interpret the questionnaire and if it was suitable for the study. The following findings were used, the Cronbach's alpha coefficient for all the items collectively was found to be good (α=0.891), indicating that the instrument is sufficiently reliable. The aim of this stage was to ensure that data collection has taken place with minimal errors according to Nunkoo et al. (2021), but the most important part was the accuracy of the data collected, ensuring the validity and the reliability of the questionnaire was essential to obtain accurate and precise results.

The questionnaire was presented in English and consisted of five sections and took 8 – 10 minutes. The process followed is the researcher emailed a questionnaire to a lecturer anonymously and it was self-administered to 50 Lecturers at a University in KwaZulu-Natal, the data was tracked using Microsoft Forms which was later downloaded and used in the data analysis. All 50 Lecturers responded within a week of receiving the questionnaire. The questionnaire data was analysed and presented to IREC for final approval to conduct the study.

3.9.1 Administration of the questionnaire

The questionnaire was administered to lecturers at the Durban University of Technology through Microsoft Forms. The first was emails sent out between August 2022 and January 2023, with an extremely low response rate. During January 2023 and August 2023, 300 hardcopies of the questionnaire were delivered to lecturers and left with the secretaries of each department and follow-up emails were sent once delivered. In both instances, lecturers/respondents were informed and assured of confidentiality being maintained. Lecturers would ask to leave the questionnaire to complete later and when the researcher returned to collect, they were unavailable, or questionnaires dropped off were not completed upon the researcher returning.

3.9.2 Derivation of the questionnaire

A questionnaire was a specific tool or instrument used for collecting data, the derivation table below was used when creating the questions for the questionnaire.

Objective One: Variables that influence the adoption of digital tools			
Construct	**NO**	**Question**	Source/Page
Adoption Enablers of digital tools	2.6.1	I am technologically savvy	Dintoe (2018: 55), Horst et al. (2021:2)
Adoption Enablers of digital tools	2.6.2	I am confident when accessing a digital tool used for my module	Wang (2015: 49), Feijoo et al. (2021:15), Aithal and Aithal 2020, Hsu and Lin (2020:4) Teane (2024)
Adoption Enablers of digital tools	2.6.3	Digital support and training influenced my decision to use a digital tool in my blended classroom	Wang (2015:49), Dintoe (2018: 54), Diaconu et al. (2019:16) Hsu and Lin (2020:4)
Adoption Enablers of digital tools	2.6.4	Teaching with digital tools can improve student engagement	Wang (2015:10), Moreira et al. (2017:260), Lowenthal and Trespalacios (2022)
Adoption Enablers of digital tools	2.6.5	Access to digital tools can improve student pass rates	Wang (2015:34), Aithal and Aithal 2020, Ramroop

			(2021), Roddy et al. (2017)
Adoption Enablers of digital tools	2.6.6	The use of digital tools makes my lectures more visual	Wang (2015:34), Aithal and Aithal 2020
Adoption Enablers of digital tools	2.6.7	The digital teaching content is compatible with my device	Wang (2015:44), Dintoe (2018:55), Rogers (2003:15), Booc et al. (2024)
Adoption Enablers of digital tools	2.6.8	Digital tools are user friendly	Lazar et al. (2020:13), Tshabalala (2021), Israel et al. (2021)
Adoption Enablers of digital tools	2.6.9	The complex nature of digital tools demotivates me	Wang (2015:49), Langegard (2021)
Adoption Enablers of digital tools	2.6.10	Covid19 has changed my opinion about adopting digital tools	Langegard (2021)
Objective Two: Apply the Diffusion of Innovation theory			
Diffusion of Innovation Theory	2.7.1	I am passionate about teaching with digital tools and will try new technology products	Dintoe (2018:4) references early adopters, van Blerk (2019)

Diffusion of Innovation Theory	2.7.2	I will use a digital tool that a colleague has recommended	Wang (2015:62)
Diffusion of ation Theory	2.7.3	I carefully consider which digital tools I use to teach	van Blerk (2019)
Diffusion of Innovation Theory	2.7.4	I need to demo/trial before deciding whether I will use it or not	Wang (2015:62)
Diffusion of Innovation Theory	2.7.5	Support services influence my adoption of new digital tools	Bond et al. (2018:6), Moreira et al. (2017:254), van Blerk (2019)
Diffusion of Innovation Theory	2.7.6	Colleagues' experiences with digital tools influence my decision to try new digital resources	Wang (2015:62), Ramroop (2021)
Diffusion of Innovation Theory	2.7.7	If a digital tool appears complex, I will not try it	Wang (2015:48), Bond et al. (2018:5), Anthony et al. (2022: 531-578)
Diffusion of Innovation Theory	2.7.8	I am reluctant to use digital teaching resources based on my experience	Wang (2015:84), Ramroop (2021)
Diffusion of Innovation Theory	2.7.9	I have returned to face-to-face teaching and learning after the COVID19 lockdown willingly	Allarmary (2019:2) Jahanmir and Cavandas (2018), Langegard et al. (2021:9), Lowenthal and

			Trespalacios (2022)
Diffusion of Innovation Theory	2.7.10	I prefer printed teaching tools to digital tools	Wang (2015:62), Tinashe (2021)
Diffusion of Innovation Theory	2.7.11	I am aware of digital tools available on the market (not including compulsory MML tools)	Dintoe (2018:54) references awareness of technology and value, Ramroop (2021)
Diffusion of Innovation Theory	2.7.12	I prefer to attend regular webinars based on digital products available	Dintoe (2018:55), Spilski (2022), Tinashe (2021)
Objective 3: To ascertain the attitude of lecturers towards digital tool			
Attitude of Lecturers	2.8.1	I have a positive attitude towards using digital tools for blended learning	Wang (2015:15-16) references perceived attitude, Jahanmir and Cavandas (2018:338), Spilski (2022)
Attitude of Lecturers	2.8.2	I believe it is important to know how to use a digital tool before adopting	Dintoe (2018:54), Tinashe (2021)
Attitude of Lecturers	2.8.3	I think using digital tools for learning is over-emphasized	Tshabalala (2021)
Attitude of Lecturers	2.8.4	I wish I could use a digital tool for all my modules	van Blerk (2019)

Attitude of Lecturers	2.8.5	Digital Teaching and Learning tools make my lectures exciting	Dintoe (2018:13), Ramroop (2021)
Attitude of Lecturers	2.8.6	Digital Tools add fun to teaching and learning	Spilski (2022)
Attitude of Lecturers	2.8.7	I believe that digital tools motivate students to attend lectures	Elfaki et al. (2019), Ali (2022)
Attitude of Lecturers	2.8.8	Embracing technology in the teaching and learning environment is essential in the 4IR era	Bond et al. (2018:5), Ali (2022)
Attitude of Lecturers	2.8.9	The COVID pandemic has changed my attitude towards electronic resources	
Attitude of Lecturers	2.8.10	As a lecturer, I encourage students to use electronic sources from the library	Wang (2015:46)
Attitude of Lecturers	2.8.11	My friends and colleagues also adopt digital tools for teaching and learning	Wang (2015:62), Anthony et al. (2022: 531-578), Tshabalala (2021)

Objective Two: Apply the Diffusion of Innovation theory.			
Diffusion of Innovation Theory	2.9.1	Digital tools make a lecturer work efficiently	Arkforful and Abaidoo (2015: 34), Anthony et al. (2022: 531-578)
Diffusion of Innovation Theory	2.9.2	Using digital tools is convenient for teaching	Wang (2015:48), Min et al. (2019)
Diffusion of Innovation Theory	2.9.3	Digital tools motivate me	Dintoe (2018:53), Arkforful and Abaidoo (2015), Amhag et al (2019)
Diffusion of Innovation Theory	2.9.4	With digital tools, I manage resources effectively	Arkforful and Abaidoo (2015: 34), Qwabe and Khumalo (2020)
Diffusion of Innovation Theory	2.9.5	I like to adopt innovative teaching resources	Dintoe (2018:54), Bond et al. (2018:5), Ali (2022), Tshabalala, Ndeyu and van der Merve (2024)
Diffusion of Innovation Theory	2.9.6	The University's current Infrastructure supports the usage of digital tools for teaching and learning	Dintoe (2018:52), Leisa-Orus et al. (2020)
Diffusion of Innovation Theory	2.9.7	Using digital tools fits into my teaching style	Tshabalala (2021)

Diffusion of Innovation Theory	2.9.8	Digital tools or resources can be accessed anytime and anywhere	Wang (2015:47), Arkforful and Abaidoo (2015: 34), Moreira et al. 2017 (256), Qwabe and Khumalo (2020: 3)
Diffusion of Innovation Theory	2.9.9	Student interaction and engagement is better online	Dintoe (2018:53) references students lack interest/excitement, Qwabe and Khumalo (2020: 2), Anthony et al. (2022: 531-578)
Diffusion of Innovation Theory	2.9.10	Using digital tools requires extensive preparation	Dintoe (2018:4), Tshabalala (2021)
Diffusion of Innovation Theory	2.9.11	Using digital tools can be demanding	Albrahin (2020), Qwabe and Khumalo (2020)
Diffusion of Innovation Theory	2.9.12	Using digital tools requires technical skill	Dintoe (2018:54), Or and Chapman (2021), Tshabalala (2021)
Diffusion of Innovation Theory	2.9.13	I am keen to always try out new digital tools	Dintoe (2018:54), Ali (2022), Tshabalala et al. (2014)

3.10 ANALYSIS OF DATA

Data was analysed using descriptive and inferential statistics. Quantitative statistics analysis was conducted, the data was analysed using the SPSS statistics package and according to Wiid and Diggines (2021: 404). The following tests are important in the analysis: descriptive statistics, reliability test, Exploratory factor analysis (EFA), Confirmatory factor analysis (CFA), t-test,

ANOVA and Cronbach Alpha. The use of frequency tables and descriptive statistics allowed for the generalisation of participant responses about the integration of digital tools for blended learning.

3.10.1 Descriptive statistics

A person, group or class could be statistically described together with its nature, form, position and other attributes by using descriptive statistics, which clearly and numerically stated the features of a set of data. The most popular descriptive statistics were the following: graphs, percentile, correlation, mean, median, mode, mean deviation, quartile deviation, range, standard deviation, variance, etcetera (Jha 2024:304). According to Otieno-Okello (2023: 82), descriptive statistics referred to the presentation and summarisation of data and the description thereof. It includes charts, tables, graphs and other data displays which are measured. Cronk (2019: 131), described it as organising and summarising of data. Descriptive analysis used a number of metrics, including the range, mode, standard deviation and mean central tendency (Adu and Miles 2022: 273). Most quantitative research projects had the reporting of descriptive statistics as one of their common requirements. The degree of measurement of the variables was provided by descriptive statistics, allowing researchers to assess the validity of analyses and proximity measurements (where applicable) (Hancock, Stapleton and Mueller 2019).

3.10.2 Inferential statistics

Using sample statistics to estimate the parameter was the fundamental concept of inferential statistics. In this case, a statistic is a measure based on the sample, while a parameter was a measure based on the population. Thus, inferential statistics described not only one group but expanded itself to the whole population. Information on the population was obtained through the use of inferential statistics in research at all levels. Inferential statistics are statistical analysis tools including the t-test, F-test (ANOVA), ANCOVA, normal probability curve, standard scores, factorial analysis, partial and multiple correlations, Chi-square test, to name a few. Tests used in inferential statistics can be classified as either parametric or non-parametric (Jha 2024:305). Otieno -Okello (2023:83), described inferential statistics as drawing conclusions about the whole population from the sample. Inferential Statistics included parametric statistical tests including the t-test, ANOVA, regression, and factor analysis are used in inferential statistics. By analysing a small known sample, inferential statistics also offered a means of guiding one to develop trustworthy assumptions about an unknown population (Malhotra, 2015). The statistical process that necessitates sample data taken from a population was known as parametric statistics. The most effective test is the presumption-based parametric test. The primary objective is to compare two or more groups' means. In social science, the most frequently used parametric tests include

regression analysis, ANOVA, ANCOVA, and Pearson product-moment correlation. Assumptions underlie parametric statistics. Non-parametric statistics were used when certain presumptions were not met. Common non-parametric tests included the Chi-square, Spearman rank correlation, Median, Sign, Kruskal Wallis, Runs, and other tests (Jha 2024: 306).

3.10.3 Regression Analysis

The relationship between a set of independent variables and a dependent variable was described by regression analysis (Wegner, 2016). Regression analysis adapted a statistical equation utilising the least squares approach to determine the degree or relationship between a dependent variable and a set of independent variables (Dubey and Kothari 2023:223). The degree of correlation between the variables was further examined using the correlation matrix and linear regression analysis. The statistical metric known as R-squared (R2) was presented in the regression model results. The percentage of a dependent variable's variation explained by the independent variable(s) in the regression model is known as the R-squared value. R-squared described the amount that the variation of the independent variable influences the variance of the dependent variable, whereas the correlation coefficient describes the strength of the association between two variables (Jha 2024:333).

3.10.4 Coefficient of Determination ($R^{2)}$

When forecasting the result of a specific event, the coefficient of determination was a statistical measurement that looked at how changes in one variable could be explained by the difference in another variable (Kumar 2021). It assessed how strong the linear relationship was between independent and dependent variables are.

3.10.5 One sample t-test

Sekaran (2016: 278) defined the t-test as a test used to see if there was a significant difference in the means for two groups in a variable of interest. Otienne (2022:235) defined the t-test to determine if a variable was significantly different from the mean value. According to Gournelos, Hammonds and Wilson (2019: 163), the t-test could be characterised as the simplest way to determine differences in two groups. In this study, the t-test was based on the average agreement score tested against the central score of three to see if it differed significantly.

3.10.6 Analysis of Variance (ANOVA)

When comparing more than two groups (such as age groups or categorical groups), an ANOVA was utilised.(Adu and Miles 2024: 62), analysis of variance is a statistical test used to determine

if more than two means are equal and it tests the relationship between a dependent and independent variable (Wiid and Diggines 2021: 301), the ANOVA was appropriate if the quantitative variable was normally distributed in the population. In this study, the ANOVA was used to determine the relationship between the following variables, Attitude and Usage, Perceived ease of use and usage, Effort expectancy and usage, adoption and usage, influence and usage, challenges, and usage and all the predictors and usage.

3.10.7 Pearson's Chi- square test

The Chi-square test was used to see the relationship between two variable and to establish confidence in the relationship, it is a non-parametric test. De Santos et al. (2022). According to Jha (2024:336), the Chi-Square test was primarily utilised when an incidence, phenomenon or circumstance could be seen, and its anticipated frequency could be determined.

3.11 FACTOR ANALYSIS

A statistical technique for looking at and identifying patterns in the connections between several variables was factor analysis. Factor analysis found the significant variables influencing the phenomenon and simplified the data (Jha 2024:334). In factor analysis (FA), concepts and theories are used to uncover the structure of a set of variables (De Santos et al. 2022). The purpose of factor analysis is to determine which items can be grouped together, commonly 5 - 0r 7- point Likert scale is well suited for this type of analysis. According to Noora (2021: 5), there are two main approaches to factor analysis: Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA). Exploratory factor analysis is often used in the early stages of research to gather information about the relationships amongst a set of variables, the confirmatory factor analysis is used in the research process to test specific hypotheses or theories concerning the structure of a set of variables (Hancock, Stapleton and Mueller 2019: 99), their first exploratory factor analysis (EFA) was carried out, the researcher made use of SPSS 27.0. For the extraction process, a varimax rotation was applied to a principal component analysis (PCA). When the goal of the research is data reduction or exploration, or when the approach is variance-focused, the PCA makes sense. The researcher established a benchmark of a minimum coefficient of 0.3 or higher for the components in order to determine the EFA's criterion. This shows that a few of the scale factor loadings measured for the 26 items in this PCA met or exceeded the required minimum for a benchmark coefficient score of at least 0.3. Consequently, the factor loadings were regarded as a fair measure within the factor, as per (Adu and Miles 2024:407).

3.11.1 Validity and Reliability

A good research instrument needs to be valid and reliable, maximises an experiment's internal and external validity and it needs to be able to answer the proposed research questions under investigation without bias (Adu and Miles 2024: 58). According to Cronk (2020:131), validity can be defined as the accuracy of a scale and reliability as the consistency of a scale. According to Gournelos et al. (2019:128), validity looks at how well the participants' answers match those outside the study. It is the extent to which an instrument measures what it is supposed to measure and performs as it is designed to perform. Hammond and Wellington (2020: 192), state that validity can mean many different things in everyday conversation. A logically sound argument or, less confidently, one that is backed by strong evidence, are both acceptable definitions of a valid argument. Welman (2012), defines validity as the extent to which the situation is represented in the findings. There are various types of validity, including construct validity, internal validity, external validity and statistical conclusion validity.

According to Andrade (2018: 498), Internal Validity examines the study design and analysis to answer the question without bias, and external validity examines whether the findings of the study can be generalised to the population from which the study was drawn. Three general types of validity can be examined: (a) content validity, also known as face validity, is a methodical and subjective assessment of how well a scale's content reflects the measurement task at hand; (b) criterion validity looks at how well the measurement scale performs in relation to other variables that have been chosen as meaningful criteria; and (c) construct validity looks at the construct or characteristic that the scale is measuring. It attempts to provide theoretical answers to questions about why a scale functions and what conclusions can be drawn about the theory underlying the scale (Adu and Miles 2024:287). Statistical conclusion validity, according to McMillan and Schumacher (214:117), is the process of how the statistics guide the findings and takes into consideration the correctness of the statistical analyses, whereas construct validity is the degree to which the intended concept can be measured. Content validity is the simplest type of validity and measures the extent to which a test represents the list of items from which it was drawn Salkind (2022), refers to the appropriateness of the content of an instrument.

According to (Maree:2020), reliability is concerned with the findings of the research and related to the credibility of the findings. It is thought of as consistency. The degree of consistency or dependability of the measurement or scale is referred to as reliability. The same result would result by measuring the same construct repeatedly. To be reliable means to consistently reach conclusions (Dubey and Kothari 2022:37).

There are various types of methods to test reliability:

Reliability is confirmed when an experiment yields the same results, whether it is done twice or three times. Nonetheless, there are significant issues with the test-retest approach to reliability testing, the primary issue is that it can be quite challenging to locate and get the cooperation of every respondent for a follow-up research study. Aside from this, these individuals' answers can differ the next time, and environmental circumstances can occasionally affect the answers as well (Dubey and Kothari 2022:37).

Inter rater/Observer reliability – As the name implies, inter-rater reliability evaluates the extent to which various observers provide consistent assessments of the same phenomenon. It is used to ascertain whether two observers are consistent in their observations (De Santos et al. 2021; Dubey and Kothari 2022:37).

Parallel form's reliability – Two identical measurement scales are to be designed for parallel form reliability. The correlation between the scores produced by the two instruments is used to assess the method's dependability. It is nearly impossible to create two completely equivalent surveys, which is the main issue with parallel form reliability (Dubey and Kothari 2022:39).

Internal consistency reliability – When data produces consistent findings even after modification. The issue with internal consistency is that its dependability entirely depends on how the facts are split up or altered. It happens occasionally that various splits produce different outcomes. To get around these split-half issues, many researchers use a method known as Cronbach Alpha, which requires the scale elements to be spaced equally apart (Dubey and Kothari 2022:39).

Cronk (2022:118) describes Cronbach's Alpha as a test used to measure internal consistency. It is but one test to check the reliability of a study and is thought of as a possible split- half coefficient.

Table 3.1 Cronbach's Coefficient Alpha

Dimensions	Items	Cronbach's Alpha
Using Digital Tools for blended learning	11	0.863
Adoption Categories and the adoption process	12	0.530
Attitude of the lecturer's towards using digital tools	3	0.762
Diffusion of Innovation Theory Characteristics	16	0.838

Total	42	0.891

The data above was taken from the pilot study conducted to see if the questionnaire was reliable. The Cronbach's alpha coefficient for the constructs using digital tools for blended learning (α=0.863), Diffusion of Innovation theory characteristics (α=0.838), and attitude of the lecturer's towards using digital tools (α=0.762) were above the recommended value of 0.70. However, Cronbach's alpha coefficient for the construct adoption categories and the adoption process was below the accepted value. Overall, the Cronbach's alpha coefficient for all the items collectively was found to be good (α=0.891), indicating that the instrument was sufficiently reliable.

3.12 LIMITATIONS OF THE STUDY

Research was limited to lecturers at the Durban University of Technology, the researcher experienced delays in data collection, only a percentage of the sample size was collected.

3.13 ETHICAL CONSIDERATIONS

According to Maree (2020: 48), the following ethical considerations needed to be kept in mind and complied with throughout the study namely: Obtaining permission to conduct the study, Informed consent, Anonymity and Confidentiality, participants' right to withdraw, and extreme care was taken in promoting participants wellbeing. Ethical consideration refers to participants' rights to being protected by obtaining informed consent and by following the institutional review processed for ethical approval before conducting the study (Sudheesh et al. 2016: 632). Researchers should follow ethical standards when conducting and communicating their research, such as (openness, honesty, accountability, fairness and respect for animals and humans) (Resnik and Elliet 2016). The Belmont report as stated by Elias and Theron (2012: 150), established three principles which were a guideline to take into consideration when administering a questionnaire to research participants, namely: respect for people, justice, and beneficence. Before commencing the study, the researcher had to complete a certificate by TRREE for Introduction to Research Ethics, as well as follow the IREC guidelines to ensuring that the above was upheld when conducting the research. The subject of the study and the organisation of the research in relation to the surveys were approved by FRC, IREC and the researcher and supervisor were required to complete an Ethics course before commencement of the study.

3.14 SUMMARY

This Chapter included the pilot study used to confirm that the questionnaire was fit for use in the study. The type of research conducted, data collection, the research process and design, the data analysis, validity, and reliability were all discussed.

The next chapter will look at the findings.

CHAPTER FOUR: RESULTS AND DISCUSSION

4.1 INTRODUCTION

This chapter presents the results and analyses of the findings of a questionnaire administered to selected lecturers from the Durban University of Technology in Durban, South Africa for this study. The chapter will present results in tables and graphs and a narrative thereof. The results and statistical tests using the latest version of SPSS.

4.2 DEMOGRAPHICS

The demographic profile of the respondents included six biographical items, namely: Gender, ethnic group and age, lecturer designation, lecturing experience, campus location and faculty. The results were depicted using frequency tables.

4.2.1 Gender

Table 4.1: Gender Frequency and graphs

Item	Frequency	Percent
Male	85	46.7
Female	96	52.7
prefer not to say	1	0.5
Total	**182**	**100**

Table 4.1 depicts the gender of the respondents. The result indicates that the majority of the respondents were females (52.7%) whilst the male respondents (46.7%)

4.2.2 Ethnic Group

Table 4.2: Respondents' Ethnicity

Item	Frequency	Percent
African	80	44
Coloured	5	2.7

Indian	76	41.8
White	20	11.0
Total	181	99.5
System (Missing)	1	0.5
Total	**182**	**100.0**

Table 4.2 depicts the ethnicity of the respondents. The results indicate that a major percentage of the respondents were African (44%) and Indian (41.8%).

4.2.3 Age

Table 4.3: Age Cohorts

	Frequency	Percent
23-25	4	2.2
26-40	69	37.9
41-56	85	46.7
57-75	24	13.2
Total	**182**	**100.0**

Table 4.3 shows that the 26 – 40 age range has the highest percentage (46.7%) of respondents, followed by the 41 – 55 age range (37.9%). The 22 – 35 age range has a significantly lower representation (13.2%) and the 57 – 75 age range has the least (2.2%). Thus, majority of the respondents are between 26 to 56 years old (84.6%)

4.2.4 Faculty of Lecturers'

Figure 4.1: Faculty of respondents.

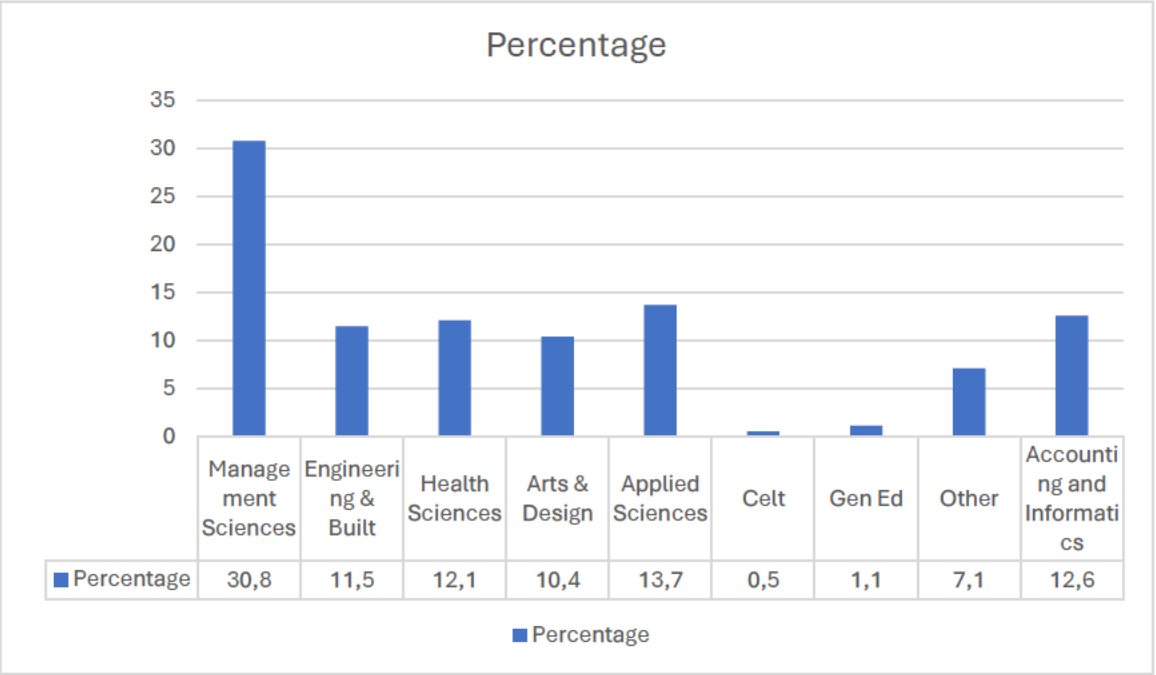


Figure 4.1 represents the faculties profile of respondents. A major percentage of respondents were found within the Faculty of Management Sciences (30.8%) and the Faculty of Applied Sciences (13.7%), whilst the Faculty of Accounting and Informatics had 12.6%. However, it must be noted that there were departments with significantly lower percentages in the categories, which included CELT (0.5%) and respondents that only focused on the Gen Education courses (1.1%).

4.2.5 Campus Location

Figure 4.2: Campus Lecturer was based on.

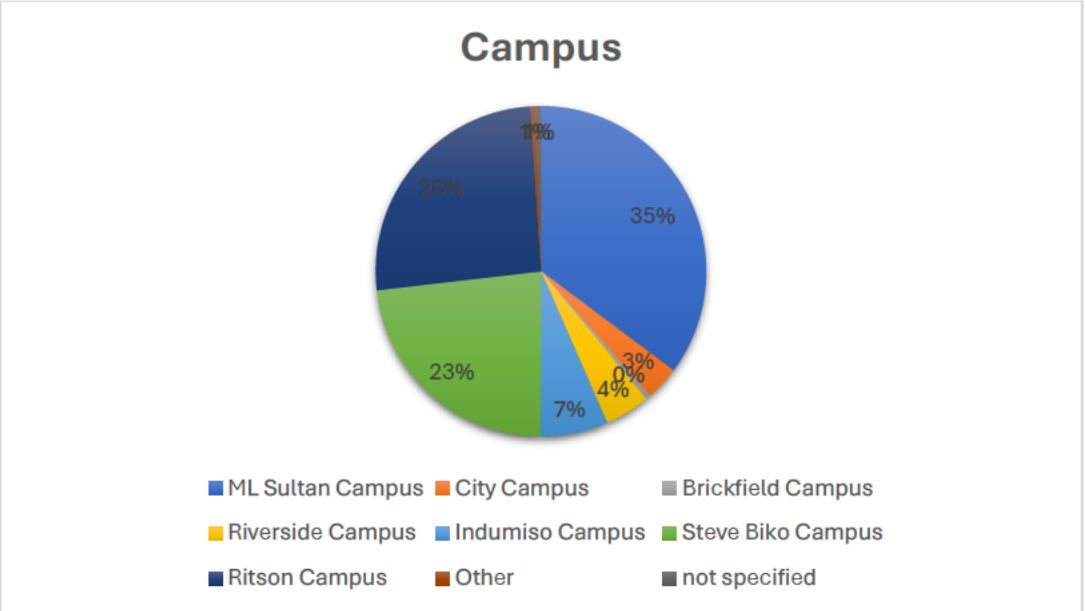


Figure 4.2 depicts the campuses that the respondents lectured on as indicated in the electron mailing list of addresses. ML Sultan Campus had a major percentage (35.2%), followed by 25.8% of respondents being based on the Steve Biko Campus.

4.2.6 Lecturing Experience

Figure 4.3: Lecturing Experience

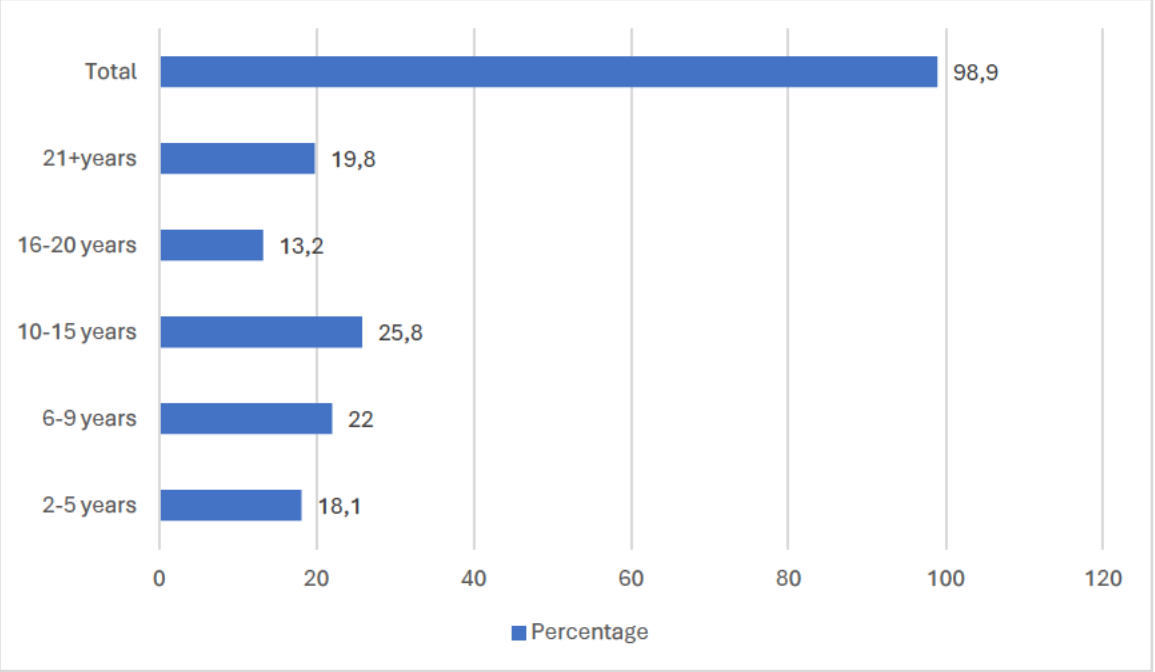


Figure 4.3 indicates that the largest group of respondents were identified as having lecturing experience of 10 to 15 years (25.8%) and six to nine years (22%) respectively. The category of over 21 years of experience had 19.85 of respondents.

4.2.7 Designation

Table 4.4: Lecturer Designation

	Frequency	Percent
Junior lecturer	11	6.0
Lecturer	115	63.2
Senior lecturer	52	28.6
Unspecified	4	2.2
Total	182	100

Table 4.4 indicates that a significant percentage (63.2%) were classified as a ‘Lecturer.’

4.3 DIGITAL TOOLS

Table 4.5 Device most used

	Responses as Frequency (%)				X^2	df	p-value
	Laptop	**Desktop**	**Android / IOS phone**	**Tablet**			
Devices used for blended teaching and learning	156 (85.7)	10 (5.5)	12 (6.6)	4 (2.2)	358.571	3	<.001*

*** - significant at the 85.7% level**

Table 4.5, illustrated that a majority of respondents used laptops as the device for teaching and learning. The Chi Square analysis indicates that there is a highly significant association (p = <.001) between the type of device selected by a respondent and used for blended teaching and learning and further reveals a highly significant association between the device type and use in blended teaching and learning (x^2 = 358.571, df = 3, P < 0.001)

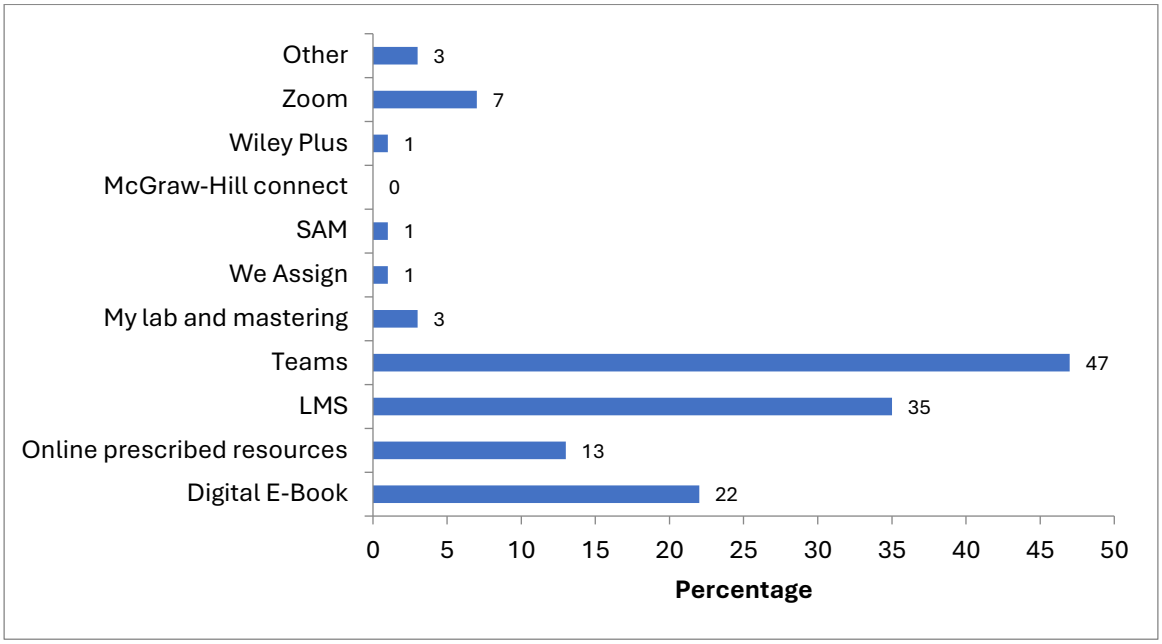
This suggests a substantive preference and possible implications for device selection in blended educational settings. The statistical significance underscores a non-random pattern in device usage among the respondents.

4.4 PREFERENCE OF PROGRAMMES, APPLICATIONS, OR SOFTWARE

Figure 4.4, illustrates the percentage distribution of various educational resources and tools. It is immediately apparent that Microsoft Teams (47%) and the Learning Management System (LMS) (35%) are the most utilised. This is compared to resources such as McGraw-Hill Connect and Wiley Plus, which show minimal to negligible usage. A notable trend is the moderate usage of Online prescribed resources (13%) and Digital eBooks (22%), suggesting a balance between collaborative platforms and digital learning materials.

The university has adopted MS Teams as a meeting platform.

Figure 4.4: Preferences.



Use of digital tools for teaching and learning

Table 4.6: Use of digital tools

	Responses as Frequency (%)				X^2	df	p-value
	More than 3 times a week	2 – 3 times a week	Once a week	Not at all			
Digital tools usage	99 (54.4)	40 (20.0)	35 (19.2)	7 (3.8)	99.110	3	<.001*

Table 4.6 depicts the use of digital tools for teaching and learning. The study revealed that a majority of the respondents significantly depended on using digital tools more than three times a week, this was reported by 54.4%, perhaps indicating an elevated level of dependence on digital tools at the Durban University of Technology. Statistical analysis yielded a Chi-square value of 99.110 with 3 degrees of freedom, indicating a highly significant association ($p < .001$) between the frequency categories of digital tool usage.

4.5 EXPERIENCE WITH DIGITAL RESOURCES

Figure 4.5a: Experience with neutral data included.

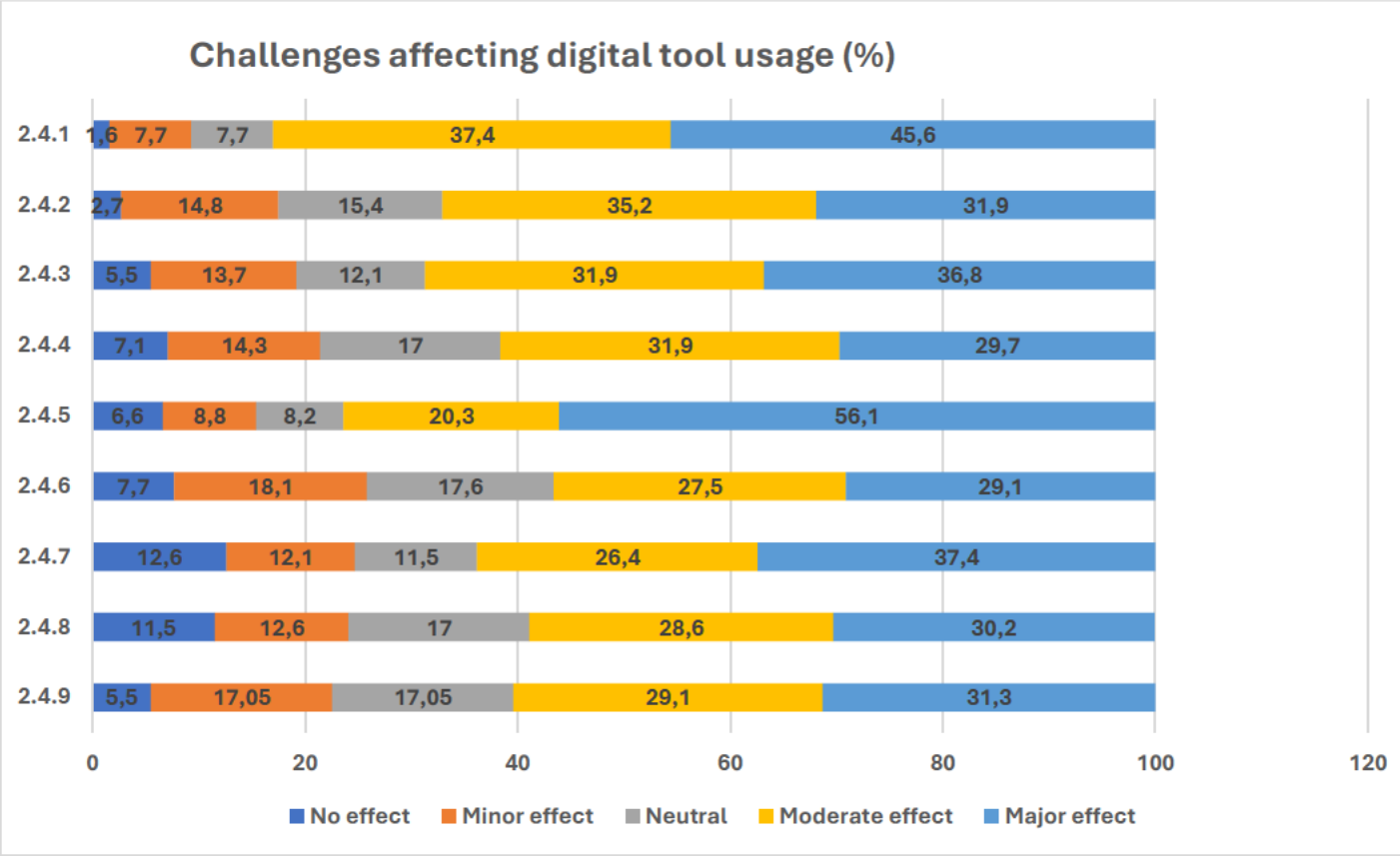
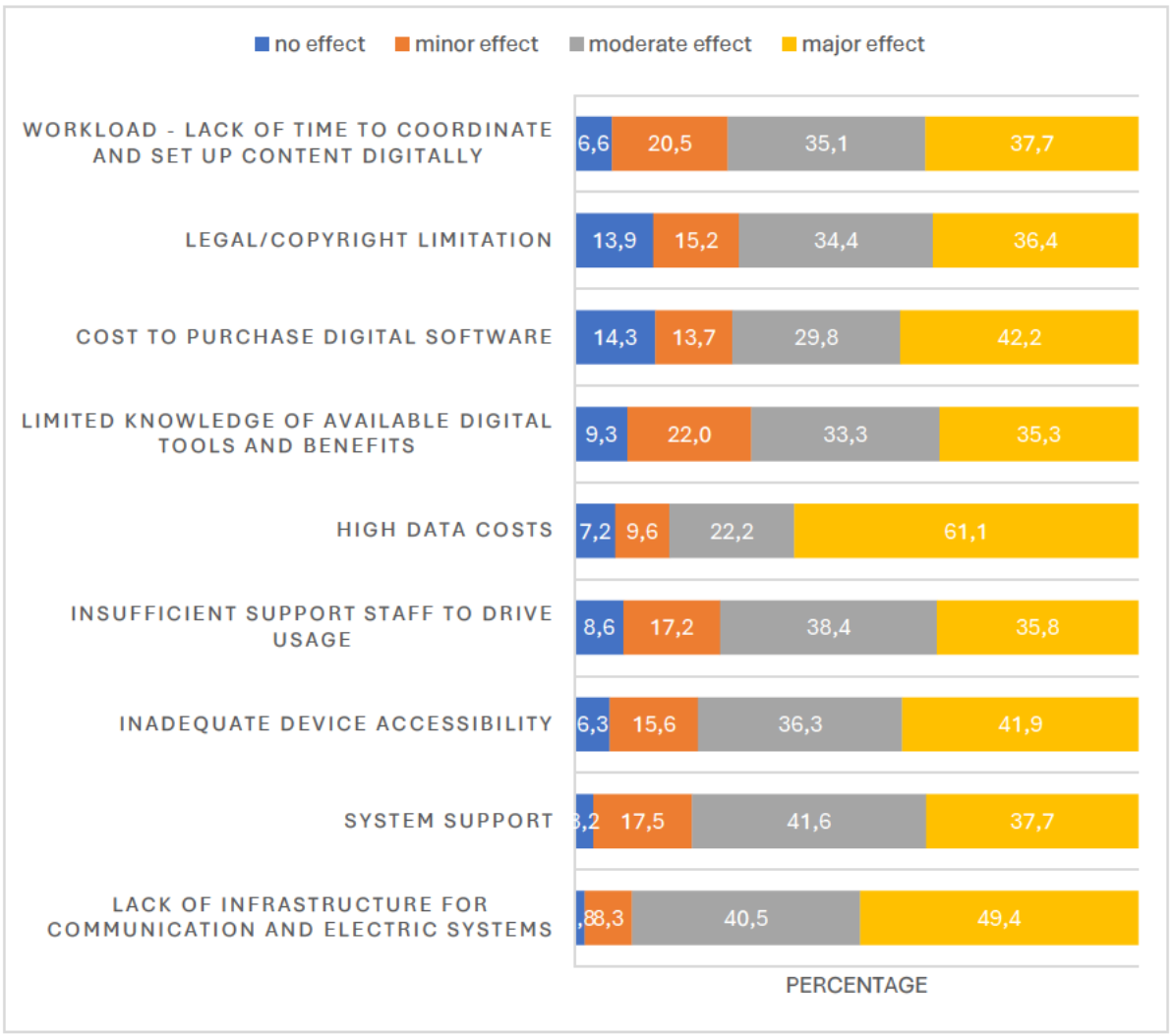


Figure 4.5a presents a clear graphical description of the various challenges encountered in adopting digital content. The data delineates the impact levels of each challenge, ranging from no effect to a major effect. Neutral has been removed and an updated graph and explanation provided below. The respondents' overall rating was not significantly influenced by the removal of the neutral point on a Likert scale. After consultation with the DUT approved Statistician, the researcher was advised to remove the neutral element from this question (Guy 1977: 1). However, using reversed items in Likert scales may assist in removing incorrect responses, which will increase the reliability of the scale (Józsa, 2017). Mixed reactions may go undetected in research designs due to neutral ratings, according to the International Affective Picture System (IAPS) (Schneider, 2016: 426). Neutral had to be eliminated from this study due to the fact it had no effect on the question regarding how respondents responded to each challenge, whether they had no effect at all or a significant effect.

Figure 4. 5b Adapted Bar Chart excluding Neutral.



A notable pattern emerged from the data collected. The largest percentage of respondents at 89.9% indicated that a lack of infrastructure for communication and electric systems was the primary challenge. On the use of digital tools for teaching and learning at the university, perhaps the high data costs (83.3%) has challenged the adoption of digital tools. As a result, the system support (79.3%) is inadequate.

A substantial percentage of 78.2% of participants considered the challenge of inadequate device accessibility as having a major effect and further showing that the inadequate device accessibility has also affected the use of digital tools. The chi square test further indicated a significant association between inadequate device accessibility and the effect it has on digital tool usage.Moreover,74.2% of respondents considered that the challenge of insufficient support staff to drive usage of digital tools has a major effect, the chi square test further indicated a significant association with support staff and the effect it has on digital tool usage. In addition, the inadequate support staff to drive usage (74.2%) has really made digital tool usage a challenge. It was found

that the workload (72.8%), was a barrier to digital tool usage. It was noted that the cost of digital software (72%) inhibits use. Furthermore, copyright limitations at the university also deter usage. The limited knowledge of digital tools (68.6%) benefits has clearly affected the adoption of digital teaching and learning tools.

Table 4.7: **Chi square test - Challenges**

Challenges	Responses as Frequency (%)				X^2	df	p-value
	No effect	**Minor effect**	**Moderate effect**	**Major effect**			
Lack of infrastructure for communication and electric systems	1.6	7.7	37.4	45.6	111.000	3	<.001*
System Support	2.7	14.8	35.2	31.9	59.351	3	<.001*
Inadequate device accessibility	5.5	13.7	31.9	36.8	54.450	3	<.001*
Insufficient support staff to drive usage	7.1	14.3	31.9	29.7	37.742	3	<.001*
High Data Costs	6.6	8.8	20.3	56.1	124.569	3	<.001*
Limited Knowledge of available digital tools and benefits	7.7	18.1	27.5	29.1	25.840	3	<.001*
Cost to purchase digital software	12.6	12.1	26.4	37.4	36.292	3	<.001*
Legal/Copyright Limitation	11.5	12.6	28.6	30.2	26.457	3	<.001*
Workload - Lack of time to coordinate and set up content digitally	5.5	17.05	29.1	31.3	37.583	3	<.001*

The chi square goodness of fit tests depicts a moderate to major effect for all with 'data costs' noted as having the highest impact in experience with digital tools.

4.6 TYPE OF ADOPTER

Table 4.8: Type of adopters

Item	Frequency	Percent
innovator	63	34.6
early adopter	54	29.7
early majority	42	23.1
late majority	21	11.5
laggard	2	1.1
Total	182	100

Table 4.8 indicates three types of adopters, namely innovators (34.6%), early adopters (29.7%) and 23.1% as early majority.

4.6.1 Test Statistics

	Q2.5 I consider myself (Type of Adopter)
Chi-Square	67.835[a]
Df	4
Asymp. Sig.	.000

Table 4.9: Chi square -Type of adopters

Table 4.9 indicates statistically significant results. P-value Asymp significance 0.000, which indicates a low probability of the results from respondents being obtained by chance. Therefore, the result of 0.00 is significant.

4.7 RELIABILITY STATISTICS

According to Bardhoshi and Erford (2017:256-263) A crucial step in the research process before the data is collected is to ensure the precision of the instrument being used. The precision of an instrument is established through ensuring that it is both reliable and valid. Cronk (2020:118) defines reliability as the consistency of a scale and validity as the accuracy. The reliability of an instrument is assessed by conducting multiple measurements on identical subjects, the reliability coefficient of 0.60 or above is deemed to be acceptable. Table 4.10 reflects the current back office for all the items that formed part of the factor analysis constructed from the questioning.

Table 4.10: Factor Construct

Factor	Construct	Items included	Variance extracted	Cronbach's alpha
1	Perceived usefulness (PU)	6.4, 6.5, 6.6, 9.7, 9.8, 9.9	25.02	0.842
2	Attitude (ATT)	8.1, 8.9, 8.11, 7.1, 7.2, 9.6	9.08	0.85
3	Perceived ease of use (PEOU)	6.1, 6.2, 6.7, 6.8	6.39	0.758
4	Effort expectancy (EE)	9.3, 9.4, 9.5	4.91	0.846
5	Adoption (AD)	9.10. 9.12, 9.13	3.66	0.764
6	Influence (INF)	6.3, 6.9, 7.5, 7.6, 7.7	3.03	0.605

There is a general indication of acceptance as the reliability scores for all sections exceed the recommended Cronbach's Alpha value. Influence has a slightly lower reliability, which might be due to a variety of reasons such as lack of access, lack of training, institutional, technological and teacher led factors, attitude towards digital tools or the process of adopting a specific digital tool, it may be an issue of not having adequate time to be able to ensure that everything that is required to use a specific digital tool is available (Lawrence and Tar 2018: 15). The reliability scores for all sections exceed the recommended Cronbach's alpha value. This indicates a degree of

acceptable, consistent scoring for these sections of the research. INF has a slightly lower reliability, which might be due to a variety of reasons such as greater diversity amongst the items (which could be measuring slightly various aspects of the construct), or ambiguous items.

4.8 DIGITAL TOOL USAGE FOR BLENDED LEARNING

Table 4.11 illustrates the use of digital tools within the context of blended learning environments. The responses received from lecturers who engaged with various digital resources in their teaching modules form the basis of this examination. Perceptions of technological competence, comfort using digital tools, and the influence of digital support on educational decision-making are all reflected in the facts displayed. The data also considers the compatibility and user-friendliness of digital resources, as well as their impact on student involvement and success.

Table 4.11: Digital Tools

ITEM	N	Mean	Std. Deviation	t	df	Sig. (2-tailed)
Q2.6.1 I am technologically savvy	182	4.07	0.805	17.87	181	0.000
Q2.6.2 I am confident when accessing a digital tool used for my module	182	4.19	0.757	21.158	181	0.000
Q2.6.3 Digital support and training Influenced my decision to use a digital tool in my blended classroom	182	3.78	1.028	10.241	181	0.000
Q2.6.4 Teaching with digital tools can improve student engagement	182	3.87	1.089	10.75	181	0.000
Q2.6.5 Access to digital tools can improve student pass rates	182	3.86	1.014	11.398	181	0.000
Q2.6.6 The use of digital tools makes my lectures more visual	181	4.1	0.883	16.759	180	0.000
Q2.6.7 The digital teaching content is compatible with my device	182	4.12	0.823	18.285	181	0.000
Q2.6.8 Digital tools are user friendly	182	3.9	0.855	14.223	181	0.000

Q2.6.9 The complex nature of digital tools de-motivates me	182	2.8	1.191	-2.24	181	0.026
Q2.6.10 Covid-19 has changed my opinion about adopting digital tools	182	4.08	0.968	15.078	181	0.000

Table 4.11 on Digital tool usage indicate, the mean value, of the digital tool usage ranging from a maximum of five to a minimum of one. The mean values in descending order are namely:

- The highest Mean Score: 4.19 (SD =0.757), which indicates that respondents were confident in accessing the digital tools used for their courses.
- The second highest Mean Score of 4.12 (SD =0.823), indicated that respondents felt that the digital content they were accessing was compatible with the devices they were using.
- Thirdly, respondents indicated that COVID-19 had changed their opinion about adopting digital tools (Mean = 4.08; SD = 0.968), in addition, respondents indicated that they were Technologically Savvy (Mean = 4.07; SD = 0.805). It was further interesting to note that respondents indicated that digital tools do make their lectures more visual (Mean = 4.1 and SD = 0.833), with respondents identifying digital tools as being user-friendly (Mean = 3.9; and SD = 0.855).
- Respondents reported that teaching with digital tools can improve student engagement (Mean Value: 0.387, and SD = 1.089). Additionally, respondents indicated that access to digital tools can improve student pass rates (Mean = 3.86, and SD = 1.014).
- On a positive note, respondents indicated that digital support and training influenced their decision to use digital tools in the classroom (Mean 3.78, and SD = 1.028).
- Lastly, respondents indicated a concern with the complex nature of digital tools (Mean = 2.8, and SD = 1.191).

4.9 ADOPTION CATEGORIES AND THE ADOPTION PROCESS

Table 4.12: Adoption Categories and Adoption processes

Item	N	Mean	Std. Deviation	t	df	Sig. (2-tailed)

Q2.7.1 I am passionate about digital teaching tools and always will try new technology products	182	4.03	0.891	15.634	181	0.000
Q2.7.2 I will use a digital tool that a colleague has recommended	182	4.03	0.739	18.756	181	0.000
Q2.7.3 I carefully consider which digital tools I use to teach	182	4.15	0.754	20.537	181	0.000
Q2.7.4 I need to trial or demo a digital product before deciding whether I will use it or not	182	4.11	0.793	18.883	181	0.000
Q2.7.5 Support services influence my adoption of new digital tools	182	3.8	0.994	10.886	181	0.000
Q2.7.6 Colleagues experience with digital tools influence my decision to try new digital resources	182	3.71	0.99	9.654	181	0.000
Q2.7.7 If a digital tool appears complex. I will not try it	182	3.13	1.231	1.385	181	0.168
Q2.7.8 I am reluctant to use digital teaching resources based on my experience	182	2.35	1.121	-7.802	181	0.000
Q2.7.9 I will return to face-to-face teaching and learning after the COVID19 lockdown willingly	182	3.41	1.194	4.595	181	0.000
Q2.7.10 I prefer printed teaching tools to digital tools	182	2.52	1.242	-5.19	181	0.000
Q2.7.11 I am aware of digital tools available on the market (not including compulsory MML tools)	182	3.5	0.939	7.186	181	0.000
Q2.7.12 I prefer to attend regular webinars based on digital products available	182	3.54	0.92	7.895	181	0.000

Table 4.12 indicates the mean value of the adoption process, ranging from a maximum of five to a minimum of one. The mean values in descending order are namely:

- The highest Mean score: 4.15 (SD = 0.754) was for careful consideration when adopting a digital tool for teaching and learning. This suggests that respondents are thoughtful in the evaluation of a digital tool before adoption.
- A mean of 4.11 (SD = 0.793), was the second highest score, which indicates that respondents need to try the product or require a demonstration before adopting the product.

- Thirdly, respondents indicated that they would use a digital product recommended by a colleague (Mean value = 4.03 and SD = 0.739) In addition, respondents indicated that they are passionate about digital tools and will try new products (Mean value: 4.03 and SD = 0.891).
- It was interesting to note that support services influence the adoption of new digital tools (Mean: 3.8, and SD = 0.994).
- Respondents reported that colleagues' experiences with digital tools influence their decision to try new resources (Mean value: 3.71 and SD = 0.99).
- Interestingly, respondents prefer to attend regular webinars based on the digital products available (Mean value: 3.54 and SD = 0.92).
- On a positive note, respondents were aware of the digital tools on the market (Mean value :3.5 and SD = 0.939).

It is important to note that respondents will engage in face-to-face teaching and learning after the COVID – 19 lockdowns. Clearly, the university engaged in emergency teaching due to the Pandemic (Mean value :3.41 and SD = 1.194). The t-test scores indicate that the scores were all significant, where t = less than 0.05.

4.10 ATTITUDE OF THE LECTURER TOWARDS USING DIGITAL TOOLS

Table 4.13: Attitude of Lecturers

Item	N	Mean	Std. Deviation	t	df	Sig. (2-tailed)

Q2.8.1 I have a positive attitude toward digital tools for blended learning.	182	4.22	0.784	20.994	181	0.000
Q2.8.2 I believe it is important to know how to use a digital tool before adopting.	182	4.39	0.678	27.644	181	0.000
Q2.8.3 I think using digital tools for learning is overemphasized.	182	2.82	1.253	-1.892	181	0.060
Q2.8.4 I wish I could use a digital tool for all my modules.	182	3.76	1.081	9.466	181	0.000
Q2.8.5 Digital tools make a lecturer work efficiently	182	3.96	0.885	14.58	181	0.000
Q2.8.6 Using digital tools is convenient for teaching	182	4.07	0.784	18.346	181	0.000
Q2.8.7 Digital tools motivate me	182	3.7	0.946	10.03	181	0.000
Q2.8.8 With digital tools, I manage resources effectively	182	4.08	0.757	19.286	181	0.000
Q2.8.9 I like to adopt innovative teaching resources	182	4.11	0.779	19.224	181	0.000
Q2.8.10 The University's current Infrastructure supports the usage of digital tools for teaching and learning	182	3.16	1.259	1.766	181	0.079
Q2.8.11 Using digital tools fits into my teaching style	182	3.92	0.834	14.851	181	0.000

Table 4.13 depicts the attitude of respondents toward digital tools. Eleven items were tested using frequencies, mean value calculations and t-tests. All items t-test scores were significant, except Q2.8.3 (digital tools for learning is over emphasized) (Mean Value2.8.3: SD = 1.253) and Q2.8.10 (The university's current infrastructure supports the usage of digital tools) (Mean Value: 3.16, SD = 1.259).

The Mean scores ranging from one to five in descending order are namely:

- Firstly, respondents believe that it is important to know how to use digital tools before adoption (Mean value: 4.39, SD = 0.678).
- Secondly, a positive attitude towards using digital tools for blended learning was noted (Mean value: 4.22, SD = 0.6784).
- Thirdly, respondents like to adopt innovative teaching resources (Mean value: 4.11, SD = 0.779).
- Respondents also indicated that they managed resources effectively with digital tools (Mean value:4.08, SD = 0.757) and that teaching with digital tools is convenient (Mean =4.07, SD0.784).
- In addition, respondents indicated that digital tools made their work more efficient (Mean value =3.96 and SD = 0.855) and that using digital tools fit in their teaching styles.
- Interestingly, respondents indicated that they wished they could use digital tools for all their modules (Mean value:3.76 and SD = 0.885) and that they were motivated by digital tools (Mean value: 3.7 and SD = 0.946).

Table 4.14: Attitude Analysis

Item				Test Value = 3		
	N	Mean	Std. Deviation	t	df	sig.
ATT	182	4.044	0.61335	22.962	181	<.001*

Table 4.14 suggests that Attitude (ATT) towards the use of digital tools is quite positive, with a mean score of 4.044 and a high t-value of 22.962, which further reinforces the notion that respondents generally hold favourable attitudes towards technology in their professional activities. Attitude towards Adoption (AD), with a mean score of 4.0751, suggests that respondents are open to exploring and adopting new technologies, underpinning a positive disposition towards innovation.

In summary, the respondents generally perceive digital tools as useful and have a positive attitude towards their use, find them easy to operate, are willing to exert effort in learning to use them, are open to discovering new technologies, and are somewhat influenced by information when making decisions about technology adoption. All constructs measured are significantly greater than the neutral midpoint, indicating an overall positive inclination towards the adoption and use of digital technologies.

4.11 DIFFUSION OF INNOVATION, DIGITAL TEACHING AND LEARNING

Table 4.15: Diffusion of Innovation

Item)	N	Mean	Std. Deviation	t	df	Sig. (2-tailed)
Q2.9.1 Digital tools/resources can be accessed anytime and anywhere	182	3.99	1.038	12.926	181	0.000
Q2.9.2 Student interaction and engagement is better online	182	3.08	1.239	0.898	181	0.371
Q2.9.3 Using digital tools requires extensive preparation	182	3.4	1.096	4.868	181	0.000
Q2.9.4 Using digital tools can be demanding	182	3.45	1.134	5.292	181	0.000
Q2.9.5 Using digital tools requires technical skills	182	3.75	0.976	10.33	181	0.000
Q2.9.6 I am keen to always try out new digital tools	182	3.98	0.925	14.34	181	0.000
Q2.9.7 Digital Teaching and Learning tools make my lectures exciting.	182	3.85	0.939	12.153	181	0.000
Q2.9.8 I believe that digital tools motivate students to attend lectures.	182	3.51	1.155	5.904	181	0.000
Q2.9.9 Digital Tools add fun to teaching and learning.	182	3.61	1.023	8.045	181	0.000
Q2.9.10 Embracing technology in the teaching and learning environment is essential in the 4IR era.	182	4.12	0.995	15.191	181	0.000
Q2.9.11 The COVID pandemic has changed my attitude towards electronic resources.	182	3.91	1.015	12.119	181	0.000
Q2.9.12 As a lecturer, I encourage students to use electronic sources from the library.	181	4.19	0.808	19.77	180	0.000
Q2.9.13 My friends and colleagues also adopt tools for teaching and learning.	182	3.92	0.847	14.62	181	0.000

Table 4.15 depicts the following:

- The highest Mean score: 4.19 (SD = 0.808), which indicates that respondents were confident in accessing digital tools used for their courses.
- The second highest mean of 4.12 indicates that in the 4IR era, it is essential to embrace technology (SD = 0.995).
- Thirdly, respondents indicated a positive response when asked about resources that can be accessed anytime and anywhere (Mean value: 3.99 and SD =1.083). In addition, respondents are keen to try out new digital tools (Mean value: 3.98 and SD =0.925), It was further interesting to note that respondents would adopt digital tools that colleagues used for teaching and learning (Mean value:3.92 and SD = 0.847).
- Respondents indicated that the COVID-19 Pandemic has changed their attitude towards electronic resources (Mean value 3.91and SD = 1.015).
- Interestingly, digital teaching and learning tools were seen as making their lectures exciting (Mean value 3.85 and SD = 0.939) respondents also indicated that they do require technical skills to use digital tools (Mean value:3.75 and SD = 0.976).
- Respondents also indicated a positive response in that using digital tools for teaching and learning are fun (Mean value: 3.61 and SD = 1.023) and that they believe that digital tools motivate students to attend lectures (Mean value: 351 and SD = 1.155).
- Respondents indicated that digital tools can be demanding (Mean value: 3.45 and SD =1.134) but also made mention that to use digital tools, extensive preparation is required (Mean value:3.4 and SD = 1.096).
- Lastly, respondents indicated that student interaction and engagement is better online (Mean value: 3.08and SD = 1.239).

To determine whether respondents agreed with the precepts of the Diffusion of Innovation theory, the dimension mean was compared to the hypothesised mean of 3.0. The null hypothesis tests whether there are as many respondents who agree as those who disagreed. The dimension statistics are shown below.

Table 4.16: Diffusion of Innovation Analysis

Mean	3.75
SD	1.01
SEM	0.0749
t- value	10.02

N	182

The observed Mean (3.75) was higher than the hypothesized mean of 3.0, indicating an agreement towards Diffusion of Innovation being used to assess digital tool usage. The SD (1.01) indicated a variation of responses from the respondents. The SEM (0.0749) suggests a reliable estimate of population size. Lastly, the t-value (10.02), which was high, shows that the results are likely statistically significant.

This suggests that, according to Diffusion of Innovation theory, there is a positive inclination towards the use of digital tools in the teaching and learning environment amongst the respondents.

4.12 FACTOR ANALYSIS

To explore the structure of data presented, a construct is measured using several items and later reduced to smaller latent variables. The after-effect analysis with Promax Rotation is applied to the set of items in the constructs. During the factor extraction process, items which do not make it into a factor or category will be removed or dropped. This could be due to items not contributing strongly to any factors or overlaps in factors. The reliability of combining the items into a single latent variable is then evaluated by using Cronbach's Alpha. The alpha value needs to be 0.7 to be considered adequate. Any mean that does not correlate strongly after the other items in the construct that could negatively affect the reliability may be removed. The factor extraction is deemed to be successful if the Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) exceeds 0.6 and Bartlett's test of sphericity is significant.

4.12.1 KMO and Bartlett's Test

Figure 4.6: KMO and Bartlett test.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.818
Bartlett's Test of Sphericity	Approx. Chi-Square	2237.225
	Df	351
	Sig.	.000

Factor analysis with ProMax rotation was applied to these forty-six items measuring various aspects of digital tool usage. Of the forty-six items in the initial solution, several items were dropped either because they did not load strongly enough onto any factor or because they loaded onto multiple factors. Six factors were extracted, which account for 52.09% of the variance in the data. A Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) of 0.818 and a significant Bartlett's test indicate that the data was adequate for successful and reliable extraction. Rotation converged in seven iterations.

The structure of the data, showing factor loadings is presented in Table 4.17.

Table 4.17: factor loadings

Item	Factor					
	1	2	3	4	5	6
Q2.9.7 Digital Teaching and Learning tools make my lectures exciting.	.955					
Q2.9.8 I believe that digital tools motivate students to attend lectures.	.762					
Q2.9.9 Digital Tools add fun to teaching and learning.	.662					
Q2.6.6 The use of digital tools makes my lectures more visual	.548					
Q2.6.4 Teaching with digital tools can improve student engagement	.398					
Q2.6.5 Access to digital tools can improve student pass rates	.396					
Q2.8.9 I like to adopt innovative teaching resources		.861				
Q2.8.1 I have a positive attitude toward digital tools for blended learning.		.780				
Q2.7.1 I am passionate about digital teaching tools and always will try new technology products		.720				
Q2.9.6 I am keen to always try out new digital tools		.672				
Q2.7.2 I will use a digital tool that a colleague has recommended		.490				
Q2.8.11 Using digital tools fits into my teaching style		.379				
Q2.6.2 I am confident when accessing a digital tool used for my module			.847			
Q2.6.1 I am technologically savvy			.732			
Q2.6.8 Digital tools are user friendly			.637			
Q2.6.7 The digital teaching content is compatible with my device			.476			

Q2.9.4 Using digital tools can be demanding				.911		
Q2.9.3 Using digital tools requires extensive preparation				.848		
Q2.9.5 Using digital tools requires technical skills				.628		
Q2.9.13 My friends and colleagues also adopt tools for teaching and learning.					.715	
Q2.9.12 As a lecturer, I encourage students to use electronic sources from the library.					.657	
Q2.9.10 Embracing technology in the teaching and learning environment is essential in the 4IR era.					.605	
Q2.7.6 Colleagues experience with digital tools influence my decision to try new digital resources						.607
Q2.6.9 The complex nature of digital tools de-motivates me						.557
Q2.7.5 Support services influence my adoption of new digital tools						.521
Q2.6.3 Digital support and training Influenced my decision to use a digital tool in my blended classroom						.449
Q2.7.7 If a digital tool appears complex. I will not try it						.418

The extraction of theme names from the factor analysis results involves interpreting the grouping of questions under each factor based on their loadings. Factor analysis helps to identify underlying variables, or factors, which explain the pattern of correlations within a set of observed variables. The high loadings (commonly an absolute value greater than 0.4) indicate which questions are most strongly associated with each factor.

The following are theme names for each factor based on the questions that load highly:

Factor 1: Engagement and Excitement through Digital Tools

Factor questions relate to the positive impact of digital tools on lectures, including making them more exciting, motivating for students, adding fun to the learning process, and improving visual aspects and engagement.

Factor 2: Attitudes towards Innovation and Adoption of Digital Tools

Questions loading on this Factor Two relate to the lecturers' attitude towards adopting innovative digital resources; their positivity towards blended learning tools; passion for trying innovative technologies, and the perceived fit of digital tools within their teaching style.

Factor 3: Confidence and Perceived Ease of Use

The questions associated with this Factor Three revolve around the lecturers' confidence in using digital tools, their perceptions of these tools as user-friendly, and the compatibility with their devices.

Factor 4: Challenges and Demands of Using Digital Tools

Factor Four reflects the perceived difficulties, preparation requirements and technical skills needed to use digital tools effectively in teaching.

Factor 5: Social Influence and Peer Adoption

Factor Five questions are about the influence of colleagues and peers on the lecturer's decisions to adopt innovative technologies; encouragement of students to use electronic resources; and the essential nature of technology adoption in the current educational era.

Factor 6: Support, Complexity, and External Influences

Factor Six includes questions about the influence of support services, the impact of digital tools' complexity on their adoption, and the role of training in the decision to use digital tools in a blended classroom.

For this study, three analytical tools were used namely Coefficient of Determination, ANOVA and Pearson regression equation.

4.13 ONE SAMPLE T-TEST FOR DIGITAL TOOLS USAGE

Table 4.18: One sample t-test

Construct	n	Mean (SD)	t	df	p-value
Perceived usefulness towards digital tool usage (4)	182	3.80 (.765)	14.081	181	<.001*
Attitude towards digital tool usage (3)	182	4.04 (.613)	22.962	181	<.001*
Perceived ease of use of digital tool usage (2)	182	4.07(.617)	23.344	181	<.001*
Effort expectancy of digital tool usage (5)	182	3.53 (.936)	7.626	181	<.001*
Adoption norm of digital tool usage (1)	182	4.08 (.730)	19.849	181	<.001*
Influences of digital tool usage (6)	181	3.44 (.680)	8.810	180	<.001*

Table 4.18 represents the results of the one sample T-test for constructs related to digital tool usage. It is important to note that there is a significant agreement that digital tools are useful when compared to usage.

- The adoption norm of using digital tools had the highest mean (4.08) represented, indicating that the respondents had a positive perception towards adopting digital tools. The t-test statistics (19.849) and the p-value (<0.001) show that there was a statistically significant influence.
- The second was perceived ease of use of digital tools, which had a mean of 4.07 indicating a positive perception that digital tools were easy to use. The t-test statistics (23.344) and p-value (<0.001) also support that the respondents found digital tools easy to use.
- Thirdly, Attitude towards using digital tools had a significant mean (4.04), still indicating a positive attitude towards using digital tools, The t-test statistics (22.962) and p-value (<0.001) confirm that respondents had a positive attitude to the use of digital tools.
- A positive mean (3.80) was also indicated for perceived usefulness of digital tools, lower than adoption, perceived ease of use and attitude, yet its t-test (14.081) and p – value (<0.001) were still significant.
- Effort Expectancy with a mean value (3.53) was still significant. The t-test statistics (7.626) and p-value (<0.001) were positive that more effort was required when using digital tools.

- Lastly, the influence of using digital tools with a mean value (3.44) was rated the lowest by respondents. This result was significant. the t-test (8.810) and p-value (<0.001) show that influence did not impact the use of digital tools.

4.14 ANOVA, COEFFICIENT OF DETERMINATION (COD) ($R^{2)}$, REGRESSION MODEL

Table 4.19: Digital tool usage

IV	**R^2**	**F**	**df1; df2**	**p-value**	**B (regression coefficient)**	**t**	**p-value**
PU	0.041	7.685	1; 179	0.006	0.240	2.772	**0.006**
ATT	0.055	10.403	1; 179	0.001	0.347	3.225	**0.001**
PEOU	0.045	8.407	1; 179	0.004	0.312	2.900	**0.004**
EE	0.002	0.350	1; 179	0.555	-0.043	-0.591	0.555
AD	0.000	0.022	1; 179	0.883	0.014	0.147	0.883
INF	0.000	0.057	1; 179	0.811	0.024	0.239	0.811
CHAL	0.000	0.068	1; 179	0.795	0.027	0.260	0.795
DV – digital tool USAGE							

Table 4.19 depicts the construct of perceived usefulness, attitude and perceived ease of use the results indicate that they are significant predictors of usage of digital tools with the p-value being <0.01.Therefore, a positive regression for Perceived Usefulness, Attitude and Perceived Ease of Use shows that an increase in the adoption or acceptance of digital tools will have a positive impact on usage if it is expectancy and influence, but do not have a significant contribution to digital tool usage.

Effort Expectancy, Adoption, Influence and Challenges were the constructs scores that have no significant p-value; this could indicate that they are not strong predictors of digital tool usage in this context.

In short, perceived usefulness, attitude and perceived ease of use are crucial for influencing adoption and using digital tools for blended learning. This emphasises the importance of a positive attitude in driving the use of digital tools at universities.

When considering the constructs of Perceived Usefulness (PU), Perceived Ease of Use (PEOU) and Attitude Toward Using Technology (ATT) in isolation, empirical evidence suggests that they are significant predictors of technology usage (USAGE). Specifically, a positive correlation is observed between each of these independent variables and the dependent variable, USAGE. Hence, it can be inferred that an increase in the agreement scores pertaining to PU, PEOU, and ATT is associated with a concomitant increase in the usage intensity of the technological tools in question. This correlation underscores the importance of these factors in influencing the adoption and utilisation of new technology platforms.

Table 4.20: All Variable at once

IV	**R^2**	**F**	**df1; df2**	**p-value**	**B (regression coefficient)**	**t**	**p-value**
PU	.088	2.385	7; 173	.024	.109	.927	.355
ATT					.293	1.905	.058
PEOU					.157	1.229	.221
EE					-.041	-.547	.585
AD					-.181	-1.719	.087
INF					-.036	-.352	.725
CHAL					.042	.410	.683

The regression (R^2) in Table 4.20 illustrates seven independent variables and elucidates 8.8% of the variance in the dependent variable, USAGE, as indicated by an F-statistic of F (7,173) =2.385 with an associated probability p=.024. While none of the independent variables reach the threshold of statistical significance at the 95% confidence level, the construct of Attitude Toward Using Technology (ATT) and Anxiety (AD) demonstrates marginal significance with p<.1 when analysed concurrently within the multivariate framework. The coefficient for ATT is positive, signifying that an enhancement in ATT is associated with increased USAGE of the technological

tools. Conversely, a higher agreement with the presence of AD inversely affects USAGE, indicating that increased anxiety correlates with a decrease in the use of these tools.

The results in both tables in the responses above (1 and 2) indicate no multicollinearity issues as the VIF values are all < 4.0.

4.15 REGRESSION MODEL ANALYSIS

A regression analysis was conducted with adoption (usage) as the dependent variable (DV) and the factors (including CHAL) as the independent variables (IV). To determine the significance of the influence exerted by independent variables (IVs) upon the dependent variable (DV), a structured approach to regression analysis was undertaken namely:

Firstly, the univariate regression analyses were performed on each independent variable (PU, ATT, PEOU, EE, AD, INF and CHAL) separately to assess their individual contributions to the dependent variable (USAGE). (Table 4.20)

Secondly, a multiple regression analysis was undertaken in Table 4.20, which incorporated all independent variables simultaneously to evaluate their collective impact on the dependent variable, as well as to identify the significance of each independent variable within a multivariate framework.

Thirdly, the final analytical step involved a stepwise regression analysis. This technique uses a sequential selection method to identify the most statistically significant independent variables. The process iteratively adds variables to the model, retaining only those which meet a pre-established level of statistical significance, thus ensuring that each retained variable contributes meaningfully to the predictive power of the model.

4.15.1 Univariate Regression Analysis

Table 4.21: Univariate Regression Analysis

IV	R^2	F	df1; df2	p-value	B (regression coefficient)	t	p-value

PU	0.041	7.685	1; 179	0.006	0.240	2.772	**0.006**
ATT	0.055	10.403	1; 179	0.001	0.347	3.225	**0.001**
PEOU	0.045	8.407	1; 179	0.004	0.312	2.900	**0.004**
EE	0.002	0.350	1; 179	0.555	-0.043	-0.591	0.555
AD	0.000	0.022	1; 179	0.883	0.014	0.147	0.883
INF	0.000	0.057	1; 179	0.811	0.024	0.239	0.811
CHAL	0.000	0.068	1; 179	0.795	0.027	0.260	0.795
DV – digital tool USAGE							

The Perceived Usefulness (PU) p-value (0.006), Perceived Ease of Use (PEOU) p-value (0.004), and Attitude (ATT) p value (0.001) shows that when compared to digital usage, it is suggested that they are significant predictors of technology usage (USAGE) when considering the individual constructs. It is observed that a positive correlation is observed between each of these independent variables when compared to the dependent variable, USAGE. Hence, it can be assumed that an increase in the agreement scores pertaining to PU, PEOU and ATT is associated with an increase in the usage intensity of the digital tools in question. This comparison reinforces the importance of these factors in influencing the adoption and utilisation of innovative technology platforms.

4.15.2 Multiple Regression Analysis

Table 4.22: Multiple Regression

IV	**R^2**	**F**	**df1; df2**	**p-value**	**B (regression coefficient)**	**t**	**p-value**
PU	.088	2.385	7; 173	.024	.109	.927	.355
ATT					.293	1.905	.058
PEOU					.157	1.229	.221
EE					-.041	-.547	.585

AD					-.181	-1.719	.087
INF					-.036	-.352	.725
CHAL					.042	.410	.683

The regression model incorporating seven independent variables elucidates 8.8% of the variance in the dependent variable, USAGE, as indicated by an F-statistic of F (7,173) =2.385 with an associated probability p=.024. While none of the independent variables reach the threshold of statistical significance at the 95% confidence level, the construct of Attitude Toward Using Technology (ATT) and Anxiety (AD) demonstrates marginal significance with p<.1 when analysed concurrently within the multivariate framework. The coefficient for ATT is positive, signifying that an enhancement in ATT is associated with increased USAGE of the technological tools. Conversely, a higher agreement with the presence of AD inversely affects USAGE, indicating that increased anxiety correlates with a reduction in the use of these tools.

The results in both tables (Table 4.21 and 4.22) in the responses above indicate no multicollinearity issues as the Variance Inflation Factor values are all < 4.0.

4.15.3 Stepwise Regression

In this analytical approach, all independent variables (IVs) are initially included in the regression model. Subsequently, each IV is subjected to a statistical significance test. IVs that exhibit statistical significance are retained within the model, while those that do not meet the significance criterion are systematically excluded. This iterative process of inclusion and exclusion yields a parsimonious model that encapsulates only the IVs that contribute meaningfully to the explanatory power of the model with respect to the dependent variable. The resultant model is thus streamlined to include only the IVs deemed important, based on the established threshold for statistical significance.

The regression analysis, with Attitude (ATT) as the sole predictor in Table 4.22 Column R^2, explains 5.5% of the variance in the dependent variable Q2.3 Usage, as indicated by the R Square value of .055. The Adjusted R Square value of .050 considers the number of predictors in the model and provides a more accurate estimate of the variance explained when applying the model to the wider population. The standard error of the estimate is .88453, and the Durbin-Watson statistic of 1.976 suggests that the assumption of independent errors is met within reason, as this value is close to two.

The ANOVA column (Table 4.22) indicates that the regression model is statistically significant with an F-statistic of 10.403 and a significance level of p-value (0 .001), suggesting that the model with ATT as a predictor is a better fit than the intercept-only model.

The B Regression coefficients column (Table 4.22) reveals that ATT has a positive unstandardized coefficient (B) of .347, with a standard error of .108, and is statistically significant (p=.001). This signifies a positive relationship between ATT and Q2.3 Usage. The standardized coefficient (Beta) of .234 allows for the comparison of the strength of the effect of ATT on USAGE with that of other variables in standardized units. Since ATT is the only predictor, its Beta is the same as the value of R in the model summary, which also reflects its strength as a predictor. The model's tolerance value of 1.000 and VIF (Variance Inflation Factor) of 1.000 indicate no multicollinearity issues, which is expected given that only one predictor is included in the model.

In conclusion, ATT is retained as the only significant predictor in the model, demonstrating a positive effect on the dependent variable Q2.3USAGE. The absence of other significant independent variables suggests that ATT is the strongest predictor of USAGE within this analytical model. (Table 4.21 Univariate Regression).

4.16 DISCUSSION OF RESULTS

4.16.1 Demographic Profile of Sample

Table 4.1 reveals that the majority of the respondents were female (52,7%). The findings are consistent with the findings of Juan and Bellonch (2021:174), where 60.6% of female professors who responded were using digital tools and although minority of male lecturers are seen to be more confident in using digital tools, female lecturers in their intention to adopt digital tools are influenced by attitude, performance and expectancy, of the technology. With regards to the ethnic group of respondents, Table 4.2 reveals that the majority of the respondents were of African (44%) and Indian (41,8%) ethnicity. Which is consistent with the demographics of Kwa Zulu Natal ethnic population and according to Ramraj (2024: 19), Kwa- Zulu Natal Province has a larger population of individuals of African Ethnicity, which concurs with the findings in this study. It is interesting to note that the majority of the study population that participated in the study had an age ranging from 26 – 56 years old (84,6%) A study by Tshabalala (2021: 223) concluded that digital tool usage was influenced by age. Table 4.3 reflects the age groups of lecturers at the Durban University of Technology. The lecturing experience of the respondent's study site shows that the majority (47.8%) range from 6-15 years of lecturing experience. According to a study by Leisa-Orus et al.

(2020: 5339) gender and years of lecturing experience could also predict the perceptions and attitudes of a large sample of Higher Education lecturers toward digital tools.

Since participation was voluntary, Figure 4.2 depicts that a majority of respondents (35.2%) were based on the Management Sciences Campus and Accounting and Informatics is based on the Ritson Campus and Applied Sciences is predominantly based on the Steve Biko and Ritson Campuses.

4.17 FACTORS THAT INFLUENCE THE ADOPTION OF DIGITAL TOOLS

Table 4.5 reveals that most respondents (85,7%) used laptops for blended teaching and learning. The future trends are revealing that mobile and tablet or handheld devices will be more popular. The introduction of blended learning at the University of South Africa encouraged lecturers to purchase their own personal laptop devices (Teane 2024: 426). A study by Rockinson - Szapkiw et al. (2013: 260), noted that 90% of students had accessed their electronic material through a laptop, tablet or mobile device and this shows a significant number of students are using electronic devices for access to their resources. Interestingly, Table 4.7 shows that 54,4% of respondents use digital tools more than three times a week. According to Tinashe (2021: 3), the way lecturers view digital tools impacts their usage of technology. At the Durban University of Technology, lecturers are required to use digital tools as lecture and assessment tools.

4.17.1 Preferences of Programmes

Figure 4.4 shows that a majority of respondents used Microsoft Teams (46%) Learning Management System (35%) Digital books (22%) and prescribed online resources (13%). This concurs with Teane (2024: 426), who stated that lecturers using Microsoft Teams recognise how efficient the platform is for virtual engagement. According to Kumar et al. (2021: 1) the Learning Management System, Moodle is a helpful tool for educators as they are able to create course content to deliver to students. This is also the LMS used at the Durban University of Technology. Online resources such as prescribed eBooks also offer an alternative option for students to access content, thus creating a seamless experience (Wang 2015: 64).

4.17.2 Challenges

Since Blended learning is a relatively novel concept, the responses from lecturers on challenges experienced and what they viewed had a major effect or no effect on them using digital tools. The first construct looked at lack of infrastructure, with 89,9% of respondents indicating that it had an effect on their use of digital tools. According to Teane (2024: 426), a lack of adequate infrastructure

and availability of resources negatively impacts a lecturer's efforts to implement a technology. At university level the Wi-Fi connectivity should be of a good quality for students to be able to access the digital tools and have sufficient devices to meet the demand. The challenge of a lack of infrastructure is not just at a university level but countries are currently working to improve their infrastructure as establishing critical infrastructure and reliable internet is essential in the use of digital tools. Another challenge presented is the High Data Cost (83.3%) respondents stated that it had a major effect on their use of digital tools and according to Dintoe (2018), connectivity challenges and high data costs can deter lecturers and students from using digital tools. The third challenge was system support (79.3%) according to Asghar et al. (2022: 4), lecturer training programmes that incorporate pedagogy training and how to implement in a digital environment was more successful. It was also interesting to note that device accessibility (78.2%) was found to influence digital tool usage. Ramroop (2021: 131) stated that a lack of access to devices is likely to impact the use of digital tools. The lowest effect was noted as respondents felt that knowledge of products and the use of Copyright was not a limitation and therefore had a minor effect and did not significantly impact their decision to adopt digital tools, this further confirmed by Table 4.9, which focuses on types of adopters.

4.18. TYPE OF ADOPTERS

Table 4.8 depicts the types of adopters with a majority of respondents identifying as innovators (34.6%) and early adopters (29.7%). Innovators are known to take initiative to try something new (Tshabalala 2014: 101). More than 60% of respondents indicating they are open to adopting digital tools suggests a positive attitude towards innovation. As indicated in the research, this further confirms that their support will influence the early and late majority to adopt. According to Or and Chapman (2021: 100), an adopter's beliefs and experiences need to be compatible for them to adopt an innovation and for the innovative type of adopter there could be various benefits which influence them such as social or financial gain (Kee 2017: 42).

4.19 DIGITAL TOOL USAGE FOR BLENDED LEARNING

According to Houlden and Velesianos (2020), there is an increase in digital tool availability and the opportunity to use them within the university space. Table 4.11 outlines digital tool usage for blended learning, it looks at the confidence and requirements when using digital tools for blended learning. At the Durban University of Technology, lecturers have been using digital tools and consider themselves to be confident when using them for their modules. Studies by Apergis (2019:

2), Teane (2024: 427), and Hsu and Lin (2020: 4), all found that lecturers who actively use digital tools and upskill will be more confident when using them. The Durban University of Technology can leverage off lecturers that are confident to help them reinforce the benefits of digital tools for teaching and learning. The consensus amongst lecturers is that they were satisfied with their device compatibility which could indicate that this was not a factor that would deter them from using digital tools, lecturers at DUT also received devices from the Institution.

With devices like laptops, smartphones and tablets becoming the devices of choice (Balfour et al. 2023), we will continue to see the digital tools being updated to meet the needs of their users and be accessible on new devices. Lecturers also indicated that the COVID – 19 Pandemic had impacted their perception of using digital tools. This could be because lecturers had more exposure and relied on digital tools to engage with their students during the time. Qwabe and Khumalo (2020: 4), highlighted that during the Covid-19 Pandemic, DUT went into an Emergency Remote Teaching phase, using digital tools such as their Learning Management System (LMS) and Microsoft Teams to interact with students. DUT also gave staff and students data which was linked to their contact number on the system, this was for online lectures and to access resources.

Lecturers agreed that they were technologically savvy and according to Ali (2022), digital savviness is related to the demand for flexibility, not just as a lecturer interacting with digital tools but they are also interacting with a new age of digitally savvy students (Apergis 2019: 3). Lecturers find digital tools user friendly, more visual and noted that it helps to improve student engagement and pass rates. This concurs with Tshabalala (2021:241), who stated that lecturers felt the platform or digital tool designed for online learning were user-friendly. According to Israel et al. (2021: 102), if these digital tools are not user friendly, there is a risk that they won't be used. According to Wang (2015: 45), states that the capabilities of digital products, for example eBooks, can increase student engagement which concurs with the study findings and using digital tools have shown to improve engagement and student success. The study also concurred Kumar et al. (2021: 1), that the use of digital tools makes engaging with learning more visual. Lastly, it was noted that the responses were significant in participants feeling that digital tools can be complex, although majority do not see complexity as a barrier it does exist and can determine a lecturer's attitude towards using digital tools Best, Sibson and Morgan (2021: 2) expressed that lecturers do not like to use complex digital tools and at the Durban University of Technology; by creating more targeted training and support, they may be able to alleviate the complex nature of the digital tools that are used.

4.20 THE ADOPTION CATEGORIES FOR DIGITAL TOOL USE

According to Langegard (2021: 9), there are important factors to consider when choosing a digital tool to adopt, these include efficiency, support available, ease of use of the product and if this product is the correct one to use. In the same way the categories of adoption need to be evaluated in the context of lecturer's preferences. Preparing lecturers to use digital tools is an important factor, it has become the way lecturers will engage with students, Amhag et al. (2019: 210), stated that the development of lecturers in pedagogical design will enhance how they interact and support students. There is also importance in lecturers having the ability to trial a product before they adopt it, and the responses were in strong agreement of this in the study. This also concurred with Booc, Liporada and Galo (2024: 19), who stated that the importance of running trials allows lecturers to know if the product, is suitable for their course and if they will be able to benefit from using it. By trialling a product, they can also see if it aligns with the universities goals and if it will be paid for accordingly. Banerjee (2012), also noted that the trialability is necessary in the process when a lecturer intends to adopt a digital tool. Lecturers also indicated their passion for using digital tools and digital tools that their colleagues recommend. On of the types of adopters is the early majority. According to Rogers (2003), they will only adopt after a reliable recommendation from colleagues. According to Avidor-Ungar and Forkost-Barush (2018), lecturers need to be passionate when using digital tools, so they can motivate their students to use them as well. Another important area is in support services for lecturers when using digital tools that are adopted by the university. Bond et al. (2018: 5), noted that the centre for teaching and learning has an important role in preparing and developing lecturers for the use of digital tools. Zungu and Walji (2022: 106), mention that the Emergency Remote Teaching (ERT) plan that was put in place by CELT at DUT was instrumental in preparing DUT for the digital tool usage during the COVID – 19 Pandemic and after.

Digital resources have become more favourable, more relevant, more reliable and easier to access than print today. Print is still an important component and in some countries is still preferred (Asghar et al. 2022: 4). Moonsamy (2015: 35), states that experience still highly influences a lecturer's decision to adopt. Lastly, lecturers disagreed that they preferred printed teaching resources and, on their reluctance, to use digital tool because of their experience. They did agree that the statement on digital tools being complex, they will not try it showing that complexity is still a barrier for some, According to Kee (2017: 4), adopting a digital tools becomes harder when it is perceived as complex. However, for others it may not be a deterring factor universally as some will learn even when a digital tool is difficult to use, that shows the importance of simplifying tools and the training and support that goes with it.

4.21 ATTITUDE OF LECTURERS USING DIGITAL TOOLS

According to Al- Shami et al. (2018), perceived usefulness is positively associated with the adoption of digital tools. Dintoe (2018), states that a lecturer's attitude towards using a digital tool impacts their usage, the most positive attitude is found in the innovators and early adopters. Their knowledge of how to use digital tools can benefit not just their students but their community as well. Lecturers that participated in the study believe in the importance of training or being familiar with a product (Table 4.13) reflects the results on attitude. According to Wu and Chen (2017: 222), who stated that the intention to use a digital tool, shows the intention to use a digital tool, shows the significance in ease of use, and the effect it has on productivity. Lecturers also responded favourably to adopting innovative teaching resources and were enthusiastic to use them. According to Ayodele et al. (2020: 16), the adoption of innovation relates to how an innovation is used. In the same way management of resources effectively by lecturers is important in the transition to using digital tools. Lecturers at DUT have been using digital tools in a non-compulsory capacity prior to the COVID-19 Pandemic whereas now Digital tools are entrenched in what they do daily.

The convenience of digital tools is a key factor in digital adoption and may encourage lecturers to embrace using technology more. The convenience of using digital tools has had a positive impact on lecturers and students, the increased flexibility, ability to use it at anytime and anywhere (Lowenthal and Trespalacious 2022). Lecturers require efficiency especially as they must manage administrative work, students lecturing and assessing and their own research growth. Lecturers that participate believed that the use of digital tools enhanced the efficiency this concurred with Anthony et al. (2022: 531-578), who in addition stated that the perceptions of both traditional and blended learning could create a positive or negative attitude for lecturers towards blended learning usage. Lecturers also felt that digital tools aligned with their teaching approaches which could contribute towards their acceptance or continued use of these digital tools. According to Tshabalala (2021: 22), it is important to consider the teaching style of a lecturer in the digital environment and how their courses are designed for digital tool usage.

In discussing the negative responses, respondents do feel that digital tool usage has a necessary place in learning. Overall, the responses on attitude from lecturers were positive towards digital tool usage for teaching and learning. Lecturers from DUT see digital tools as convenient, motivating and effective for managing their resources. There is also a preference with lecturers to

know how a product works before adopting. An assessment on attitude in (Table 4.14) was important to note as it showed the attitude of lecturers when using digital tools, an overall mean score (4.044) indicated a significantly positive attitude towards using digital tools for teaching and learning.

4.22 DIFFUSION OF INNOVATION IN THE ADOPTION OF DIGITAL TOOLS

The findings from this section on Diffusion of Innovation Theory are reflected in (Table 4.15). According to Miller (2019: 634), lecturers are pressured to manage student performance, continue their own research as well as complete administrative work, however from this study what is encouraging to see was lecturers still encourage students to use electronic resources that are in the library. Wang (2015: 54), stated that the library is the most compatible place for resources to be disseminated, Vallee et al. (2022) noted the library as a central hub for accessing resources, The Durban University of Technology invests in their electronic resources to ensure the best compatible resources are available.

Teaching in the teaching and learning environment is ever-growing and in the findings, lecturers agreed that it was important to embrace the use of technology in the Fourth Industrial Revolution era. This concurred with Anthony et al. (2022: 531-578), who stated that lecturers are embracing digital tools and blended learning more, noting that newer lecturers were more accepting than senior lecturers. Lecturers will embrace digital tools where they align with their teaching needs (Ali 2022). This will also encourage students to embrace and use digital tools. Lecturers also agreed with the statement that digital tools/resources can be accessed anytime and anywhere. This concurred with Lowenthal and Trespalacios (2022: 60), who noted that the flexibility, convenience and accessibility encourage students to use digital tools and lecturers' resources created. Lecturers also know that it will be accessed, and they can track the views. Lecturers also acknowledged their interest to try new products, this concurs with the information presented in (Table 4.8) and Dewi et al. (2023: 4), who stated that a higher rate of adoption is seen when a respondent has tried a product. Lecturers also found digital tools enjoyable, felt it positively impacted their student's engagement and participation and are aware of digital tools adopted by colleagues which show the collaboration it shows that colleagues can impact their decision to adopt or use a digital tool. These findings show that there is an appreciation amongst lecturers, and there is potential to further motivate them to use new innovative products, also shows how the Pandemic has positively impacted how they adopt digital tools, and the use of digital tools align with the university's goals.

The findings in (Table 4.16) represent the Diffusion of Innovation Theory as the theory used in the study to assess the adoption of digital tools for blended learning. With a mean score (3.75) and SD (1.01) it tells us that the respondents agreed with the use of the Theory.

4.23 CONCLUSION

This chapter presented the results and the discussion of results. The key information regarding the demographics, reliability and inferential statistics were discussed and related to literature in the discussion of results.

It presented interesting findings on the relationship between various constructs including adoption, attitude, influence and usefulness and digital tool usage. The findings revealed that a majority of respondents had a positive attitude towards using digital tools and that Diffusion of Innovation does apply to this study. In the next chapter, the concluding remarks will be discussed.

CHAPTER FIVE: CONCLUSION AND RECOMMENDATIONS

5.1 INTRODUCTION

Chapters One to Four focused on the theory and primary data. This chapter will conclude the study by providing an overview of the main research findings considering the aims and objectives of the study, as well as the importance and contribution of the study. Lastly, it will examine the study's limitations and make recommendations.

5.2 SUMMARY OF THE STUDY

Chapter One

Chapter One focused on the introduction and overview of the study, research methodology, aims and objectives and the rationale of the study.

Chapter Two

This chapter examined relevant literature about the Diffusion of Innovation Theory, Blended Learning, Digital tools for teaching and learning, attitude, and the adoption of digital tools at the selected university. Furthermore, other technology theories related to digital tool adoption were reviewed. However, the Diffusion of Innovation was found to be relevant to the study. It is important to note that the attitude of lecturers towards blended learning plays a critical role.

Chapter Three

Chapter three presented the research process adopted. It included the literature derivation table for the data collection tool. In addition, the reliability and validity theories were examined.

Chapter Four

The results are presented in tables and graphs followed by a discussion of results using previous studies. The study found the following factors that influenced the usage of digital tools; perceived usefulness, attitude, perceived ease of use, effort expectancy, adoption and influence. Interestingly, the application of the Diffusion of Innovation theory to blended learning at the selected university was appropriate and there was a positive correlation with the items tested. It is important to note that the attitude of lecturers towards the use of digital tools and adoption was positive. However, the challenges experienced include high data costs, lack of infrastructure for communication and electric systems, system support, the cost to purchase digital software and device accessibility. Overall, the respondents indicated that they were keen on adopting digital tools for blended learning.

5.3 DESCRIBE THE SAMPLE

The majority of the respondents were female. Most of the respondents were African and Indian, which is a representation of the Province of KwaZulu-Natal. Between the ages of 26 – 40 years old, Majority of respondents were based on the ML Sultan and Steve Biko campuses. Interestingly, the lecturing experience ranged from 6 – 15 years. On a positive note, the laptop was the device most used for blended teaching and learning.

5.4 CONCLUSION

5.4.1 Objective One: To determine the factors that influence the adoption of digital tools

To determine the factors that influence the adoption of digital tools, the relationship between the following constructs was compared to the digital tool usage, Table 4.18 represents the results. It was shown that Adoption norm of digital tool usage, Perceived ease of use of digital tool usage, Attitude towards digital tool usage and Perceived usefulness towards digital tool usage, were found to have a significantly positive relationship with digital tool usage whereas Effort Expectancy and Influence were shown to be significant however did not reflect any impact on digital tool usage. Interestingly, all comparisons were significant whether looking at a positive or negative impact to the use of digital tools. This further comparison of the relationship between the constructs and digital tool usage was conducted, Table 4.19 which yielded different results, in this study, the perceived usefulness, attitude and perceived ease of use were found to be significant predictors of digital tools usage whilst Effort expectancy, Adoption and Influence were shown to have not had a significant contribution to digital tool usage. If a digital tool is easy to use, there is a strong likelihood of it being adopted. The adoption process and the impact it has on the use of digital tools is such an important part of using new technology. The adoption of digital tools in the field of education has been widely researched (Rubaai et al. 2019: 115, Alario et al. 2018), and supported adoption in the process of adopting digital tools. According to Moonsamy (2015: 34), perceived usefulness, user experience and facilitating conditions were found to highly influence a lecturer's decision to adopt.

According to Rogers (2003), the rate of adopting a digital tool is influenced by social systems, communication and the perceived benefits and compatibility of innovations. The adoption categories are listed as follows; relative advantage, complexity, trialability, compatibility and observability and each impacts the adoption of digital tools (Rogers 2003). Relative Advantage according to Goel, Ives and Harris (2019) are an influencing factor in predicting behaviour related

to technology adoption. According to Min et al. (2019: 2), compatibility and complexity were found to have a negative relationship with the intention to adopt. The easier a product is to use the more likely it will be adopted (Kee 2017: 43). According to Dewi et al. (2023: 304), a higher rate of adoption is connected to the ability to trial a product. According to Ayodele et al. (2020: 16) one of the main drivers in the adoption rate is an innovation's visibility and how it is recommended or how the university encourages its usage and how it boosts the observability of available digital resources. Further to this adoption takes place when the threshold of adopters is reached, and the non-adopters now follow suit by adopting as well. The types of adopters according to Sobhanmanesh et al. (2023: 156), are as follows, Innovators, Early Adopters, Early Majority, Late Majority and Laggards. Each type of adopter influences the adoption process in their own way, for example, innovators are the first to adopt a digital tool (Kee 2017: 34), Innovators are bold and they comprehend complex technological information, the types of adopters according to Dintoe (2018: 54), are early adopters, their experience affects their attitude as they believe they are technologically advanced, next is the early majority and according to Cakiroglu (2022: 90), they are generally a large part of society and reluctant to accept innovation without evidence to support usage. The late majority are sceptical, Rogers (2003), and are usually persuaded by peers and lastly, the laggards are more traditional, they only adopt when something is successful.

In this study, adoption was shown to have a positive perception towards the adoption of digital tools for blended teaching and learning which concurred with Moonsamy (2015: 40), further to this respondents were passionate about using digital tools, respondents preferred to trial a product before adopting it, respondents also agreed that if a digital tool is complex they would not want to try it, and that their colleagues' experience does impact their decision to adopt a digital tool. Respondents also indicated their confidence in using digital tools and that their devices were compatible. It is important to note that 34.6% of respondents were innovators (eager to try new products or systems) and 29.7% were early adopters (happy to adopt but calculate the risk). McTavish (2019:76), noted that the delay in lecturers understanding the adoption of digital tools and other technologies, which is important for universities as teaching and learning is their core business. The researcher in this study agrees with previous research presented and the findings presented concur with that of previous research however further research is needed on the impact of the adoption of digital tools as this has looked at the factors that influence adoption.

A study by Moonsamy (2015: 34), found that perceived ease of use and social influence did not have a huge impact on a lecturer adopting digital tools. Perceived ease of use was further found to have a negative relationship with the intention to adopt (Min et al. 2019: 2), According to Kee (2017: 34), perceived ease of use is required for the likelihood of an innovation to be adopted which contradicts with what Moonsamy (2015: 33), and Min et al. (2019: 3), found. Langegard (2021: 9), stated that perceived ease of use needs to be considered in the use of digital tools. The

findings of the study concur with (Kee 2017: 35, Langegard 2021: 10), in that respondents indicated a positive perception that digital tools were easy to use, and this impacted their use of digital tools. Further to this with the differing opinions, this could be an area for further research as the theory could have evolved since 2015.

The attitude of an adopter is seen to reflect mostly in early adopters, who have been shown to share their attitude towards adopting digital tools (Min et al. 2019: 6), Once an early adopter shows a positive attitude towards a digital tool and gives it a stamp of approval, their peers are likely to follow (Dintoe 2018: 55). According to Kim and Crowston (2011: 2), a relative advantage which is a factor of Diffusion of Innovation has been found to have a positive relationship with attitude and the intention to use it. Attitude will be looked at in more detail under Objective Three, however, it is also an important part of the adoption of digital tools process, as a lecturer's attitude influences whether they use a product or refer a colleague to use it.

The acceptance of digital tools and digital technologies is influenced by factors such as perceived usefulness (Al-Shami et al. 2018), this positive association with the adoption of digital tools also has a significant impact on determining a respondent's attitude towards using digital tools for teaching and learning as well as understanding the direct impact or the intention to use newer technology (Teo et al. 2019: 531). Moonsamy (2015: 31), found that perceived usefulness highly influenced a lecturer's decision to adopt. According to Kim and Crowston (2011: 3), when analysing constructs of Diffusion of Innovation, it was found that perceived usefulnesswhen influenced by compatibility and complexity had a negative relationship with the intention to adopt a new technology. In this study, it is noted that perceived usefulness had a positive impact on digital tool usage, respondents found digital tools useful or convenient to use. This further contributes to how the usefulness of a digital tool can influence the decision to adopt it.

Social Influence and Effort Expectancy were shown to have a negative relationship with the adoption of digital tools (Moonsamy 2015:33). Effort Expectancy (Extension of Perceived Ease of Use), adoption, influences and challenges did not have an influence on the adoption of digital tools. It was interesting to note that effort expectancy is an adaptation of perceived ease of use in the Technology Acceptance Model (Or and Chapman 2021: 100), and with the adoption of digital tools similarly, effort expectancy did not influence the adoption of digital tools, taking into consideration that if something is easy to use it will be adopted. This study found that effort expectancy although significant and positive was significant in expressing that more effort was required when using digital tools, it was further shown to have no strong predictors of digital tool usage. The research concurs with previous studies that effort expectancy and social influence do not impact a lecturer's decision to adopt a digital tool.

Lastly, the challenges with the highest effect on respondents' adoption of digital tools were Lack of infrastructure for communication and electric systems, High Data Costs, Cost of purchasing digital software, System Support and Inadequate device accessibility. For blended learning to take place you need to have appropriate digital software. Establishing critical infrastructure, reliable internet and adequate software and hardware will allow universities to be ready to use digital tools and allows students and lecturers to embrace blended learning (Ali 2022).

A lack of infrastructure is a global issue, studies by Langegard (2021: 9), and Teane (2024: 427), both reported on technical limitations in the adoption of digital tools which negatively impacts lecturers' efforts to implement digital resources. High data costs, campus Wi-Fi is critical in students using digital tools, the connectivity issues at the selected university are ongoing with emails sent often to students, requiring them to use data which has a high cost. During the COVID-19 pandemic, the university did support staff and students with data bundles, but this has since stopped. Dintoe (2018: 55), identified data cost as a deterrent for lecturers to use digital tools, the research agrees with this statement as lecturers do consider their students and how they will access content. The cost to adopt certain digital tools can also deter lecturers from using it, especially considering budget constraints at universities (Best, Sibson and Morgan 2021: 2), A study by Tinashe (2021: 9), highlighted that lecturers are more likely to utilise a digital tool or system when they feel supported. Ramroop (2021: 146), stated that a lack of adequate infrastructure and lack of access to devices used to access online tools is still a challenge today. The research concurs with previous researchers and the study that these are core challenges yet not unique to the selected university of technology and in their vision leading to 2030, they need to look at ways to address these challenges.

5.4.2 Objective Two: To apply the Diffusion of Innovation theory to blended learning at the Durban University of Technology

It was interesting to note that respondents encouraging their students to use electronic resources from the library, clearly, respondents embraced technology in the teaching and learning environment at the selected university. Perhaps this is because digital tools can be accessed anytime and anywhere. Furthermore, respondents were keen to try out new digital tools. Digital teaching and learning tools made lecturers exciting. However, the COVID-19 pandemic has changed the respondents' attitudes towards electronic resources. The study also covered the Diffusion of Innovation and the adoption process in objective one in detail.

Rogers' 1962 Diffusion of Innovation Theory examines how new ideas, products or technological advancements grow within a community or social structure. Based on their willingness to accept innovations, the theory classifies adopters into five categories: innovators, early adopters, early

majority, late majority and laggards. There are four main elements in the Diffusion of Innovation: The Innovation or idea; the channels of communication; the social system and time; each has a significant impact on the adoption of digital technologies. Moonsamy (2015: 35) found that lecturers were not willing to embrace new technology for teaching and learning. The younger the lecturers that come into the university space, the more digital tools will be embraced (Asperges 2019), these lecturers will encourage their colleagues to adopt. Diffusion of Innovation can aid in reflecting on the adoption of digital tools for blended learning (Houlden and Velesianos 2020). The Diffusion of Innovation Theory according to Rogers and Shoemaker (1971), has been extensively utilised in multiple areas, such as public health, technology adoption and marketing, offering significant perspectives on the complexity of innovation adoption procedures. The Diffusion of Innovation theory by Rogers (2003) is most suited to understanding the adoption decision process of lecturers who have adopted digital tools. Haces and Macia (2024), define Diffusion of innovation as a framework of analysis for examining the adoption and use of new ideas, techniques, or technology. DOI shares insight on how innovations are disseminated amongst diverse groups and countries and provides perspective into how innovations are accepted. According to Sobhanmanesh et al. (2023: 156), the Diffusion of innovation theory is focused on the way people adopt new technology. Research in blended learning suggests that little is known about blended learning and Diffusion of Innovation at an institutional level (Ali 2022).

In this study, respondents had a positive response to embracing technology adoption for teaching and learning, encouraging their students to use digital resources from the library, and are keen to try out new digital tools. It further showed that Diffusion of Innovation had a positive impact on the process of digital tool usage and a positive inclination towards the use of digital tools in the teaching and learning environment amongst the respondents. The research concurs with Houlden and Velesianos (2020) and Sobhanmanesh et al. (2023: 156), in that Diffusion of Innovation focuses on the way people adopt a new technology. Furthermore, the research could look at whether the COVID-19 pandemic and Emergency Remote Teaching impacted respondents' decision to use digital tools using the Diffusion of innovation theory.

5.4.3 Objective Three: To ascertain the attitudes of lecturers towards digital tools for blended learning at the Durban University of Technology

The respondents generally perceive digital tools as useful and have a positive attitude towards their use, find them easy to operate, are willing to exert effort in learning to use them, are open to discovering new technologies, and are somewhat influenced by information when making decisions about technology adoption. All constructs measured are significantly greater than the neutral midpoint, indicating an overall positive inclination towards the adoption and use of digital technologies.

It was encouraging to note that respondents at the selected university had a positive towards using digital tools for blended learning, Furthermore, they believed it was important to understand how to use a product before adopting it. They acknowledged the convenience, efficiency and the effectiveness of managing their online resources and that it fits their teaching styles. Interestingly there were mixed responses on whether the university infrastructure supported the usage of digital tools for teaching and learning.

The importance of a positive attitude is fundamental for using and integrating technology, as well as the promotion and acceptance by lecturers and students (Avidor-Ungar et al. 2018), lecturers need to be passionate to motivate students. Jahanmir and Cavandas (2018:338), states that attitude towards innovation is related to the desirability to adopt. Hsu and Lin (2020:13), are of the view that lecturers today are more confident in using technology but are not as confident when designing supporting learning material. Amhag et al. (2019:212), found that when considering the need for training, those lecturers with low competence when using digital tools needed more training in preparation of their online lectures and that their attitude influenced the adoption of digital tools and Wang (2015:77) highlighted that a factor affecting lecturers' use of digital tools is limited support from the Institution. Dintoe (2018:55), stated that where Institutions offer the right knowledge to lecturers through their support and development, lecturers will be more skilled and it will positively impact the adoption of digital tools.

The researcher agrees with the findings on attitude. Attitude has not just contributed to a digital tool being adopted but it will impact others who wish to adopt when someone speaks positively of a product. Olafare (2017: 2), noted that attitude influences the use of digital tools but so does experience, which is an important factor for universities to maintain a positive attitude constant training is required (Amhag et al. 2019: 212). The COVID-19 pandemic impacted the use of digital tools, but attitude could not be considered as it was a compulsory shift to online learning. Further research in the area of attitude during the COVID-19 pandemic towards using digital tools is needed.

Regarding university infrastructure, this challenge has been addressed in Objective One, Consideration can be given in that the university has different campuses with different buildings and infrastructure, and this could be why responses were mixed.

5.5 CONCLUSION OF THE STUDY

In this study, various literature was examined, the adoption of digital tools for blended learning by lecturers at the Durban University of Technology using the Diffusion of Innovation Theory. The objectives of the study focused on the factors that influenced the adoption of digital tools, it considered applying Diffusion of Innovation to blended learning at DUT and ascertained the

attitude of lecturers towards using digital tools for blended learning. With all three objectives being discussed, all were important in assessing the impact of digital tool usage for blended learning and despite the challenges, respondents showed an encouraging response towards embracing digital tools. Applying Diffusion of Innovation was insightful in showing the portion of respondents who were innovators and early adopters.

5.6 IMPLICATIONS FOR POLICY AND PRACTICE

The implications for policy from this study could be to introduce a new policy on compulsory training when digital tools are implemented by the selected university, with feedback and a follow-up of the experience when using the digital tools presented back to the university board on the impact seen whilst using these digital tools suggested, further investing in infrastructure, fundraising or finding investors to contribute towards improving the infrastructure or planning to budget for this as part of the universities digital strategy is imperative, continuous professional development improvement in areas relevant to lectures and where they require assistance based on the type of adopter they are is advised, create an incentive for using digital tools, it could be digital badges or accolades for using and reviewing them for other lecturers to try, and lastly, improve technical support, more training and faculty support and shorter downtime periods.

5.7 LIMITATIONS

- This study was limited to KwaZulu-Natal, so this study can be expanded to other provinces.
- Adoption has a differing response to other researchers' studies and is an area that can be researched further.
- The challenges in data collection with a lack of responses from respondents at the selected university.
- The study on Diffusion of Innovation was broad, it can be focused more on specific characteristics; Relative Advantage, Complexity, Trialability, Observability and Compatibility.

5.8 IMPLICATIONS FOR FURTHER RESEARCH

- Explore conducting this study on other universities of technology.
- Conduct a comparative study comparing universities of technology and traditional universities.

- Focus the study on specific types of adopters, Innovators, Early Adopters, Early Majority, Late Majority and laggards.
- Analyse adoption and the difference in the impact on digital tools.
- Look at why social influence may not impact the adoption of digital tools.
- Has the COVID-19 Pandemic had a negative or positive impact on the use of digital tools.
- Does the current infrastructure support digital teaching and learning based on an analysis of various campuses.
- Attitude of lecturers in adopting digital tools during the COVID-19 pandemic.
- Look at the study from a qualitative perspective.

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APPENDIX A: QUESTIONNAIRE

DURBAN UNIVERSITY OF TECHNOLOGY QUESTIONNAIRE

Title: ***Adoption of digital tools for blended learning by lecturers at the Durban University of Technology: The Diffusion of Innovation theory***

Dear Participant,

My name is **Gabriella Govender,** a master's student in Business Administration at the Durban University of Technology. I hereby seek your consent to participate in a research study on the topic: **"**Adoption of digital tools for blended learning by lecturers at the Durban University of Technology: The Diffusion of Innovation theory**".**

This study aims to determine the factors that impact the adoption of digital tools for blended learning by lecturers at DUT using the Diffusion of Innovation theory, and how these factors may influence lecturer attitudes towards using digital tools. The objectives of the study are to apply the Diffusion of Innovation theory when using digital tools in a blended learning environment at DUT and to ascertain the attitude of lecturers toward digital tools for blended learning at DUT.

Through your participation, I hope to ascertain the lecturer's experience, usefulness, perceived ease of use, and preference when using digital tools for blended learning and how these factors influence whether or not the products are adopted. The results of the study will contribute to the existing body of knowledge. The information and the ratings that you provide will assist me in identifying the factors. The questionnaire will be administered to elicit the required information, which should not take more than 10 minutes to complete.

Please know that your participation in this project is voluntary. You may refuse to participate or withdraw from the project at any time with no negative consequences. Your name will not be attached to the questionnaire and all information will be held in the strictest confidence. Therefore, should you have any about the questionnaire or about participating in this study, do not hesitate to contact me or my supervisor at the telephone numbers at the end of the questionnaire.

Participant Consent

- I hereby confirm that I have been informed by the researcher, Mrs. Gabriella Govender, about the nature, conduct, benefits and risks of this study.
- Research Ethics Clearance Number: **IREC 043/21**
- I have also received, read, and understood the above-written information regarding the study.
- I am aware that the results of the study, including personal details regarding my sex, age, date of birth, initials, and diagnosis will be anonymously processed into a study report.
- Given the requirements of research, I agree that the data collected during this study can be processed in a computerised system by the researcher.
- I may withdraw my consent and participation in the study at any stage, without prejudice.

- I have had sufficient opportunity to ask questions and (of my own free will) declare myself prepared to participate in the study.
- I understand that significant new findings developed during this research that may relate to my participation will be made available to me.

Signature: _____

Date: _____

1. Biographical Information

Please Mark your response with an **X** over the appropriate answer.

1.1 Gender

Male	1
Female	2
Prefer not to say	3

1.2 Ethnic Group

African	1
Coloured	2
Indian	3
White	4
Other	5

1.3 Age

1993-1995 Current Generation Z	23-25 years old	1
1981-1995: Millennial	26-40 years old	2
1965-1980: Generation X/Y	41-56 years old	3
1946-1964: Baby Boomers	57-75 years old	4

1.4 Lecturer Designation

Junior Lecturer	1
Lecturer	2
Senior Lecturer	3

1.5 Lecturing Experience

2-5 years	1
6-9 years	2
10-15 years	3
16-20 years	4
21+ years	5

1.6 Campus

ML Sultan	1
City	2
Brickfield	3
Riverside	4
Indumiso	5
Steve Biko	6
Ritson	7
Other	8

1.7 Faculty

Faculty of Accounting and Informatics	1
Centre for General Education	2

CELT - Centre for Excellence in L&T	3
Faculty of Applied Sciences	4
Faculty of Arts and Design	5
Faculty of Health Sciences	6
Faculty of Engineering and the Built Environment	7
Faculty of Management Sciences	8
Other	9

2. Digital Tools

2.1. Device most used for blended teaching and learning:

Laptop	1
Desktop	2
Android/IOS Phone	3
Tablet	4

2.2 Preference of programs, applications, or software used for teaching and blended learning:

Digital E-book (VitalSource/Ebsco/ProQuest/ITSI)	1
Online resources for prescribed book	2
Learning Management System	3
Microsoft teams	4
My Lab and Mastering	5
Web Assign	6
SAM (IT Software)	7
McGraw-Hill Connect	8
Wiley Plus	9
Zoom	10

IF OTHER, SPECIFY	11

2.3 I use digital tools (Listed in 2.2) for teaching and learning:

More than three times a week	1
Two-three times a week	2
Once a week	3
Not at all	4

2.4 Indicate the extent to which the following challenges affect the use of digital tools for blended learning using the rating scale in the table below and mark your response with an **X**:

SCALE GUIDE				
1	**2**	**3**	**4**	**5**
No effect	Minor effect	Neutral	Moderate effect	Major effect

2.4.1	Lack of infrastructure for Communication and Electric Systems	1	2	3	4	5
2.4.2	System support	1	2	3	4	5
2.4.3	Inadequate device accessibility	1	2	3	4	5
2.4.4	Insufficient support staff to drive usage	1	2	3	4	5
2.4.5	High data costs	1	2	3	4	5
2.4.6	Limited knowledge of available digital tools and benefits	1	2	3	4	5
2.4.7	Cost to purchase digital software	1	2	3	4	5
2.4.8	Legal or Copyright Limitations	1	2	3	4	5
2.4.9	Workload - Lack of time to coordinate and set up content digitally	1	2	3	4	5

2.5 I consider myself the following: (Type of Adopter)

Innovator - eager to try new products/systems	1
Early Adopter - happy to adopt but calculate the risk	2
Early Majority - adopt when the product is successful	3
Late Majority - only after others have adopted	4
Laggard - dislike change (conservative/traditional)	5

Please rate the following statements using the rating scale in the key numerical descriptor below and mark your response with an **X**

1	**2**	**3**	**4**	**5**
Strongly disagree	Disagree	Neutral	Agree	Strongly agree

2.6 Digital tool usage for blended learning

2.6.1	I am technologically savvy	1	2	3	4	5
2.6.2	I am confident when accessing a digital tool used for my module	1	2	3	4	5
2.6.3	Digital support and training influenced my decision to use a digital tool in my blended classroom	1	2	3	4	5
2.6.4	Teaching with digital tools can improve student engagement	1	2	3	4	5
2.6.5	Access to digital tools can improve student pass rates	1	2	3	4	5
2.6.6	The use of digital tools makes my lectures more visual	1	2	3	4	5
2.6.7	The digital teaching content is compatible with my device	1	2	3	4	5
2.6.8	Digital tools are user friendly	1	2	3	4	5
2.6.9	The complex nature of digital tools demotivates me	1	2	3	4	5
2.6.10	Covid19 has changed my opinion about adopting digital tools	1	2	3	4	5

2.7 Adoption Categories and the adoption process

2.7.1	I am passionate about teaching with digital tools and will try new technology products	1	2	3	4	5
2.7.2	I will use a digital tool that a colleague has recommended	1	2	3	4	5
2.7.3	I carefully consider which digital tools I use to teach	1	2	3	4	5
2.7.4	I need to demo/trial before deciding whether I will use it or not	1	2	3	4	5
2.7.5	Support services influence my adoption of new digital tools	1	2	3	4	5
2.7.6	Colleagues' experiences with digital tools influence my decision to try new digital resources	1	2	3	4	5
2.7.7	If a digital tool appears complex, I will not try it	1	2	3	4	5
2.7.8	I am reluctant to use digital teaching resources based on my experience	1	2	3	4	5
2.7.9	I have returned to face-to-face teaching and learning after the COVID-19 lockdown willingly	1	2	3	4	5
2.7.10	I prefer printed teaching tools to digital tools	1	2	3	4	5
2.7.11	I am aware of digital tools available on the market (not including compulsory MML tools)	1	2	3	4	5
2.7.12	I prefer to attend regular webinars based on digital products available	1	2	3	4	5

Please rate the following statements using the rating scale in the key numerical descriptor below and mark your response with an **X**

1	**2**	**3**	**4**	**5**
Strongly disagree	Disagree	Neutral	Agree	Strongly agree

2.8 Attitude of the lecturer towards using digital tools

2.8.1	I have a positive attitude towards using digital tools for blended learning	1	2	3	4	5
2.8.2	I believe it is important to know how to use a digital tool before adopting	1	2	3	4	5

2.8.3	I think using digital tools for learning is over-emphasised	1	2	3	4	5
2.8.4	I wish I could use a digital tool for all my modules	1	2	3	4	5
2.8.5	Digital Teaching and Learning tools make my lectures exciting	1	2	3	4	5
2.8.6	Digital Tools add fun to teaching and learning	1	2	3	4	5
2.8.7	I believe that digital tools motivate students to attend lectures	1	2	3	4	5
2.8.8	Embracing technology in the teaching and learning environment is essential in the 4IR era	1	2	3	4	5
2.8.9	The COVID19 pandemic has changed my attitude towards electronic resources	1	2	3	4	5
2.8.10	As a lecturer, I encourage students to use electronic sources from the library	1	2	3	4	5
2.8.11	My friends and colleagues also adopt digital tools for teaching and learning	1	2	3	4	5

2.9 Diffusion of Innovation Theory characteristics

2.9.1	Digital tools make a lecturer work efficiently	1	2	3	4	5
2.9.2	Using digital tools is convenient for teaching	1	2	3	4	5
2.9.3	Digital tools motivate me	1	2	3	4	5
2.9.4	With digital tools, I manage resources effectively	1	2	3	4	5
2.9.5	I like to adopt innovative teaching resources	1	2	3	4	5
2.9.6	The University’s current Infrastructure supports the usage of digital tools for teaching and learning	1	2	3	4	5
2.9.7	Using digital tools fits into my teaching style	1	2	3	4	5
2.9.8	Digital tools or resources can be accessed anytime and anywhere	1	2	3	4	5
2.9.9	Student interaction and engagement is better online	1	2	3	4	5
2.9.10	Using digital tools requires extensive preparation	1	2	3	4	5
2.9.11	Using digital tools can be demanding	1	2	3	4	5

2.9.12	Using digital tools requires technical skill	1	2	3	4	5
2.9.13	I am keen to always try out new digital tools	1	2	3	4	5

Thanking you in anticipation.

Gabriella Govender
Student
Gabywood17@yahoo.com
20918479@dut4life.ac.za
0731138575

Dr. Mandusha Maharaj
Supervisor maharama@dut.ac.za
0832627929

APPENDIX B: PERMISSION TO CONDUCT STUDY

Directorate for Research and Postgraduate Support
Durban University of Technology
Tromso Annexe, Steve Biko Campus
P.O. Box 1334, Durban 4000
Tel.: 031-3732576/7
Fax: 031-3732946

31st May 2022
Mrs Gabriella Wood Govender
c/o Department of Entrepreneurial Studies and Management
Faculty of Management of Sciences
Durban University of Technology

Dear Mrs Wood Govender

PERMISSION TO CONDUCT RESEARCH AT THE DUT

Your email correspondence in respect of the above refers. I am pleased to inform you that the Institutional Research and Innovation Committee (IRIC) has granted **Gatekeeper Permission** for you to conduct your research "Adoption of digital tools for blended learning by lecturers at the Durban University of Technology: the diffusion of innovation theory." at the Durban University of Technology. **Kindly note that this letter must be issued to the IREC for approval before you commence data collection.**

The DUT may impose any other condition it deems appropriate in the circumstances having regard to nature and extent of access to and use of information requested.

We would be grateful if a summary of your key research findings would be submitted to the IRIC on completion of your studies.

Kindest regards.
Yours sincerely

PROF. KEO MOTAUNG
ACTING-DIRECTOR: RESEARCH AND POSTGRADUATE SUPPORT DIRECTORATE

APPENDIX C: INFORMED CONSENT FORM

Faculty of Management Sciences

Dear Participant,
Letter of Information

My name is **Gabriella Govender;** I am a master's student of Business Administration at the Durban University of Technology. I hereby seek your consent to conduct a research study on the topic **"**Adoption of digital tools for blended learning by lecturers at the Durban University of Technology: The Diffusion of Innovation theory**".**

This topic aims to determine the factors that impact the adoption of digital tools for blended learning by lecturers at DUT using the Diffusion of Innovation theory and how these factors may influence lecturer attitudes towards using digital tools. The objectives of the study are to apply the Diffusion of Innovation theory to using digital tools in a blended learning environment at DUT and to ascertain the attitude of lecturers towards digital tools for blended learning at DUT.

Through your participation, I hope to ascertain the experience, usefulness, perceived ease of use, and preference of lecturers when using digital tools for blended learning and how these factors influence whether the products are adopted or not. The results of the study are to contribute to the existing body of knowledge. The information and the ratings that you provide will assist me in identifying the factors. The questionnaire will be administered to elicit the required information which should not take more than 10 minutes to complete.

Please, know that your participation in this project is voluntary. You may refuse to participate or withdraw from the project at any time with no negative consequences. Your name will not be attached to the questionnaire and all information will be held in the strictest confidence. Therefore, should you have any queries with regards to the questionnaire or about participating in this study, do not hesitate to contact me or my supervisor on the telephone numbers below.

Participant Consent

- I hereby confirm that I have been informed by the researcher, Mrs. Gabriella Govender about the nature, conduct, benefits and risks of this study Research Ethics Clearance Number: **IREC 043/21**
-
- I have also received, read and understood the above-written information regarding the study.
- I am aware that the results of the study, including personal details regarding my sex, age, date of birth, initials and diagnosis will be anonymously processed into a study report.

- In view of the requirements of research, I agree that the data collected during this study can be processed in a computerised system by the researcher.
- I may, at any stage, without prejudice, withdraw my consent and participation in the study.
- I have had sufficient opportunity to ask questions and (of my own free will) declare myself prepared to participate in the study.
- I understand that significant new findings developed during the course of this research which may relate to my participation will be made available to me.
- By completing the questionnaire, I give consent to my response being used in the research findings.

Thank you in anticipation.

Gabriella Govender
Student
Gabywood17@yahoo.com
20918479@dut4life.ac.za
0731138575

Dr. Mandusha Maharaj
Supervisor / Promoter
maharama@dut.ac.za
0832627929

APPENDIX D: CONSENT FORM OF PARTICIPANTS

Full Title of the Study:

Adoption of digital tools for blended learning by lecturers at the Durban University of Technology: The Diffusion of Innovation theory.

Names of Researcher/s: Mrs. Gabriella Govender**.**

Statement of Agreement to Participate in the Research Study:

•I hereby confirm that I have been informed by the researcher, Mrs. Gabriella Govender, about the nature, conduct, benefits and risks of this study - Research Ethics Clearance Number: _,

• I have also received, read, and understood the above-written information (Participant Letter of Information) regarding the study.

• I am aware that the results of the study, including personal details regarding my sex, age, date of birth, initials and diagnosis will be anonymously processed into a study report.

• In view of the requirements of research, I agree that the data collected during this study can be processed in a computerised system by the researcher.

• I may, at any stage, without prejudice, withdraw my consent and participation in the study.

• I have had sufficient opportunity to ask questions and (of my own free will) declare myself prepared to participate in the study.

• I understand that significant new findings developed during the course of this research which may relate to my participation will be made available to me.

_____	_____	_____	_____
Full Name of Participant	**Date**	**Time**	**Signature / Right Thumbprint**

I, Mrs. Gabriella Govender, herewith confirm that the above participant has been fully informed about the nature, conduct and risks of the above study.

_____	_____	_____
Full Name of Researcher	**Date**	**Signature**

_____	_____	_____
Full Name of Witness (If applicable)	**Date**	**Signature**

APPENDIX E: CERTIFICATE OF TRAINING RESEARCH ETHICS

Zertifikat Certificado
Certificat Certificate

Promouvoir les plus hauts standards éthiques dans la protection des participants à la recherche biomédicale
Promoting the highest ethical standards in the protection of biomedical research participants

TRREE

Clinical Trials Centre
The University of Hong Kong

Certificat de formation - Training Certificate

Ce document atteste que - this document certifies that

Gabriella Govender

a complété avec succès - has successfully completed

Introduction to Research Ethics

du programme de formation TRREE en évaluation éthique de la recherche
of the TRREE training programme in research ethics evaluation

Release Date: 2021/03/13

Professeur Dominique Sprumont
Coordinateur TRREE Coordinator

FMH

FPH

Ce programme est soutenu par - This program is supported by :

APPENDIX F: IREC – ETHICAL CLEARANCE

Institutional Research Ethics Committee
Research and Postgraduate Support Directorate
2nd Floor, Barwyn Court
Gate 1, Steve Biko Campus
Durban University of Technology

P O Box 1334, Durban, South Africa, 4001

Tel: 031 373 2375
Email: lavishad@dut.ac.za
http://www.dut.ac.za/research/institutional_research_ethics

www.dut.ac.za

2 June 2022

Mrs G R Wood Govender
24 Aquarius Road
Woodhurst
Chatsworth
4092

Dear Mrs Wood Govender

Adoption of digital tools for blended learning by lecturers at the Durban University of Technology: the diffusion of innovation theory.
Ethical Clearance number IREC 043/21

The Institutional Research Ethics Committee acknowledges receipt of your final data collection tool for review.

We are pleased to inform you that the data collection tool has been approved. Kindly ensure that participants used for the pilot study are not part of the main study.

In addition, the IREC acknowledges receipt of your gatekeeper permission letter.

Please note that FULL APPROVAL is granted to your research proposal. You may proceed with data collection.

Any adverse events [serious or minor] which occur in connection with this study and/or which may alter its ethical consideration must be reported to the IREC according to the IREC Standard Operating Procedures (SOP's).

Please note that any deviations from the approved proposal require the approval of the IREC as outlined in the IREC SOP's.

Yours Sincerely,

Dr K Padayachy
Deputy Chairperson: IREC

APPENDIX G: LETTER FROM THE STATISTICIAN

Gill Hendry B.Sc. (Hons), M.Sc. (Wits), PhD (UKZN)
Mathematical and Statistical Services

Cell: 083 300 9896
Email: gillhendrystats@gmail.com

7 November 2024

Re: Statistical assistance

Please be advised that I assisted Gabriella Wood Govender (Student number 20918579), who is currently studying for a Masters in Management Science (Business Administration) at the Durban University of Technology, with the statistical analysis of the data.

Yours sincerely

Dr Gill Hendry
Private Consulting Statistician

APPENDIX H: EDITOR LETTER

EDITOR'S LETTER

Researchers Beyond-Borders (PTY) LTD
Umhlanga, Durban
South Africa
22 November 2024

To whom it may concern

Editing of Masters Dissertation: Gabriella Govender (**Student number** -20918479)

Title of dissertation: Adoption of digital tools for blended learning by lecturers at the Durban University of Technology: The Diffusion of Innovation Theory

This letter serves as confirmation that the aforementioned dissertation has been language edited.

Any queries may be directed to the author of this letter.

Regards

Maleni Pillay
Researchers Beyond-Borders
consult@researchersbeyondborders.com
www.researchersbeyondborders.com

APPENDIX I: TURNITIN REPORT

25/11/2024

24112024_Gabriella_November_2024_Final_Thesis_

ORIGINALITY REPORT

17%	13%	13%	5%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	researchspace.ukzn.ac.za Internet Source	1%
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