**DURBAN UNIVERSITY OF TECHNOLOGY**

# CHALLENGES AND BEST PRACTICES IN THE USE OF E-LEARNING TECHNOLOGIES FOR TEACHING AND LEARNING AT UOTS – A CASE STUDY OF THE DURBAN UNIVERSITY OF TECHNOLOGY

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**DECLARATION**

I, Navitha Ramroop, hereby declare that this thesis is the result of my own research and investigation, and has not been submitted previously in part or in full for any degree or to any other university. I further declare that all sources cited or quoted are duly acknowledged in the bibliography.

14th December 2021

**N. Ramroop** **Date**

## DEDICATION

Mr. Vimal and Mrs. Shyra Ramdeyal, I have never been able to say “Thank you!” for all that you so selflessly sacrificed to make me who I am today! This study is therefore dedicated to you for the unconditional love you have always embraced me with.

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| | |
|---|---|
| UoT | University of Technology |
| IT | Information technology |
| DVD | Digital video disk |
| BYOD | Bring your own device |
| PC | Personal computer |
| HEI | Higher education institution |
| ICT | Information and communication technology |
| ILS | Inventory of learning styles |
| WWW | World wide web |
| LMS | Learning management system |
| Moodle | Modular object-orientated dynamic learning environment |
| CD-ROM | Compact disk read-only memory |
| 4IR | Fourth Industrial Revolution |
| DUT | Durban University of Technology |
| GNI | Gross national income |
| HDI | Human development index |
| HE | Higher education |
| TPACK | Technological Pedagogical Content Knowledge |
| WHO | World Health Organisation |
| KMO | Kaiser-Meyer-Olkin |
| SEM | Structural Equation Model |
| SPSS | Statistical Package for Social Science |

| | |
|---|---|
| Wi-Fi | Wireless fidelity |
| MCQ | Multiple choice question |
| RMSEA | Root Mean Square Error of Approximation |
| CFI | Comparative fit index |
| CELT | Centre for Excellence in Learning and Teaching |
| ITSS | Information Technology and Support Services |

## ABSTRACT

This study reflected on the current context of the South African higher education landscape by focussing on the role that technology plays in academia for successful teaching and learning, with particular reference to e-learning.

Higher education institutions (HEIs) are re-designing their curricula to merge existing teaching and learning content with technological practices and applications, with the goal of producing appropriately qualified graduates who will be globally recognised and best suited for industry. Literature on the subject revealed that technology-enhanced learning, or e-learning, has peaked in most parts of the world. However, each educational institution is unique and the challenges and opportunities posed by e-learning differ. The uniqueness differs because the technological metamorphosis evolves around resources, skills sets, infrastructure and the mind-sets of lecturers and students. The common belief is that technology empowers people, enabling them to do what they want to do, promoting creativity and productivity.

It was necessary (before researching the technology applicable for teaching and learning) to understand how teaching and learning occurred in HEIs. The findings revealed the learning and teaching processes, as expounded by the Constructivist Theory, as that which not only involves the transmission of information, nor is it deemed only as the acquisition of knowledge. The student is an active participant and the lecturer ensures the facilitation of the learning process. Technology adds a further dimension to teaching and learning practices, justifying e-learning in pedagogies.

The aim of this study was therefore to investigate the challenges experienced and best-practices adopted in the use of e-learning technologies for teaching and learning at Universities of Technology (UoTs), with specific reference to

the Durban University of Technology (DUT). An empirical research approach was adopted, with surveys being conducted with both teaching staff and students at DUT. Apart from determining the challenges and best-practices experienced by lecturers and students at DUT, the study has produced recommendations and intervention strategies to address the challenges of teaching and learning with e-learning. The development of a framework of strategies concluded the study, highlighting the challenges of e-learning while providing recommended intervention strategies, best-practices and a phased implementation plan.

However, while this study focussed on the challenges and best-practices for e-learning in HEIs, the driving force in 2020 for institutions of higher learning to embrace technology as a teaching and learning tool was the Covid-19 pandemic. The study was already in progress when it was hindered by the pandemic.

The Covid-19 pandemic spread at an unfathomable rate, resulting in medical institutions being unable to cope with the increased number of patients and fatalities, while businesses buckled under the strain of an economic downturn. Statistics revealed that as at 25 May 2021, the virus infected 167 million people globally, while claiming the lives of 3,47 million people. In South Africa alone, 55 874 people succumbed to the virus. Lockdown measures were necessary to curtail the spread of the virus. HEIs were also unfortunately forced to close their doors to students. The forced closure of HEIs did not deter lecturers and students from engaging in teaching and learning, but it forced a move away from the traditional teaching and learning practices. The Covid-19 pandemic has accelerated the need globally for all educational sectors to invest every effort into moving towards digital curricula.

Even without the forceful nature of the Covid-19 pandemic, DUT had already embarked on the use of digital technology to enable teaching and learning.

The impact of the global pandemic provided a platform to further highlight the challenges of using technology for teaching and learning, as well as the best-practices adopted at the institution.

Many significant findings arose from analysing the data produced from both the staff and the student surveys. The findings provided a plethora of rich information which aided in the development of the framework addressing the challenges experienced by staff (rigid teaching practices; the lack of access to technology; the lack of skills; poor infrastructure), as well as those experienced by the students (technology is a distraction to weaker students, the lack of concentration in online learning, the lack of human contact, the lack of access to technology). The findings relating to how the lecturers and students perceive the usefulness of technology in teaching and learning, as well as their perceived ease with the use of technological devices, are clearly depicted in the underpinnings of the Technology Acceptance Model (TAM). This is evident from the approach adopted by lecturers and students in the use of technology in higher education.

The recommendations made in the study take into account the plight of the "have-nots". The findings revealed that many students are not equipped to engage in e-learning as access to devices and data, as well as proper networking infrastructure, and a conducive learning environment are challenges. The recommendations suggest that HEIs need to be attentive to students who are less privileged or who emerge from disadvantaged backgrounds and hence need the minimum essentials for e-learning. In seeking solutions to the e-learning challenges in higher education, the Social Justice Theory and principles are of fundamental importance. Any other approach could result in solving technology-related challenges, but would leave those who require the support the most outside the ambit of transformation in higher education.

The study has not only produced recommendations for addressing the e-learning challenges, but has also developed a phased implementation plan for e-learning implementation at DUT.

# CHAPTER ONE: INTRODUCTION TO THE STUDY

## 1.1 Introduction

The development of information technology and its multitude of tools has enhanced and led to improvements in people's daily lives, with influences in various fields such as finance, business, health and education (Al-Fraihat *et al.* 2020: 67). In recent years, digital technologies have strengthened the involvement of individuals in social, political and economic dimensions, being seen as a significant transformational tool, especially for developing countries (Soomro *et al.* 2020: 1). With these emerging technologies and recent innovations, there has been a change in how individuals acquire knowledge on a daily basis. The authors state further that the integration of technology in education has seen a rapid growth in e-learning and virtual pedagogical environments. Hussain, Wang and Rahim (2013) state that information and communication technologies (ICTs) provide for a range of techniques in the field of pedagogy, which has introduced new concepts of teaching and learning.

Prior to 2020, using technological tools to deliver curricula was not a forced endeavour by HEIs. The worldwide impact of the Covid-19 pandemic accelerated the need for HEIs to rethink the delivery of their curricula to students. Although the #RhodesMustFall and #FeesMustFall student-led protests forced universities to shut down and decisions were made at higher education institutions (HEIs) for "blended learning" to be a strategy for students to complete their courses (Czerniewicz 2020: para. 2-3), the consequences and tragedies inflicted by the Covid-19 pandemic left HEIs worldwide with no option but to pursue online and web-based teaching and learning on a scale never seen before.

The transformation of traditional classroom activities into online or virtual sessions has led to most HEIs becoming "electronic" or "virtual" universities (Al-Hunaiyyan *et al.* 2016: 87). Educational transformation is further advocated by the Fourth Industrial Revolution (4IR). 4IR dictates that the traditional information transfer as a way of teaching, is no longer viable for HEIs (Gleason 2018: 147). The author believes that preparing employable and responsible HE graduates can be obtained if ‘technological unemployment’ is addressed, i.e. HEIs need to prepare students with a different kind of education which embraces new technologies for future employment (2018: 148). According to Ramraj and Marimuthu (2019: 36), the mammoth obligation of “delivering relevant content that adequately prepares students with vital and necessary skills as technologies continue to transform” has lecturers at HEIs scurrying to marry transformed methods of teaching with traditional approaches. Lecturers therefore need to strive to attain the correct qualifications and the correct knowledge and training. Of course, the ability to produce graduates, through these transformed methods requires commitment and dedication.

However, for the successful implementation of e-learning in HEIs, an understanding of the role of technology, as well as of current teaching and learning practices, needs to be in order (Al-Hunaiyyan *et al.* 2016: 88). HEIs are challenged by “technologically-driven developments”, especially in how students are expected to learn with technology (Lim and Wang 2017: 2). Toffler (1990, as cited in Lim and Wang 2017: 3) believed that students have to “learn, unlearn and re-learn” when engaging with technology for learning. Students are expected to be highly competent in technological educational environments. However, Sutherland (2020: 234) avers that these students are remnants of an educational system that cannot produce appropriately qualified school leavers. Moreover, current systems are also inadequate to train and re-train individuals in information and communication technology.

Al-Hunaiyyan *et al*. (2016: 91) argue that further to building teaching competencies and ensuring that students have adequate skills and knowledge to engage in e-learning, “the lack of a strong telecommunication infrastructure; shortage of technical staff; the poor readiness of students and faculty members; government policies; and financial matters” are challenges which, if not addressed, cannot ensure the sustainability of e-learning systems in universities.

The purpose of this study is to explore the trends and practices, the challenges and the best practices of e-learning in higher education. Furthermore, the effectiveness of this technological innovation as a tool for teaching and learning will be determined. The overall aim is to determine the challenges that lecturers and students at DUT experience with e-learning. The results derived from an analysis of the data obtained from the lecturers and the students will inform the development of possible strategies to overcome these challenges and produce a framework for the successful implementation of e-learning in higher education, especially at DUT.

This research study therefore revolves around a case study method. Furthermore, a quantitative methodology consisting of descriptive and inferential statistics produces findings which inform the levels of agreement or disagreement with the hypotheses. Chapter 4 allows for a detailed analysis of the survey results, with Chapter 5 presenting the findings and interpretation of the results. The surveys conducted were informed by numerous literary findings from a range of academic journals, books, policy documents, legislations and e-books on teaching and learning, higher education and e-learning as documented in Chapters 2 and 3.

This chapter therefore sets out the context of the study. It mentions the role of e-learning in higher education and gives an overview of the challenges and the techniques employed for data collection, justifying the purpose of the study. It also sets out the rationale for the study, the problem statement, aim and objectives, research questions and overall structure of the thesis.

### 1.2 Context of the Study

Educational institutions are investing in technology for learning and teaching in a variety of disciplines. However, technological advancements in transforming higher education are coupled with underlying pressures and opportunities (Gumport and Chun 2000: 20). The authors advocate that the impact thereof will nonetheless depend on institutional willingness and individual actors, their resources, professional interests and specific locations. Apart from adapting to a technologically based education platform, access to devices; training; infrastructure; organisational support; organisational policies; geographic origins of students; student and teacher characteristics; and curricula play a pivotal role in the slow migration to digital technology for higher education. South Africa is still considered a developing country in terms of the access that the population has to its technological infrastructure. Lembani *et al.* (2019: 70) iterate that only a relatively small portion of the country's population enjoys technological access (22%), as compared to developed countries such as the United Kingdom, which provides technological access to 92% of its population, and the United States of America, with access for 89% of its population.

Such challenges posed by technology usage in higher education institutions in developing countries need to be addressed in order to make technology a successful tool for the purposes of teaching and learning. Lembani *et al.* (2019: 71) state that, owing to South Africa's digital inequalities relating to access to technology, there needs to be a more critical understanding of digital equity for learning with technology. The authors (2019: 82) also emphasise the fact that South Africa, as a developing country, is less technologically advanced, with a Gross National Income (GNI) of $1,035 billion, as compared to its developed counterparts that enjoy a GNI of $12,615 billion. Developing countries have low living standards, a less developed industrial base and a low Human Development Index (HDI) (Lembani *et al.* 2019: 72). This results not only in digital inequalities, but also influences a lack of skills to use digital technologies in a meaningful way. DUT is part of a hierarchical system of HEIs, and is still deemed to be a developing university, attempting to resolve the under-preparedness of students and improve academic development (Leibowitz *et al.* 2015: 317). The integration of technology into its everyday curriculum will prove challenging, especially in its efforts to reform and re-define itself and its purpose within the higher education scope.

Geographical locations also impede or promote inclusive and equitable access to technology for learning, which can be further aggravated by the lack of owning technological devices. Mashile and Pretorius (2003) posit that challenges such as students not having access to digital technology and such devices are often those associated with a low socio-economic status, poverty, unemployment and geographic isolation, thus making the acceptance of e-learning a “bitter-sweet” expectation.

The challenges of teaching with technology emanate from a range of barriers which include a lack of access to resources, resistance to change and negative attitudes (Mashile and Pretorius 2003: 132-139; Wheeler and John 2008). The acceptance of technology in the educational ambit and its success require efforts by reluctant lecturers and managers to integrate digital technology into the curriculum and the lecture room.

Although lecturers are expected to successfully engage with technology for “content delivery, reinforcement of students’ skills, complementing the curriculum and transformation – experimenting, implementing and refining new approaches to teaching-learning” (Soomro *et al.* 2020: 3), there are certain factors which inhibit their full acceptance of using technology as a tool for teaching. Al-Hunaiyyan *et al.* (2016: 91) confirm that limited resources and the lack of qualified teaching staff and their lack of training impose significant hurdles in ensuring the success of teaching with technology.

There is no doubt that with the proper planning, design and implementation of online learning activities, there can be effective learning which contributes to student performance. Hussain, Wang and Rahim (2013: 4) believe that “online learning activities facilitate more effective education and offer significant benefits over traditional methods”. However, not all students enjoy the same privileges of access and digital knowledge. It cannot be taken for granted that a “one-size-fits-all” policy for integrating technology into learning will have the same results for all students, especially in a developing country like South Africa (Lembani *et al.* 2019: 81). The author advocates that digital inequalities create a gap for learning with technology and contribute to "same course, different access" challenges.

Figure 1 below indicates the three areas that cover the range of challenges which have justified the need to conduct this study. The reluctance and readiness to engage in technology for their teaching practices is an indication of teaching staff and their perceptions of whether or not technology makes their jobs easier and more innovative (Stigler and Givven 2017: 84; Chimbo and Tekere 2014: 68). Student readiness, or the lack thereof, apart from access, is a key indication of the acceptance of acknowledging a digitally-inclined learning culture (Al-Kurdi, Alshurideh and Salloum 2020: 6491). The implementation of e-learning systems is changing the higher education landscape and HEIs are expected to be at the forefront. HEIs must adapt and respond, and a refusal to acknowledge the change or resultant failures could make them redundant (Ramraj and Marimuthu 2020: 36).


**Figure 1.1: Challenges in e-learning- 3 Notable areas**

*Source*: Unknown

Consequently, whether or not e-learning succeeds will depend on certain strategic dimensions such as vision and philosophy, curriculum, professional development, learning support, infrastructure, policy and institutional structure, partnerships and research and evaluation (Lim and Wang 2017: 3-4).

In the context of e-learning and higher education, it is fundamental to explore the strategies to address the challenges and gaps presented, especially if the tremendous benefits and potential of e-learning technology are to greatly impact on its sustainability as a medium for teaching and learning at HEIs. Hence, there is an urgent need to investigate the current challenges posed by incorporating technology into teaching and learning at HEIs, as well as the potential strategies to overcome these challenges to create a coherent teaching and learning environment for all, irrespective of social, economic and geographical standing.

This chapter therefore sets the stage for the exploration by the study on academic development through the use of e-learning technologies in higher education and the challenges and best practices of the use of e-learning for teaching and learning.

### 1.3 The Role of e-Learning in Higher Education

E-learning refers to the use of technology to support teaching and learning via numerous types of media that deliver text, audio, images, animation and streaming video (Nichols 2007: 8; Durban University of Technology 2016: 7). The authors confirm that e-learning can also include technology applications which provide for audio or video tape; satellite TV services; CD-ROM; and computer-based learning, and can include local intranet/extranet and web-based learning. Further platforms that students are engaging in for e-learning not only filter from the LMS, but include the use of Skype, WhatsApp, Zoom and Facebook which has infiltrated the e-learning dimension (Majanja 2020: 319). E-learning has now become a more interactive tool, facilitating synchronous and asynchronous approaches to teaching and learning in HEIs (Durban University of Technology 2016: 6-7). The role of e-learning at HEIs encompasses the use of virtual classrooms for the online delivery of modules, using a blended method approach or a mixed mode of technology and face-to-face delivery (Durban University of Technology 2016: 7).

Hence, the approaches to e-learning include a combination of face-to-face teaching and the use of technology (blended learning), to virtual classrooms where students are not in an actual classroom but find a similar learning environment through the use of technology, to a flipped classroom where students can access the course content in their own time (for example, watching a recorded lecture at home) and then applying their knowledge or engaging in interactive work in class (DUT E-learning Fact Sheet 2014: 1).

E-learning is a powerful tool in education, with its immense impact on basic educational processes such as the transferability of learning and acquisition of skills. Majanja (2020: 319) states that E-learning in higher education creates positive motivation for learning, improves the quality of learning and improves assessment practices. According to Elhaty *et al.* (2020: 2866), e-learning provides a means to communicate knowledge and achieve the pre-set goals of education. The authors further suggest that e-learning ensures the readiness of students to meet the requirements of working life, a dependence that now exists in one way or another in information technology and its rapidly changing nature.

### 1.4 Challenges with the adoption of technology in Higher Education

More than twenty years after achieving its democracy, South Africa is now in the race to compete globally with developed countries. Not only does this country compete on an international basis for scarce skills, finances, infrastructure, business acquisitions and worldwide monopoly, but advancements in technology and innovative knowledge, have also become priority (Lembani *et al.* 2017: 71).

With the notion of a country (South Africa) still trying to rise above an apartheid legacy, it must be acknowledged that a gap exists between demographics and regions that have access to modern ICTs, and those that are less privileged and do not have access or have restricted access (Lembani *et al.* 2019: 72).

However, there are many variables that pose challenges which weigh heavily on implementing technology in education. Sife, Lwoga, and Sanga (2007: 63-64) have identified these variables. The authors believe that institutions want to embrace the integration of technology into higher education but do not have clear plans to guide the way. The authors further argue that the competing interests of all stakeholders in the institution should be considered when implementing technological changes. Stakeholders in an institution need to be aware of the current technology available. Lack of awareness steers a negative attitude towards technological advancements. Many institutions fail to transform their teaching and learning processes with the aid of technology. Instead, they replicate these processes. Brew (2006: 21) highlights the process of teaching, i.e. planning, implementation, evaluation and revision of project work, assignments, practical work and tutorials, as merely transferring knowledge and not allowing for active participation by students through technology. The acquisition of knowledge, the ability to "commit to memory", as well as processing and organizing, are those learning processes which are influenced by the use of technology, if applied correctly (Vermunt and Donche 2017: 272).

Lembani *et al.* (2019: 72) believe that the constraints in adopting technology in higher education are brought about by material (ownership of technologies), cognitive (literacy knowledge and skills) and social (social standing) resources. The lack of these resources contributes largely to the lack of digital equity. The other dominant factors that inhibit technology adoption in HEIs focus not only on the technology itself, but on the students' and lecturers' attitudes and interactions with technology (Al-Fraihat *et al.* 2020: 68).

For successful teaching and learning with technology, it is imperative that those factors which constrain the successful implementation of e-learning be reviewed and corrected, providing for quality systems and improved learning and teaching practices.

### 1.4.1 A glance at the challenges of e-learning

Converting conventional learning material to an e-learning platform will require minimum essentials for e-learning. E-learning has revolutionised the education sector, forcing academics to "re-think the education systems and techniques of imparting knowledge and being open-minded to incorporating technology-driven education" for effective pedagogical transformation (Ramraj and Marimuthu 2019: 39). However, unreliable technology; technical issues for both teachers and students; time and commitment to training in e-learning; resistance to change; and adapting to new teaching approaches are just a few challenges in this process (Al-Hunaiyyan *et al.* 2016: 91).

While some teachers will be less eager to adopt e-learning to support their teaching as they find it difficult to adapt to change, others question the benefits of e-learning in relation to conventional teaching (Buchanan, Sainter and Saunders 2013: 8). Staff who are already established in an organisation's teaching environment may find it difficult to adapt to new teaching approaches and hence display their reluctance due to the lack of skills and knowledge in using technological tools (Moonsamy and Govender 2018: 3071). Although lecturing staff may reveal their acceptance of technologically inclined curricula, some still do not engage as comfortably with technology. Soomro *et al.* (2020: 3) postulate that further inhibitions are forced through the lack of proper infrastructure at HEIs to engage with technology and/or even the lack of access to technological devices. Without the proper institutional support and proper investment by HEIs, teaching staff are more inclined to resist any efforts to engage with new methods of teaching.

On the other hand, students who are part of the e-learning environment need to master the course's subject material and have the necessary technical skills. However, owing to South Africa's digital inequalities in accessing technology for education, as cited by Lembani *et al.* (2017: 71), it is critical to assess student access for e-learning. The authors state further that having "meaningful access" also implies a serene location for students to effectively and conveniently use technology for learning. In as much as having *access* to technology is important, it is not feasible if students are unable to *use* the technology. Olutola and Olatye (2015: 303) caution that students who are not trained, or do not have the necessary skills and knowledge in using technological devices, do not experience the full benefits of e-learning. Although technology has been deemed to improve student output, many students experience difficulty with not interacting with their lecturers in a face-to-face environment. The lack of human contact between students and lecturers; students and their peers; and students and their learning materials impedes successful engagement in e-learning environments (Britto, Murugeson and Subramanian 2016: 94). Moreover, learning with technology also distracts weaker students. Selwyn (2016: 1011) explains that students are distracted by social media and other entertaining content, thus procrastinating in completing academic tasks. A lack of interactive learning material can also create a certain amount of disinterest in students who crave creative, collaborative, participatory and connected learning materials (Selwyn 2016: 1013). Gillet-Swan (2017: 27) states that, apart from e-learning contributing to a lack of interest in academic activities, e-learning does not allow for the practical side of learning that is imperative for enhancing problem-solving skills. Inadequate technological infrastructure and technical resources, a non-conducive environment and the lack of technical support creates an array of challenges for students wanting to engage in e-learning activities.

Hence, the uptake of e-learning in HEIs is dependent on whether the challenges experienced by lecturers and students can be resolved.

### 1.5 Rationale for the study

Higher education institutions (HEIs) which were previously known as technikons have only recently been awarded the title of "Universities of Technology" (UoTs) and these institutions are still harnessing the idea of using technology for teaching and learning (Kruss and Visser 2017: 894, Perumal 2010: 68). Thus, UoTs are still developing in terms of the use of technology for teaching and learning.

According to Allen and Seaman (2015: 21), the need to integrate the use of technology in higher education is now increasing at a rapid rate. This has been further compounded by the repercussions of the Covid-19 pandemic. Although this study is not a result of the impact of Covid-19, the emphasis on a technologically inclined educational system was already being explored by the researcher. The idea to research the e-learning phenomenon was not necessarily derived only from formal scholarly literature, but also from the researcher’s everyday experiences and occupation. In her role as an IT Service Desk Administrator within the Information and Technology Support Services Department at DUT, the area of interest was sparked by the daily calls received by staff and students on challenges experienced with e-learning and the associated technologies. These challenges are significant as they impact on how lecturers plan, prepare and deliver their curricula, as well as assess and monitor student progress using technological tools. The challenges inflicted on the student population surface not only from the ownership or access to devices, but are deep-seated within the socio-economic circumstances, language barriers and the under-preparedness of students entering tertiary institutions.

The delivery of higher education curricula through the use of technology, was a fairly general practice prior to the Covid-19 era. Staff and students who were reluctant to adapt to such technology or who encountered challenges in using technology for teaching and learning, were certainly disadvantaged by not obtaining the full benefit of the higher education teaching and learning experience. Hence, there was a need to determine the challenges that lecturers and students at DUT experienced with e-learning. In identifying these challenges, it is then possible to develop and implement possible strategies to overcome these challenges. The data obtained from the lecturers and the students will inform the development of such possible strategies. Dhawan (2020: 17) recognises these challenges and argues further that the inability to overcome these challenges may further perpetuate the digital divide for those students who are less affluent and less tech-savvy, while lecturers will continue their habitual traditional teaching methods.

To further understand how technology impacted on lecturers and students, the researcher had to explore the higher education sector first in order to understand the teaching and learning environment, before investigating the implications of a technology-driven educational system.

Although HEIs (such as UoTs) engage in feverishly trying to implement technologies such as e-learning for improving educational opportunities and embrace the concepts of greater personal development for staff and students, there has to be an investigation into the current reality of how lecturers and students perceive and experience e-learning. As mentioned in the challenges listed above, the expectation is to transform students into digital students, but the inhibiting factors need to be addressed. The teaching fraternity is also plagued by the many challenges of embracing technology as a tool. Consequently, these challenges need to be addressed before this fraternity can be expected to deliver a digital curriculum (Al-Hunaiyyan *et al.* 2016: 91).

It is envisaged that, based on the findings of this study and the assessment of e-learning in higher education, recommendations on closing the gap in teaching and learning challenges brought forth by e-learning technologies will be submitted to relevant owners and users of e-learning, thus creating a more feasible e-learning environment.

As much as HEIs are focussed on building sustainable student communities of living and learning, deep-seated challenges need to be dealt with. This study aims to highlight the implications of the use of technology in higher education; the challenges and best practices of using technology for teaching and learning; and to then explore such challenges at the case study institution (DUT). Through the research findings and an informative framework illustrating an array of intervention strategies, the institution may be in a better position, enabled to address the challenges and utilise technology as an innovative tool for teaching and learning.

### 1.6 Research problem

Sife *et al.* (2007: 63) iterate that emerging and evolving technologies for teaching and learning at HEIs are creating overwhelming concerns as stakeholders grapple with engaging with these technologies. The challenges identified in pursuing online learning, or e-learning, contribute to negative perceptions and reluctance to accept and engage with this newly developed method of teaching and learning by lecturers and students. The gap created by the lack of physical access to various ICTs, coupled with not being equipped with the necessary digital skills, is an area to be seriously considered by HEIs wanting to implement successful e-learning (Soomro *et al.* 2020: 3). It is therefore necessary to explore the effectiveness of e-learning as a tool and importantly, to assess how best the current trends and practices inform the delivery of a digital curriculum. The assessment of the most feasible strategies for the implementation of successful e-learning is crucial in contributing towards alleviating some of the challenges identified. As mentioned already, the Covid-19 pandemic has ushered in e-learning at an alarming pace. It has therefore become crucial for these challenges to be eradicated.

#### 1.6.1 Problem statement

The purpose of this study is therefore to assess the impact of e-learning in higher education and to ascertain the challenges hindering the development of lecturers and students in accepting and engaging with digital pedagogy. The study therefore investigates possible intervention strategies applicable to the successful implementation of e-learning.

### 1.7 Research aim and objectives

The aim of the study was to investigate the challenges and best practices in the use of e-learning technologies for teaching and learning at UoTs, with specific reference to DUT.

In order to achieve the above aim, the following objectives had to be addressed: -

- To explore the practices and trends in the use of e-learning technologies for teaching and learning in higher education, particularly at UoTs (through a review of related literature);
- To investigate the effectiveness of using e-learning technologies in teaching and learning in higher education (through a review of related literature);
- To ascertain e-learning practices and trends in the use of e-learning technologies for teaching and learning at DUT;
- To determine the challenges encountered in the use of e-learning technologies for teaching and learning at DUT;
- To determine the most feasible strategies to address the challenges with e-learning technologies in teaching and learning at DUT; and
- To develop a suitable framework to address challenges in respect of e-learning technologies for teaching and learning and the best-practices that could be applicable in higher education.

### 1.8 Research questions guiding the study

1. What are the current practices and trends in the use of e-learning technologies forteaching and learning in HEIs, especially at UOTs?
2. Is the use of e-learning technologies effective for teaching and learning at HEIs?
3. What are the e-learning practices and trends in the use of e-learning technologies for teaching and learning at DUT?
4. What challenges are experienced by lecturers and students at DUT in using e-learning technology for teaching and learning?

5. What possible strategies can be developed to overcome the challenges experienced in the use of e-learning technologies by lecturers and students of DUT?
6. What best practices may be deemed a perfect fit for teaching and learning with e-learning technologies?

### 1.9 Hypotheses

Based on the research objectives and the review of related literature, the research hypotheses below were developed to guide the study.

The null hypothesis states that: -

**Ho1:** The lack of skills/knowledge/engagement in the use of technology does not play a significant role in contributing to rigid teaching practices;

The alternative hypothesis states that:

**H1:** The lack of skills/knowledge/engagement in the use of technology plays a significant role in contributing to rigid teaching practices;

The null hypothesis states that: -

**Ho2:** Challenges in integrating technology into teaching practices do not play a significant role in contributing to the lack of skills/knowledge/engagement in the use of technology;

The alternative hypothesis states that:

**H2:** Challenges in integrating technology into teaching practices play a significant role in contributing to the lack of skills/knowledge/engagement in the use of technology; and

The null hypothesis states that: -

**Ho3:** Best practices in staff development do not play a role in contributing to more effective teaching practices through the use of technology.

The alternative hypothesis states that:

**H3:** Best practices in staff development play a role in contributing to more effective teaching practices through the use of technology.

### 1.10 Research Methodology

In order to address the aims and objectives of the study, an empirical study was justifiable. A quantitative methodology of enquiry was conducted, with data collected from both lecturers and students of DUT via questionnaires. The questionnaires were developed by the researcher, taking into account the relevant literature reviewed. The survey was administered to 220 full–time teaching staff, identified through the systematic sampling technique; whilst 375 full-time students (Levels 1-3) from all six faculties on the Durban campuses were selected via a convenience sampling technique. The data collection process commenced in November 2019. However due to the impact of the Covid-19 pandemic, administering the surveys was hampered. The researcher had to reach out to survey participants via social media and email as the institution was forced into lock-down.

The data collected was analysed using the SPSS statistical package and interpreted using descriptive and inferential statistical techniques.

### 1.11 Delimitations of the study

The study was limited to DUT's full-time teaching staff and full-time 1$^{st}$, 2$^{nd}$ and 3$^{rd}$ year students.

The researcher believed that the full-time teaching staff were familiar with the operations of the institution and the institutional requirements for teaching and learning and would provide relevant responses accordingly. The researcher limited the study to full-time students as the assumption was that most part-time students are already employed and are familiar with working with technologies. The scope of the study was to assess the impact of the (lack of) experiences and challenges of learning with technologies on full-time students.

At the initial stages of the study, the researcher intended to administer surveys to the students personally. Students from the Pietermaritzburg and Indumiso campuses of DUT were therefore not selected as part of the population as it would have been difficult for the researcher to co-ordinate data collection at these distant campuses.

The researcher limited the study to DUT, as an institution of higher education within South Africa.

**1.12 Structure of thesis**

**Chapter 1 – Introduction**

The introduction provides an overview of the study, focussing on the problem statement and the significance of the study. The aims and objectives are also set out while examining the role of technology in higher education; its challenges for teaching and learning; and more especially, e-learning and its impact on the higher education environment.

**Chapter 2: Literature Review A**

Chapter Two is divided into three parts and provides a literary foundation for understanding the use of technology in higher education and its impact on teaching and learning.

- **Part A: Technology for Higher Education**

The focus is on the history of higher education in South with particular reference to apartheid, the role of HEIs and the emergence of UOTs. The role of technologies and e-learning for HEIs is also highlighted.

- **Part B: Teaching and learning in Higher Education**

Literature discussed in Part B provides an understanding on the paradigms of teaching and learning in HEIs. Existing challenges are highlighted, along with remedies that can be provided by introducing technology to teaching and learning practices.

- **Part C: The use of e-learning in teaching and learning in Higher Education**

The use and significance of e-learning in teaching and learning in higher education are presented in Part C. Discussions in Part C also focus on the effectiveness and benefits of incorporating digital technologies into teaching and learning practices.

**Chapter 3 – Literature Review B**

Chapter 3 provides an in-depth review on the use of e-learning technologies at UOTs. This chapter discusses in detail the challenges and best practices of e-learning for teaching and learning at HEIs.

Chapter 3 also discusses how the use of technology as a tool for teaching and learning was further enforced when countries around the world were forced to shut down educational institutions and businesses due to the global Covid-19 pandemic. Technology enhanced interactions became the "new-normal" in the various aspects of life.

**Chapter 4 – Research Methodology**

The fourth chapter focusses on the research methodology adopted for this study, with particular reference to the research design, target population and sampling, as well as data analysis and interpretation as collected and collated from the data sources.

**Chapter 5 – Analysis and interpretation of results and discussion of findings**

Chapter Five provides for an in-depth analysis of the descriptive and inferential statistics, demonstrating the findings and results of the lecturer and student surveys.

**Chapter 6 - Summary of findings, conclusions and recommendations**

Based on the findings of the study, Chapter Six provides recommendations on addressing the challenges of teaching and learning with e-learning in DUT. A framework illustrating intervention strategies to overcome these challenges, as well as an implementation plan for successful e-learning initiatives, concludes the study.

### 1.13 Outline of the Study

Figure 1.2 below sets out the outline of the study.

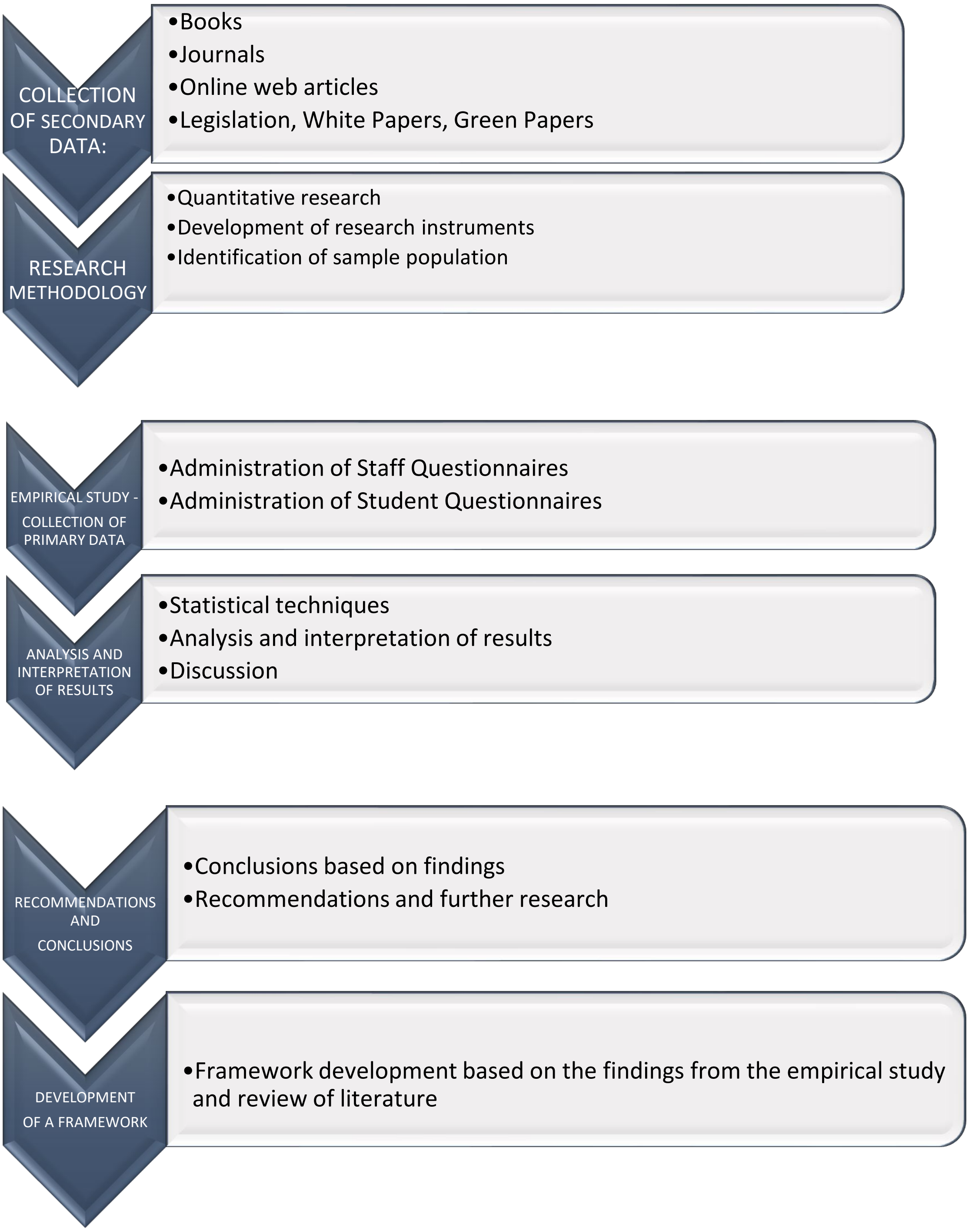


**Figure 1.2 Outline of the Study**

### 1.14 Conclusion

This chapter provided an overview of the study. The purpose of the study is to explore the impact of e-learning on teaching and learning in HEIs, especially at DUT. In addition to assessing the challenges of e-learning experienced by lecturers and students, the researcher will provide an insight into the many recommendations which could be adhered to, to alleviate the burdens imposed by lack of knowledge, skills and access of technology in education. Further, the study will attempt to provide possible intervention strategies that could be implemented to counteract the multitude of challenges experienced by students and lecturers in the use of technology in education.

The next chapter identifies the role of technology in higher education as well as the concepts of teaching and learning in higher education. The use of e-learning in teaching and learning in HEIs is also discussed in Chapter 2.

# CHAPTER 2: LITERATURE REVIEW

## E-LEARNING TECHNOLOGY AND TEACHING AND LEARNING AT HIGHER EDUCATION INSTITUTIONS

### 2.1 Introduction

The objectives of the study, as set out in Chapter One, lend focus to the impact of e-learning technologies on the teaching and learning practices of HEIs, as well as identifying the challenges and best-practices of e-learning. The integration of technology into curricula is a means of enhancing and providing quality education, where students are encouraged to be highly competent in technology-rich educational environments (Lim *et al.* 2017: 3). Lecturers who keep abreast with evolving technologies are key in making instruction accessible, creating new efficiencies and driving better student outcomes (Ramraj and Marimuthu 2019: 35).

However, in order to understand the impact of technology on teaching and learning outcomes within HEIs, more especially at DUT, it is necessary to firstly gain a perspective of how technology is perceived by some of the HEIs in other countries. It is also imperative to gain insight into and understand the role of teaching and learning at HEIs. With online platforms growing continuously, the impact of e-learning, its definition and effectiveness, must be analysed and assessed for effective curriculum delivery.

This chapter is therefore divided into three parts which provide an intricate discussion from the literature reviewed on the role of technology in higher education; the concepts of teaching and learning in higher education; and the use of e-learning for teaching and learning in higher education.

### 2.2 Part A: Technology for higher education

This section provides an insight into the role of technology for higher education. It also defines HEIs and UoTs within the South African context.

Technology in education and online platforms for teaching and learning are accelerating at an unfathomable speed and is being used to transform the different areas of education as compared to traditional educational methods (Ramraj and Marimuthu 2019: 36). The impact of this technology acceleration was already at a rapid pace over two decades ago, in 1996, when Apteker and Ord (1999) published “Do you love IT in the mornings?” Their writings covered an array of topics on how technology and the internet changed the dimensions of living. The authors (Apteker and Ord 1999: 99) concluded:

> “Everything online is a mouse click away. The internet allows you to explore new things which, before you got connected, were always too far away”.

Furthermore, the integration of technology in education is also increasing at a rapid rate. HEIs are implementing technologies to improve educational opportunities, ensure greater personal development and provide access to social networking for their students. Twenty years later, Perumal (2010: 77) reiterated that technology is extensive in academia, enabling students to “simulate, visualize, model and experiment with complex, real-world scientific problems”. The author also points out that technology in education promotes “exploratory land inquiry-based modes of learning”, thus enabling collaboration and interactive learning (2010: 78). The year 2020 saw the greatest acceleration of technology in education, with e-learning being mainstream, mainly due to the profound impact of the Covid-19 pandemic. E-learning became a mandatory component in educational institutions, with face-to-face education becoming almost non-existent (Radha *et al.* 2020:1088).

Generations Y (millennials) and Z (centennials) enjoy constant and diverse interactions with technology since early childhood. Kuleto, Ilic, Stanescu, Rankovic, Sevi, Paun and Teodorescu (2021: 1) believe that these generations are attracted to e-learning and reformed curriculum through the use of devices and virtual engagements. The authors argue that using technological resources increases the attractiveness of studying at an HEI, considering the decline in those who actually pursue a higher education qualification (2021: 2).

### 2.2.1 The role of technology in education in other parts of the world

This study will focus on the concept of e-learning and its impetus towards a transformative higher education pedagogy within a South African context. It will assess the impact of e-learning in higher education and determine the teaching and learning challenges of this technology application at the case study institution, the Durban University of Technology (DUT). However, before ascertaining the influence of e-learning in South African higher education institutions and DUT, it would be of interest to assess how some of the other countries engage with the concept of e-learning technologies in higher education, and the challenges and best-practices of the use of e-learning technologies for teaching and learning needs to be acknowledged. For this reason, mention is made of some of the countries in other parts of the world focussing on technology in education, more especially the impact of e-learning on teaching and learning.

#### 2.2.1.1 Technology in some international HEIs

According to Zhang (2015: 212), the world-wide-web or internet usage offers access to students to economic (financial resources), social (relationships and networks) and cultural (knowledge and dispositions) capital to achieve educational, career and social status. The author avers that, a decade ago, 98% of American public schools were already linked to network technologies. Trelease (2016: 583) also believes that since the inception of the world-wide web in the mid-1990s, contemporary education and research have been enhanced with multimedia networking technology. The author further elaborates that in recent times, technologies such as digital video, structural simulations and mobile devices are being adopted in educational practices (2016: 583).

Reif (2013: 44) commented that technology has the ability to make higher education cheaper and better. The author adds that learning with technology has proven advantageous for students at the Massachusetts Institute of Technology (MIT). Students in every state in the United States of America are indulging in online courses. The author elaborates further that students have access to the best educational resources, with the immediate practice, feedback and reinforcement of learning materials. This type of education also provides the flexibility of students engaging in learning, anytime, any day and as often as needed.

Allen and Seaman (2015: 21) tracked the trends of technology in education in the United States HEIs. Online learning has provided millions of potential students with access to higher education and there is clearly a demand for this type of learning irrespective of time or geographic constraints. The results of their study show evidence that HEIs that incorporate technology into their curricula have increased from 48.8% in 2002 to 70.8% in 2015. These institutions believe that technology incorporation is critical to their long-term strategies.

Amongst 10 universities in Tanzania, the University of Dar es Salaam (UDSM) and Sokoine University of Agriculture (SUA) implemented an e-learning platform, whilst Mzumbe University and the Open University of Tanzania (OUT) possessed facilities which formed the basis for the establishment of e-learning platforms. The latter institutions have included Information Technology Strategies to provide education, especially to those who work full time or have household commitments (Sife, Lwoga and Sanga, 2007: 62).

Studies carried out in G. Venkataswamy Naidu College in India by Jeyabharathi and Santhanalakshmi (2016: 38) show that students have positive perceptions of technology-enhanced learning as it encourages them to engage in deeper forms of learning. The findings of the study indicated that 97 % of students perceived technology-enhanced learning as an appropriate method for quality education, while perceptions of traditional learning methods were acceptable to just a few respondents. The authors conclude that students are more attracted to technology for learning purposes as it provides informative and functional attributes for better educational value. Complementing these findings, Priya's (2016: 173) broad spectrum study on technology and e-learning in India has further indicated that the adoption of technology in some institutions has increased faculty and student access to information, providing for a rich collaborative environment, thus improving academic standards.

As much as it is necessary to gain insight into how technology enhances the educational environment, it is also necessary to pay attention to behaviour and attitudes towards technology integration. Kirkup and Kirkwood (2005: 185-189) studied the acceptance of ICT at the UK Open University (UKOU). The authors concluded that not many were resistant to using technology integrated curricula, but practise lead to using technology to improve and support existing practices. However, the process of change or adopting new technologies will guide users of technology to re-think their practices, which will eventually lead to change in teaching and learning. With 95% of HEIs in the United Kingdom adopting technology for education, the focus has been transferred from the adoption, usability and course contents to student attitudes and students' characteristics in using such technology (Al-Fraihat *et al.* 2020: 68).

According to Ali *et al.* (2018: 60), the education system in Lebanon has mandated e-learning in higher education as the system for teaching and learning, thus replacing traditional methods for both students and lecturers. Based on this, the authors investigated e-learning in the HEIs of Karachi (Pakistan) in order to analyse the acceptance of e-learning as they believe that e-learning is still in its infancy in Pakistan. Their findings proved favourable in terms of e-learning as a teaching and learning tool – students looked forward to using the user-friendly applications, which saved time and cost. However, the authors also emphasise that "the use of an e-learning system will be meaningless if the policy-makers fail to develop a positive perception of this system amongst students" (2018: 68). It is imperative for HEIs to develop their education systems for technology-enhanced learning by also focussing on HEIs worldwide which have already obtained success via technology and success in implementing e-learning for teaching and learning. Jeyabharathi and Santhanalakshmi (2016: 36) believe that "active learning, critical thinking, problem solving skills, communication skills, information handling skills and self-directed learning are referred to as twenty-first century skills".

Whilst focussing on teaching and learning and technology within the higher education sector, it is also important to recognise the concept of "higher education" and more specifically, higher education in South Africa.

### 2.2.2. Higher Education Institutions and UoTs

The discussion below entails an overview of the higher education environment in South Africa, with particular reference to the role of apartheid and its impact on the education system. The culmination of technikons into the emergence of UoTs is also discussed, with the emphasis of technology at the fore.

#### 2.2.2.1 Higher education in South Africa

Fisher and Scott (2010: 1) believe that higher education in South Africa had a "uniquely important role" in producing qualified graduates and post-graduates, thus resolving the persistent skills shortages that plague the nation. The authors add that enhanced education and skills levels increase workforce productivity; uplifts the innovative capacity of the economy; and facilitates the absorption and diffusion of new technology. A combination of these factors leads to economic growth, not only in South Africa, but globally as well.

However, Shay (2015: 434) states that although South Africa has gained from the post-apartheid evolution, the education system is still plagued with "very poor educational performance". Although there have been initiatives to reform higher education, the overall participation rate by Black students has been low. Black students make up a majority of the student population. Although enrolments have increased significantly, retention rates are on the decline.

Contextually, it is important to understand the era of apartheid and the impact it had on the South African education system.

#### 2.2.2.2 Apartheid and its impact on South African education

South Africa, two decades after achieving its democracy, is now in the race to compete globally with developed countries. South Africa is however still haunted by the inequalities of the apartheid era, which left the country crippled in many ways. Singh (2004: 5) states that the apartheid legacy of South Africa promoted separate development, thus providing inferior education and limited or no access to learning opportunities for non-whites.

Clark and Worger (2016: 3) define apartheid as "…literally 'apartness' or separateness in the Afrikaans and Dutch languages, the name that was given to a policy of separating people by race with regard to where they lived, where they went to school, where they worked and where they died". This blasphemous trait of South Africa impeded all aspects of living, including the education systems.

In the 1980s, higher education in South Africa, under the auspices of the National Party, became racially fragmented. The government put into place tactics to prevent institutions designated for the use of one race group from admitting students from other races (Bunting 2006: 37; Perumal 2010: 1; Bozalek and Boughey 2012: 691). Besides this distinction, the government then created two types of institutions, i.e. universities and technikons. The essence of universities was 'science' and the essence of technikons was 'technology'. 'Science' designated all scholarly activities, whilst 'technology' focussed on the application of knowledge (Bunting 2006: 37).

According to Leibowitz *et al.* (2015: 317), the South African higher education system is hierarchical. Research intensive universities occupy the highest level, while comprehensive universities focus on mass education, with the UoTs embracing technology-based qualifications. The author maintains that the apartheid regime led to universities trying to re-define themselves, their purpose and their identities.

Apartheid tainted not only the quality of education, but also the quality of teaching due to lower levels of staff morale and commitment to teaching (Leibowitz *et al.* 2015: 317). Boughey (2010: 4) pointed out that there has been challenges in determining whether it was actually the "under-preparedness" of black students (lack of skills, conceptual background and language proficiency) or the inability of higher education institutions (academic development, or the lack thereof) that proved problematic in the delivery of education.

Before determining whether it is the calibre of students, the policies and processes of HEIs or the ability of academics which will determine how pedagogy results in successful empowerment, it is imperative to look at the role that HEIs play in the South African context.

**2.2.2.3 The role of Higher Education Institutions in South Africa**

HEIs in South Africa embody a diverse student population consisting of all race groups and social economic statuses. Mzangwa (2019: 4) states that the Council on Higher Education (CHE) embarked on transforming the unequal standards of education by transforming and bringing about developments and changes to HEIs in South Africa. The author further states that the role of HEIs in South Africa is to ensure social justice and mobility as they are transformational agents which offer advanced qualifications in discipline-specific fields.

According to Maassen and Cloete (2006: 8), historically, the role of HEIs in South Africa focussed on ridding higher education of apartheid tendencies and also focussed on reviving higher education with international experiences and best-practices. However, not many in academia seemed to have paid attention to the rapidly growing international practices, with a lack of intellectual capacity in South African higher education. In their investigation of higher education in South Africa, Filho *et al.* (2018: 293) state that although HEIs have transformed, many have to embrace the concept of sustainability by taking cognisance of global issues pertaining to sustainability to promote educational initiatives. The authors add that assessing how international institutions thrive and become sustainable can be a learning curve for HEIs in South Africa. However, not only has it been difficult to deal with post-apartheid concerns, HEIs were expected to transform and reform structures and activities to fit into a new landscape of higher education as promulgated by the government.

Some technikons converted to Universities of Technology (UoTs), whilst others merged with universities, transforming into Comprehensive Universities. The traditional university also existed (Bozalek and Boughey 2012: 696). However, comprehensive universities lacked a clear identity, with a struggle to define their role; whilst UoTs were inclusive of institutions which lacked research initiatives and had virtually no research base or enrolments (Fisher and Scott 2011: 33). By 2004, six out of the 15 technikons remained independent and earned the title of UoT. The functions and roles of UoTs were not clearly defined. However, it was clearly determined that South Africa would have a unitary, although differentiated, higher education system (Mthembu 2011: 186).

UoTs (previous technikons) now had the opportunity and status to offer degree courses. Whether or not the rushed move of technikons into UoTs was feasible, without consideration of emergent practices or learning from mistakes during innovative strategies, was still to be pondered upon. An advantage for such change could be for institutions to reconsider their educational and research undertakings (Perumal 2010: 43-45).

However, the lack of a research tradition, as well as staff that are not as skilled or qualified as the more prestigious institutions, brings about an environment that enabled some institutions to advance higher than others did (Bozalek and Boughey 2012: 696). Therefore, as much as institutions earned the status of offering degree-based courses, the research ethos, the ability to bring in income and produce a higher throughput rate needs to be remedied. Such inadequacies affect the teaching and learning ambit of institutions.

How and why then was there a need to create UoTs? Do UoTs contribute to success rates in higher education? Has industry inherited from UoTs the calibre of students that will enhance their business prospects?

#### 2.2.2.4 The emergence of UoTs

The birth of UoTs, as discussed above, developed from the foundation that was laid by technikons. Kruss and Visser (2017: 894) state that technikons were tasked with teaching in fields of applied technology. The authors also state that UoTs are challenged by defining their identities and roles and establishing a scientific reputation in an environment currently dominated by research universities. Although the research culture may remain weak, and a strong reliance on government subsidies and tuition fees co-exist with an impoverished student base, UoTs are still rapidly developing national and local reputations in selected technology (Kruss and Visser 2017: 894).

Mentz, Kotze and van der Merwe (2008: 30) ponder the debate that sparked on the existence of UoTs, stating that there is a creation of a new kind of higher education institution. The authors added that this creation was beneficial to technikons as it provided the "much sought after academic legitimacy that comes with the designation of university." Not only are UoTs a new kind of HEI, but the transition of principles, methods and organisation, from functioning in a traditional sphere to now using processes which create value, have marked UoTs as "new generation organisations" (Mthembu 2011: 189). The author further states that new generation organisations are recognised for innovation, psychological stamina and levels of creative insight.

Perumal (2010: 67-68), in his writings on the development of UoTs, focussed on government policy tools (the White Paper on Higher Education 1997 and the National Plan for Higher Education) which outlined the initiatives of the post-apartheid government in transforming higher education in South Africa. The author argues that universities must be portrayed as part of a social system, facilitating the application of knowledge through technology and innovation. Mthembu (2011: 189) agrees that UoTs need to be innovative, and whilst traditional universities educate students intellectually, UoTs are challenged to produce students with intellectual and practical skills which are immediately applicable in the workplace. Thus, the role of UoTs is to create a critical balance between the theoretical and the practical.

Similarly, Perumal (2010: 68) adds that UoTs need to adapt, with curricula being more relevant to the dynamic needs of an ever-evolving society. UoTs have to operate in a changing external landscape, ascertaining their relevance through their learning strategies and learning to cope with many variables and forces. UoTs need to develop curricula that are in accordance to the requirements laid out by business, government and civil society. The primary function of UoTs in a field of research and innovation is to apply already acquired knowledge and produce social and technological innovations which would be beneficial to business and industry (Mthembu 2011: 190).

### 2.2.3 The role of technologies and e-learning in higher education

The world-wide-web, or the internet which is a more familiar term, has revolutionised the way people work, shop, live and play. Livelihoods have become one continuous evolving journey, with technology and technological devices influencing daily life-styles (Parker 2018: 13). Daily developments in the world of technology have produced intriguing devices, making it simple for humans to focus on various aspects of life with the simple touch of a button. Technology is an ever-evolving phenomenon contributing to continuous development in people’s daily interactions (Ramraj and Marimuthu 2019: 35). The birth of one technological development leads to others using it as an advantage to create another with a higher level of sophistication and an increased complexity of applications.

Smith (2015: viii) maintains that although technology is marginal to teaching and research, it was not central. However, over the years, technology is now deemed central to the viability and excellence of every educational institution. Hence, institutions are continually adapting to the dynamic nature of technology.

Therefore, one cannot deny that the internet or technology does play an integral role in education. The introduction of technology in pedagogy was initiated in 1969 when many United States universities established their first electronic connections (Esterhuysen and Stanz 2004: 63). Decades later, just as technology has brought benefits to business, it has provided for research, coursework and support in education. It is thus imperative to give impetus to how technology has evolved before focussing on what technology has provided to pedagogy at a university level.

#### 2.2.3.1 The evolution of technology

Technological advancements in this century can be attributed to the ever-evolving wants and needs of man to make living as comfortable and convenient as it can be. Schwab (as cited by Staunton 2017) mentions how the technological revolution is responsible for how humanity encompasses life. The author posits:

> "[T]the First Industrial Revolution used water and steam power to mechanize production. The Second used electric power to create mass production. The Third used electronics and information technology to automate production. Now a Fourth Industrial Revolution is building on the Third, the digital revolution that has been occurring since the middle of the last century. It is characterized by a fusion of technologies that is blurring the lines between the physical, digital, and biological spheres."

The world is fundamentally changing by the digital revolution, the digital society is growing in terms of learning, living and learning technologically. Apart from everyday living being influenced by the advent of the internet, social media and mobile devices, the field of education also needs to respond to the digital revolution. Education needs to put digital literacies in place with other literacies in courses offered in education (Staunton 2017).

Digital computing and communication technology have revolutionised how people communicate, work, produce, teach and learn. The revolution has diversified and innovated the traditional computer, the traditional mobile phone and the internet. On 6$^{th}$ August 1991, the World Wide Web became available publicly, allowing access to information of various kinds by just the click on a link (Bryant 2011). The author adds that at the beginning of 1950 and continuing to date, there is a conversion of analogue technologies to digital technologies.

Tekic and Koroteev (2019: 685) state that many processes and products underwent conversions in the digital age, enabling the successful representation of “analogue reality through digital signals”, for example, the analogue computer to digital computer; phonograph and gramophone to compact cassette and eventually to compact disk; the VHS to DVD; analogue photography to digital photography; analogue television to digital television; analogue radio to digital radio; analogue mobile phone to digital mobile phone; analogue watch to digital watch; analogue thermometer to digital thermometer; and offset printing to digital printing. The authors add that digital signals have several important advantages over analogue, and are cheaper and more reliable. With the conversion of products and processes, there has been a steady decline in some of the analogue technologies such as the typewriter, the telegram, the fax, the landline phone and the pay-phone (Sife, Lwoga and Sanga 2007: 3; Temitope 2016: 2; Engelbrecht 2003: 20; Ramroop 2003: 17; Kim, Mims and Holmes 2006: 83-88, Amory 2007: 664-665). Many of these processes and products impact the delivery of education. Sife, Lwoga and Sanga (2007: 3) encourage the use of television, DVDs and web-based technologies and video-conferencing, amongst others as these types of technologies provide simulation for self-study, permanent accessibility, speed and links to related topics and up-to-date notes for teaching and learning in higher education.

The Horizon Report (2016: 36) indicates that certain digital technologies have since improved and the four most interactive technology-driven applications/devices in higher education have become practical accessories to students accessing a variety of learning materials online. The authors add that many students are entering lecture halls with their own devices, whilst campuses worldwide encourage and accommodate the use of these mobile devices for teaching and learning by providing access to the institutions' networks. This phenomenon has become largely accepted as BYOD (Bring Your Own Device) (Safar 2018: 2). The authors infer that BYOD enables students to take ownership of their learning activities as they are already familiar with their technological device, be it a laptop, a tablet, a smartphone or a smart watch. Dommet (2018: 80) maintains that the student population now own more internet-capable devices at a mammoth growth of almost 90% ownership. This growth ricochets of the decrease in device price, especially amongst smartphone and laptop devices. Technical ownership also plays a pivotal role in ensuring support for learning activities.

With the discussion of how technology has infiltrated education, it is also imperative to bear in mind that with technological innovations, there are additional impediments to be considered with technology vs pedagogy. Dommet (2018: 80) acknowledges that such challenges exist with respect to software licencing/purchasing. These challenges will be discussed further in the study. Although there may be existing challenges, the ideology of learning with technology can be enhanced with certain devices, which have proven helpful.

Learning with technology has provided higher-quality education. However, Hart *et al.* (2019: 1-2) argue that attention to off-line learning also needs to be considered. The authors posit that students are inclined to procrastinate or those who are not self-directed learners may not perform adequately as they do in off-line learning. The physical presence of a lecturer is non-existent in order to re-direct students' attention. Results of studies conducted by Nicol *et al.* (2018: 259) indicate that students who engage in off-line learning and those who engage with technology for learning, showed minimal differences in their performances. However, the authors concur with Hart *et al* (2019: 1-2) that self-paced and responsible learning is higher in off-line classes, than in the online environment.

The review of literature thus far has shown that the evolution of technology has influenced every part of post-modern activities. Technology is now seen as an agent to support educational transformation (Amory 2007: 656). The discussion below illustrates the various technological devices and their development and use for educational practices in HEIs.

#### 2.2.3.1.1 Digital watches to smart watches

Previously, digital watches were used only to tell the time and date. Watches have now evolved and contain features that exist in other smart technological devices. Digital watches have transformed into smart watches. According to Odegard (2013), students can now send messages to the smart watch from a web interface. Lecturers can access questions from students (which they may be too shy to ask out aloud) and incorporate answers by providing an answer to a general question, rather than to any one particular student. A wearable technological device like the smart watch is becoming increasingly popular, with a world of information readily available and controlled by students, encouraging further mobility (NMC Horizon Report 2016: 36).

#### 2.2.3.1.2 The computer

The desktop computer has been revolutionised into a laptop or tablet form. The 1st computer was invented around the time of the Second World War. Computers were at that time limited in their functions but still housed internal memory, paper tape readers, card readers and card punchers, ensuring the storage of data (van den Ende and Kemp 1999: 839).

According to Trelease (2016: 587), the major innovation in personal computers in the 1980s saw these devices as ‘information appliances” in homes and classrooms.

The author further comments:

> “Useful commodity and instructional software required custom-programming, thorough assessment, and proof of educational value before schools and families would commit significant funds for mass adoption.”

It is through these innovations that desktop computers could perform limitless functions, focussing on simple mathematical equations up to intricate graphics.

The transformation of the computer to the laptop form has enabled collaboration in education via better communication channels, access to information and networking for learning purposes. Laptops have over the years become more affordable to the point that university students can purchase them (Kay and Lauricella 2014: 2).

Additionally, Kay and Lauricella (2014: 3) investigated the benefits of using laptops in higher education. Their results revealed that laptops helped improve learning especially in terms of productivity, research and communication. Students could access learning resources with ease and interactions with peers became simpler with instant messaging applications, improving collaboration. The authors maintain that productivity improved as there was better organisation of files and information, and more effective note-taking.

Paramasivan (2016: 101) maintains that ICTs today, including laptops, connect wirelessly to the internet and provide for education to be widely available, whilst enhancing social integration. Laptops, as personal digital assistants, have now become affordable, accessible and are integrated into society worldwide. The South African Department of Higher Education and Training (2017: 26) maintains that laptops provide for improved access to information and communication technology as an enabler for distance education. This phenomenal device has periodically become more intricate in its functionality, incorporating more applications, limitless software capabilities; and is compact enough to travel with – it is an entire world of digital helpers living in a box (Kay and Lauricella 2014: 3-4).

#### 2.2.3.1.3 Mobile Phones to smartphones

Anshari *et al.* (2017: 3064) illustrate the smartphone as one that has transformed from the traditional cell phone, incorporating computations like that of a personal computer. A smartphone has a powerful operating system, along with numerous applications and high-speed data communication capabilities. The author adds that smartphones are used in all walks of life, from performing personal and daily activities to professional activities, with access to a pool of information on the internet, thus making the smartphone a multi-purpose device.

Anshari *et al.* (2017: 3073) further convey the convenience of smartphones in enhancing education. Smartphones provide for digital materials instead of textbooks, as well as access to the world-wide-web which provides access to almost everything related to a student's study. Rich teaching contents as well as the capability of multimedia contents can be generated via smartphones. Mobile handset ownership outweighs personal computers and competition between mobile phone companies is on the increase, with focus leaning towards the adoption of mobile learning (m-learning) in higher education institutions (Naicker and van der Merwe 2012: 4).

El-Sofany and El-Haggar (2020: 6-7) note that as a component of m-learning, mobile phones ensure a new freedom of learning for students while increasing the flexibility of lecturers who can develop "on-the- spot" learning materials which meet specific needs or provide support and feedback to students instantly. The authors further argue that such mobile technology provides for the mobility of the learner, the mobility of technology and the mobility of learning for anywhere-anytime studying.

**2.2.3.1.4 Social networking**

Information and communications technologies (ICTs) have become the main conduit for human communication, dissolving the time and distance factor and enabling instant feedback as compared to traditional communication methods (e.g. letters). Communicating with distant family and friends is done speedily and conveniently through ICT solutions such as video conferencing, social networks, emails, various electronic messaging systems, etc. (Temitope 2015: 2).

Social networking sites create opportunities for like-minded individuals to form communities based on mutual or common interests. People communicate remotely around shared interests, shared environments and personal relationships. Technology has connected individuals to the extent that people can send messages, track each other's activities and share multimedia (Veerasamy and Govender 2013: 95). The authors state further that sharing information via Facebook, LinkedIn, Twitter, MySpace, WeChat, YouTube, blogging, etc. allows for an online platform which provides the means for social interactions, student involvement in discussions and out-of-class communication amongst students and lecturers.

In view of the above realities and understanding the nature of how technology has evolved, especially for higher education students, the prominence of technology in higher education becomes that much more fathomable.

#### 2.2.3.2 Technology in higher education

Esterhuysen and Stanz (2004: 63) state:

> "All over the world, there is a social and political momentum towards expanding higher education to reach greater numbers of learners of all ages and backgrounds at times and locations that suit them."

One way of ensuring this is via the strategic use of the internet (storing, retrieving and distributing information), which creates possibilities for interactive distance education in an efficient and effective manner (Engelbrecht 2003: 23; Grajek 2015: 22).

With the belief that great technological interventions and innovations can be used to enhance teaching and learning, Kirkwood and Price (2014: 26) postulate that there is much more to be learned about the effective contribution of technology to higher education. Moonsamy and Govender (2018: 3069) affirm that there has been an increased use of technology in education over the past 20 years, with students preferring the use of new media and the internet for learning purposes. Lecturers and students expect to use the institution's technology systems for access, transmitting and storing data via their own personal or work devices. Institutions have therefore increased access points and institutional applications have mushroomed (Grajek 2015: 22).

Borokhovski *et al.'*s (2016: 26) meta-analysis investigated educational technology and the impetus for higher education. They identified more than one purpose of technology which served measures of academia. Technology, in its intrinsic form, was found to be responsible for: -

- The promotion of communication or facilitating the exchange of information. Such communication enabled a higher interaction between students and lecturers and amongst students and their peers;
- The provision of cognitive support for students. Various technologies enable, facilitate and support learning via cognitive technological tools (simulations, wikis, spreadsheets);
- The facilitation of information searches and retrieval of such. Web links, search engines and electronic databases allow for access to supplementary information; and
- The enhancement of content presentation via PowerPoint presentations, graphical visualisations as well as interactive computer tutorials.

On the other hand, Singh (2012: 6) believes that the use of technology in the teaching and learning environment has been the most significant change for education. However, higher education institutions seem to be slow in accepting and indulging fully in the use of technologies for teaching and learning. Reasons range from financial to fear.

Mouyabi (2010: 1180) argues that although technology integration into higher education is a must for some, the success of such is dependent on the learning culture of institutions. Institutions of higher education need to also be wary of costs and time saving when integrating technologies into curricula.

### 2.3 Part B: Teaching and learning in higher education

The following discussion emphasises the teaching and learning ambits in HEIs. It explores how teaching and learning occurs, while taking into account the challenges that lecturers and students experience. It also looks at how technology application in education can yield possible solutions to remedy the challenges within teaching and learning.

### 2.3.1 Teaching and learning at HEIs

The synopsis of teaching and learning in the higher education environment differs considerably to that of teaching and learning within the traditional school system. Bester and Brand (2013: 1) view the relationship between teaching and learning as one that is simplistic in nature and they maintain that "essentially, classroom teaching consists of a teacher who teaches and learners who learn". Internal and external factors play a key role in determining the success of teaching and learning.

While Bester and Brand have emphasized the simplicity of teaching and learning, Stigler and Givvin (2017: 81) describe teaching and learning as "a complex system of interacting parts". It is difficult to change one part without it having an effect on the other. Teaching and learning is made up of components which include the lecturer, students, curricula, teaching routines, assessments, homework, as well as the larger community of parents. Time and effort, the two essentials in teaching and learning, would prove futile if students did not learn.

#### 2.3.1.1 The Concept of Teaching in HEIs/UoTs

The concept of teaching is aptly described by Buckridge (2008: 119) as the ability to conceptualise content in a 'learnable' form. The same content has to be transformed into knowledge and be communicable and non-transient into a continuous cycle of learning. Dufresne (2017: 1207), in his readings on Wittgenstein and Zhuangzi (Educational theorists), summed up that teaching does not take place by one just pointing to an object and saying its name, one must be able to share one's knowledge of that object with another. Vadivoo (2016: 59) states:

> "[T]he teacher is no longer information provider, he is becoming a mentor, facilitator and co-learner. A teacher guides the students to the

information to be accessed and interacted with, he is becoming less central to the learning process."

Not only is knowledge-sharing sufficient in teaching practice, but when teaching concepts, students put these into practice and the practise of these concepts becomes habits. Dufresne (2017: 1213) believes that teaching staff themselves should be habituated if they are helping students develop their own habits and that "teachers are most importantly models that their students can emulate".

Stigler and Givvin (2017: 81) believe that teaching is a system (both cultural and complex) incorporating routines, beliefs and values that developed over time. Evidence presented by Stigler and Givvin (2017: 81) coincides with Drufesne's thoughts above on habituation, i.e. "teachers largely just teach the way they themselves were taught". Ambedkar (2016: 12) theorizes on the excellence in teaching and learning, with the belief that teaching can only be fruitful if teachers frequently incorporate innovate changes which are influenced by new knowledge and technological advancements. The author adds that teaching methods cannot remain stagnant and neglect new ideas and methods to be incorporated into teaching styles. Teachers need to deepen their knowledge, strengthen their skills and be inventive.

#### 2.3.1.1.1 How teaching takes place at HEIs

Brew (2006: 21) viewed traditional teaching in higher education as that activity which includes project work, assignments, practical work and tutorials. The author maintains that traditional teaching is therefore that which embodies the transference of knowledge from one individual to another. Brew's (2006: 22) research into teaching resulted in the realisation that traditional teaching focussed on students being told about concepts and not on students being active in the learning process, thus deeming the teaching-learning process unsuccessful.

However, Moonsamy and Govender (2018: 3069) posit that academics at HEIs traditionally lectured face-to-face with the use of printed textbooks and that many continue to do so in present times. However, in 2020, lecturers had to adopt a different stance in delivering the curriculum. The Covid-19 pandemic and its impact on teaching and learning forced lecturers to engage in web-based or online learning, more commonly known as e-learning (Radha *et al.* 2020: 1088). Lecturers explored teaching practices with technology and had to combine subject expertise, pedagogy and knowledge via media sources and the application of learning theories (Majanja 2020: 317). Similarly, in the pre-covid era, Ambedkar (2016: 12) maintained that good teaching entails appropriate activities and experiences for learning, thus encouraging a student to learn through his or her own efforts. The responsibility of the lecturer lies not only in imparting knowledge, but also in stimulating, guiding and encouraging students to be self-sufficient in acquiring knowledge. Subramanian and Chitra (2016: 45) state that effective teaching strategies not only activate students' curiosity, but also engage them in learning, developing critical thinking skills and stimulating valuable classroom interaction. Hence, Ambedkar (2016: 15) posits that teaching is not a "mechanical process" by means of "telling and testing'. Instead, teaching needs to bring students and subject-matter together. A lecturer's knowledge of subject content is of the utmost importance in ensuring the success of imparting information to students. Students are more comfortable if the lecturers' knowledge of the subject matter surpasses their expectations when they pose questions to the lecturer.

To ensure good teaching practice, one needs to evaluate the practices that are used. Student surveys, comments and peer reviews are but a few methods that can be used for such evaluation. Good outcomes of teaching practice are also dependant on the quality of teaching material, such as subject outlines, tutor manuals, resource books, etc. (Buckridge 2008: 120). Higgs (2006: 834) concludes that the quality of teaching in higher education has also been influenced by the "turbulent policy of higher education", influencing how practising educators think about what they do in the classroom.

Lecturers may not always be able impart their knowledge to students, but they can provide students with conceptual tools so that they may develop suitable habits (Dufresne, 2017: 1213).

Difficulty sometimes exists when a lecturer cannot make a student understand a concept in exactly the same way as they understand it. Dufresne (2017: 1213) therefore maintains that if a student is placed in an appropriate environment to practise the concept being taught, then learning does take place.

The concepts of teaching and learning are often taken for granted. “Teaching-focused conceptions” and “learning-focused conceptions” dictate activity in the education ambit. Kirkwood and Price (2013: 537) maintain that:

> “While some teachers have *teaching‐focused* conceptions (i.e., teaching as the transmission of information, skills and attitudes to students), others have *learning‐focused* conceptions (i.e., promoting the development of the students' own conceptual understanding).”

The deployment of technology in teaching therefore depends on how teaching staff perceive teaching concepts. The authors add that teaching staff that apply the concept of “transmission of knowledge” will adopt a teacher-centred approach, whilst those who apply the concept of “promoting the development of students” will adopt a learner-centred approach.

#### 2.3.1.1.2 Technology as a means to enhance teaching at HEIs/UoTs

Various authors have proclaimed the usefulness of technology in enhancing standard teaching practices. Bester and Brand (2013: 4) believe that the successful integration of technology into pedagogy edifies teaching practices. The authors add that students have become visual students, an attribute of technology enhancements. Thus, a lack of visuals in teaching practice will lead to less productive learning.

Education has become dynamic and as a result, students are absorbing more information from visuals than hard copied printed notes. Students therefore find academics who combine technology use in their teaching more reliable and knowledgeable (Bester and Brand 2013: 4).

According to Moonsamy and Govender (2018: 3069), students who have taken to technology in their learning activities have become “digital natives”, a breed which is now technologically savvy. The authors state further that academics are concerned with the process of educating digital natives to prioritise the outcomes of such education. Academics therefore have to keep abreast with technology to meet the demands of these digital natives and enhance their teaching practices with online learning technologies.

#### 2.3.2.1 The concept of learning in HEIs/UoTs

The concept of learning knows no distinction between colour, race, gender, class or creed. Life in itself is a learning curve, all that happens within life is always offering a lesson to be learned, whether negative or positive. The Oxford English Dictionary defines learning as a process of acquiring new knowledge “as a result of study, experience, or teaching”. Learning is not only the acquisition of knowledge, but the ability to “commit to memory”. Matric sees the end of a scholarly journey where the traditional school classroom does not become a forgotten entity, but the repeated experiences lead to learning in the higher education environment. Cameron and Rideout (2020: 12) state that learning in a HEI environment is challenging as students adjust from school to university learning styles.

Learning has evolved over the last 10-15 years and becoming an independent learner is critical in order to adjust to the university environment (Illeris 2018: 1; Cameron and Rideout 2020: 12). The concept of learning has become significant not only for professionals and students, but also in political and economic contexts. Illeris (2018: 1) argues that the level of education and skills of nations, companies and individuals is of paramount importance when competing in a global market where competition is fierce. The author adds that learning breaks through the traditional barriers of acquiring knowledge and skills and also focusses on emotional, social and societal dimensions. For example, learning provides proof of competence development, i.e. the ability to manage different existing and future challenges in working life or other areas requiring competencies. No matter what the learning activity, with such developments come learning patterns. Vermunt and Donche (2017: 270) argue that a learning pattern is “a coherent whole of learning activities that learners usually employ- their beliefs about learning and their learning motivation, a whole that is characteristic of them in a certain period of time”.

Learning also entails participation by the lecturer, i.e. if a student successfully grasps concepts, it rests on the lecturer to cultivate the ability of the student to use the concepts (Dufresne, 2017: 1212). These perspectives on learning are significant as well when technology is used for learning in higher education. Although digital competence or capability is important for learning in higher education, the concept of life-long learning is also important as an enabler in education, contributing to continuous self-development (Biggins, Holley and Zezulkova 2017: 1). The authors further advocate that life-long learning is key to ensure personal fulfilment and development of students so that they can develop as active citizens, be included socially and be successfully employed (2017: 2).

#### 2.3.2.1.1 Learning patterns and styles as factors that influence learning at HEIs/UoTs

Vermunt and Donche (2017: 272) aver that learning patterns and styles as factors that influence learning do impact on the use of e-learning technology for learning. Results from their study show that there are four qualitative learning patterns, namely reproduction-directed learning, meaning-directed learning, application-directed learning and undirected learning, which relate to the way in which students engage with learning material. The following description was provided by the authors for each of these learning patterns:

- **Reproduction-directed learning** incorporates “memorising and rehearsing and analysing” – students pay more attention to the content provided by the lecturer, the goal being to pass the test by ensuring that material is as close to the original provided by the lecturer.

- **Meaning-directed learning**: As the name suggests, this is a process whereby students try to understand the meaning of the content they learn, critically engaging in the learning material provided, as well as not limiting themselves to the prescribed content. This learning pattern incorporates ‘relating and structuring’ and ‘critical processing’ of learning material.

- **Application-directed learners** try to discover relations between what they learn and the world outside. This learning pattern allows for the material learned to be put into a practical situation. Students who adopt this learning pattern are those preparing themselves for a particular professional or vocational upgrade. This type of learning is depicted as ‘concrete processing’.

- **Undirected learning patterns** can be associated more with students who are transitioning from one level of study to another (school to university), or from one country to another where pedagogies differ. Students who learn in an undirected way do not know how to approach their studies well enough. This is a difficult transitioning process for students and incorporates a ‘lack of regulation’.

Hence, each of these learning patterns have to be considered when engaging in the use of e-learning technology for teaching and learning.

The other area that influences how learning takes place is learning styles. Table 2.1 below depicts Vermunt and Vermetten’s (as cited in Vermunt and Donche, 2017: 270) Inventory of Learning Styles (ILS). The authors add that this instrument was used to review learning styles of students in higher education.

**Table2.1: Inventory of Learning Styles (ILS)**

| Learning components | |
|---|---|
| **Scales of the ILS** | **Description of content** |
| Processing strategies | |
| Deep processing | |
| Relating and structuring | Relating elements of the subject matter to each other and to prior knowledge; structuring these elements into a whole |
| Critical processing | Forming one's own view on the subjects that are dealt with, drawing one's own conclusions, and being critical of the conclusions drawn by textbook authors and teachers |
| Stepwise processing | |
| Memorizing and rehearsing | Learning facts, definitions, lists of characteristics, and the like by heart by rehearsing them |
| Analysing | Going through the subject matter in a stepwise fashion and studying the separate elements thoroughly, in detail and one by one |
| Concrete processing | Concretising and applying subject matter by connecting it to one's own experiences and by using in practice what one learns in a course |
| Regulation strategies | |
| Self-regulation | |
| Learning process and outcomes | Regulating one's own learning processes through regulation activities like planning learning activities, monitoring progress, diagnosing problems, testing one's outcomes, adjusting, and reflecting |
| Learning contents | Consulting literature and sources outside the syllabus |
| External regulation | |
| Learning process | Letting one's own learning processes be regulated by external sources, such as introductions, learning objectives, directions, questions, or assignments of teachers or textbook authors |
| Learning outcomes | Testing one's learning outcomes by external means, such as the tests, assignments, and questions provided |
| Lack of regulation | Monitoring difficulties with the regulation of one's own learning processes |
| Conceptions of learning | |
| Construction of knowledge | Learning viewed as constructing one's own knowledge and insights. Most learning activities are seen as tasks of students. |
| Intake of knowledge | Learning viewed as taking in knowledge provided by education through memorizing and reproducing; other learning activities are tasks of teachers. |
| Use of knowledge | Learning viewed as acquiring knowledge that can be used by means of concretising and applying. These activities are seen as tasks of both students and teachers. |
| Stimulating education | Learning activities are viewed as tasks of students, but teachers and textbook authors should continuously stimulate students to use these activities. |
| Cooperative learning | Attaching a lot of value to learning in co-operation with fellow students and sharing the tasks of learning with them |
| Learning orientations | |
| Personally interested | Studying out of interest in the course subjects and to develop oneself as a person |
| Certificate oriented | Striving for high study achievements; studying to pass examinations and to obtain certificates, credit points, and a degree |
| Self-test oriented | Studying to test one's own capabilities and to prove to oneself and others that one is able to cope with the demands of higher education |
| Vocation oriented | Studying to acquire professional skill and to obtain a(nother) job |
| Ambivalent | A doubtful, uncertain attitude toward the studies, one's own capabilities, the chosen subject area, the type of education, etc. |

*Source:* Vermunt and Vermetten (2017: 270)

Table 2.1 shows that learning styles are influenced by processing strategies, regulation strategies, conceptions of learning and learning orientations.

**Processing strategies** show that some students learn by relating elements from prior knowledge, while others draw their own conclusions by critically analysing study material. Memorising material or separating learning elements thoroughly and detailing them or connecting the subject matter to one's own experience is also how students engage in learning (Vermunt and Vermetten 2017: 270). The **regulation strategies** of learning show learning processes whereby students regulate their own learning by planning, monitoring, reflecting on learning activities (Vermunt and Vermetten 2017: 270). The **conceptions of learning** occur through students either constructing their own knowledge or memorising learning material, or applying knowledge or learning through peer interaction. **Learning orientations** differ from students who are interested in learning to develop themselves to those who require learning in order to obtain a job or professional skill. Table 2.1 above puts into perspective the individual differences of students, adhering to the fact that each student is unique and approaches studying or learning in their own unique way. However, Majanja (2020: 319) states that e-learning brings together the preferred learning styles adopted by students as learning takes place via multi-media and computer integration, flexibility of time, interactivity and self-learning.

Vermunt and Donche (2017: 274) maintain that the learning patterns of students are not mutually exclusive and it is evident that several personal factors (age, knowledge of learning materials and educational experience) and contextual factors (teaching methods, types of assessments and collaboration with peers) inform the learning patterns of students.

Dufresne (2017: 1212), on the other hand, is not concerned about amassing abstract principles but rather the development of practical skills and habits. The author adds that when a student becomes familiar with the practical application of the knowledge gathered, the student forgets that he has actually learned as the activity the student engaged in develops into a routine. Hiralaal (2012: 319) explains that e-learning assists students in the learning process by prompting students to gain a deeper understanding of learning materials, increasing their level of independence while promoting student-centred education, creativity, critical thinking and informed decision-making.

#### 2.3.2.1.2 Learning and understanding

This section focuses on the concepts of learning and understanding, i.e. the learning patterns as discussed earlier (Vermunt and Donche 2017: 272) and the learning styles as shown in Table 2.1 earlier highlight the capabilities of how students learn and absorb critical information. Stigler and Givvin (2017: 87) maintain that understanding the learning material is more important for the development of the student, rather than a student memorising and reproducing information just for assessment purposes. The authors add that producing students who understand concepts and connecting concepts to problems has proven difficult in teaching and learning.  The authors state further that students need to embrace methods of learning that will enable them to accomplish any goals.  Reproducing information to meet assessment demands cannot be categorized as "learning".

Results of studies conducted by the Association of American Colleges and Universities maintain that graduates must be critical thinkers (Horizon Report 2016: 14), meaning that students need to form their own views on the subject matter and draw their own conclusions, thus promoting their understanding of course content (Vermunt and Donche 2017: 20).  Stupple *et al.* (2016: 91) advise that critical thinking plays a vital role in learning and is an important aspect in higher education outcomes.  Critical thinking skills allow for students to make informed decisions.  The ability to be a critical thinker enables students to be more hands-on and apply their knowledge to real-world experiences. Enhancing learning with technology allows for "learners to be more creative, without rigid guidelines" (Hoziron Report 2016: 14). Learning outcomes can be enhanced through the strategic use of technology in teaching and learning. Optimal learning and understanding occurs as e-learning creates the opportunity for students to present knowledge that is diverse, relevant and of optimum quality. Students have the opportunity to interact online with peers and the lecturer, creating a deeper understanding of learning material and enhancing critical thinking (Hiralaal 2012: 319).

#### 2.3.2.2 Existing teaching challenges in HEIs

The challenges experienced by lecturers in teaching in HEIs are elucidated in the discussion below. These challenges were those inherent in teaching practices prior to lecturers being forced to engage in a fully online teaching environment by the infiltration of the Covid-19 pandemic.

- **Diverse student populations:** Lecturers in HEIs are expected to teach a diverse student population (Bozalek, Ng'ambi and Gachago 2013: 419). However, the authors also state that this diverse student population, informed by multilingualism and massification of education, contributes to added pressure on lecturers to increase throughput. Massification leads to universities surpassing 1$^{st}$ year enrolments which immerse existing venues with larger number of students, thus challenging lecturers to create inventive teaching practices yet shattering the ability of lecturing staff to "fortify higher-order cognitive skills which support capabilities amongst first-year students" (Seedat-Khan, Ramnund-Mansingh and Johnson 2020: 5).

- **Deficiency of resources:** Lecturers are expected to teach and produce graduates while operating with a deficiency in resources (Bozalek, Ng'ambi and Gachago 2013: 419). The lack of venues for larger classes leads to lecturers engaging in repetitive lectures to students or employing the services of less qualified teaching assistants, with simulcast lectures transmitted to multiple venues (Seedat-Khan, Ramnund-Mansingh and Johnson 2020: 4). The authors argue that such activities in developing South African HEIs adversely impacts on the quality of education, with additional pressure on the lecturing fraternity. Infrastructural and human resource deficiencies as the student intake increases at HEIs create demands on existing lecturing staff to engage with higher numbers of students (Seedat-Khan, Ramnund-Mansingh and Johnson (2020: 7).

- **Large classes:** Teaching large classes proves challenging to lecturers in HEIs. Lecturers are burdened with a heavier workload and are unable to provide individual attention to students or even assess or grade students fairly due to over-populated classes (Chan 2010 cited in Awan and Kamran 2018: 625). Seedat-Khan, Ramnund-Mansingh and Johnson (2020: 4) state that trying to teach large classes with innovative techniques has proven unsuccessful and they reiterate that large classes limit access for academic consultations and prevent in-depth comprehensive feedback from lecturers to students. The authors advocate that large classes can render lecturers uncomfortable due to the size of the class; create awkwardness for the lecturer as he/she is unable to control student behaviour, be unheard or command student attention; and lecturers are unsure of whether students understand the material that is being delivered. The authors add that such challenges are ignored at the institutional level, resulting in the overall dissatisfaction of lecturers and students.

- **Varied levels of student preparedness:** The post-apartheid era in South Africa has proven difficult for lecturers to teach students from varied secondary school backgrounds (Bladergroen, Basson and Blaine 2018: 22). The authors state that teaching these students in a higher education setting is a problem as graduates of secondary schools lack capabilities as required at university level, making teaching more difficult. Lecturers face the challenge of meeting the needs of a student population with “mixed ability”, especially when assessing the students’ work (Awan and Kamran 2018: 645). Seedat-Khan, Ramnund-Mansingh and Johnson (2020: 2) confirm that although students meet the minimum criteria for university entrance, “preparedness and proficiency” are not automatically indicated. The authors argue that the lowering of pass grades adversely compromises student preparedness for university success. Lecturers thus need to adjust teaching styles and curricula in order to meet the needs of students.

- **Lack of student interest/engagement:** A deficiency exists between the level of education at schools and the level of education offered at HEIs, and students continue with the same attitude as when in school, i.e. absenteeism and a lack of involvement in studies (Cross and Carpentier 2009:16). This type of disinterest or disengagement by students increases the burden that lecturers face in classrooms as students do not admit to not understanding the material and lecturers cannot connect with students on the knowledge gained (Eng 2017: 10).
- **Workloads of lecturers:** Workloads of lecturers are an integration of teaching, research, administration and consultation with students (Miller 2019: 634-636). The author argues that lecturers are pressurised to increase research output, while engaging in teaching activities with the number of students increasing each year. The author also states that some lecturing staff are expected to engage in a post-grad supervisory capacity and complete administrative tasks.

#### 2.3.2.3 How technology helps to address teaching challenges

Given the challenges experienced by lecturers in their teaching practices, the discussion below provides possible solutions that can be adopted through the use of technology for teaching and learning.

- **Diverse student population:** Bladergroen, Basson and Blaine (2018: 22) realised that with the option of blended learning, it would be possible to improve the teaching productivity of lecturers, even with large diverse groups of students. The authors add that teaching with technology improves the learning productivity of students and students become more responsible for their own learning. Combining face-to-face teaching and teaching with technology (blended learning) allows for lecturers to provide adequate feedback to students and ensures that students participate actively and collaborate, thus improving their academic performance, irrespective of their diverse nature (Britto, Murugeson and Subramanian 2016: 94; Sintonen and Kynaslahti 2015: 7). Bozalek, Ng'ambi and Gachago (2013: 420) agree that adding technologies to current pedagogical practices provides for a positive impact on diversity and that inhibitions created language barriers. They also state that technologies such as social media options provide for positive interaction between lecturers and students, creating opportunities for collaboration, learning and interaction- co-creation- thus improving teaching and learning.

- **Deficiency of resources:** Reif (2013: 44) admits to digital learning offering students and lecturers the best educational resources. He further comments on the proceedings of an online-learning summit at MIT where a Professor of Physics complimented the ability of digital learning to reinforce his teachings. Students were better enabled to apply and retain concepts, fostering immediate practice and feedback on lessons.

- **Large classes:** Stigler and Givvin (2017: 86) believe that teaching face-to-face to a large student complement may prove difficult if the lecturer wants to modify any part of the curriculum. However, e-learning provides for a change in curriculum design and online lessons with videos, and other digital materials can provide for revised lessons with students being randomly assigned different instructions with access anywhere and anytime. Lecturing to students is no longer confined to a lecture hall, what with space constraints being a problem, as e-learning can infiltrate student activities and allow for curriculum delivery with ease (Duluta and Mocanu 2016: 286).

- **Varied levels of preparedness:** Asabere *et al.* (2017: 167) believe that technology provides for the flexible process of delivering education, thus ensuring easy access to knowledge by both students and lecturers. The authors state further that the flexibility, interaction and reception of information allows for students to improve academically, whilst offering them an educational platform which also allows for training. Bednjanec, Tretinjak and Tretinjak (2015: 838) agree that teaching students via technology allows for them (students) to be successful in solving problems while becoming self-confident, independent students.

- **Lack of student engagement/interest:** Kirkwood and Price (2013: 6) critically reviewed the influence of technology in education, maintaining that it is taken for granted that “technologies can enhance learning”, as seen in the United Kingdom, Europe and throughout other parts of the world. The empirical analysis by Bladergroen, Basson and Blaine (2018: 19) supports the abovementioned theory by Kirkwood and Price, which exhibits the positive contribution of blended learning to engineering students. This study found that students portrayed a willingness to accept the blended teaching strategy, maintaining that traditional face-to-face strategies are no longer sufficient in a classroom.
- **Workloads of lecturers:** Sivagurunathan, Subramanian and Saravanan (2016: 89) believe that teaching with technology changes the role of the lecturer from teaching to facilitating, thus allowing lecturers to transfer some of their teaching activities to online materials and instructional media. Using technology for teaching supplements teaching practices as lecturers can use online sources for up-to-date lesson plans, research and other information needs (Saravanan 2016:21).

It was necessary to understand the role of teaching and learning in higher education before assessing the contribution of technology to educational endeavours by role players within the higher education sector. Understanding learning patterns and learning styles, as well as identifying challenges that exist in teaching practices, allows for lecturers to make informed decisions on how the incorporation of technology can provide possible solutions. Part C of this chapter therefore assesses e-learning for teaching and learning in higher education.

## 2.4 Part C: The use of e-learning for teaching and learning in higher education

Part C demonstrates the use of e-learning technologies for teaching and learning in HEIs with a focus on its definition and effectiveness as a tool to enhance digital pedagogy.

### 2.4.1 The use of e-learning for teaching and learning in HEIs

As discussed above, communication, interactions, management and the use of information have all been influenced by new and emerging technologies. These technological forces are creating a paradigm shift in businesses, social interactions, entertainment, politics and also in education (Noor-Ul-Amin 2013: 38). The author describes the role of technology as that which comes with profound implications for the education sector from kindergarten to doctoral studies, from schools to higher education institutions (HEIs). Access to information on the World-Wide-Web, tutorials, email facilities, Skype and other media whilst on the go is escalating significantly with such new and improved technologies (Arkoful and Abaidoo 2015: 31).

Anshari *et al.* (2017: 3 065) posits that educational technology improves education. Technology, as an enhancing tool, facilitates the learning process and improves the performance of the education systems, thus advancing its effectiveness and efficiency. Results of such technological advancements can be further seen in the education sector. HEIs have also adopted Learning Management Systems (LMSs) to further enhance teaching and learning. LMSs are varied, from Moodle to Blackboard to Sakai. Arkoful and Abaidoo (2015: 29) maintain that using modern information and communication technologies for teaching and learning is of the utmost importance in institutions of higher education, hence such HEIs are working tirelessly to ensure a digital curriculum. Such a digital platform thus embraces technology in terms of adopting e-learning procedures to ensure that teaching and learning become digitally focussed. A discussion on the consequences of deploying such a technological platform is necessary and it is important for HEIs to assess technologies in teaching and learning before embarking on this technological trajectory.

Mainka and Benzies (2006: 104) discuss the significance of e-learning implementation and the transition from a vision to reality. Their arguments focussed on the fact that by HEIs simply making technology available, it does not imply that adoption will be readily accepted by technologically unenthusiastic academic staff. It is important for the concept of e-learning to be understood on many contexts, especially as to whether it revolutionises teaching and learning, thus proving to be superior to traditional or conventional teaching and learning methods.

Conventional teaching emphasized content, with course material being transcribed from textbooks. Lectures and presentations, together with tutorials and learning activities, formed the basis of teaching. Integrating technology into pedagogy helps to improve and develop the quality of education by providing support in current curricula (Noor-Ul-Amin, 2013: 39). The success of incorporating e-learning into teaching and learning needs to be investigated-it cannot simply be speculated upon. Therefore, a discussion on various definitions relating to e-learning and its impact on teaching and learning are presented below.

#### 2.4.1.1 The concept and definition of e-learning

E-learning expands the options for teaching and learning using technology. There are a number of definitions of e-learning. Laurillard (2004: 2) defines e-learning as "the use of any of the new technologies or applications in the service of learning or learner support". Supporting this definition, Grajek (2015: 3) agrees that e-learning provides for collaboration and access to content from digital sources outside the classroom, i.e. e-learning is learning that involves a web-based component. These definitions indicate that e-learning does provide access to learning opportunities in a virtual learning environment which are unrestricted by time and distance. Peer interaction, access to content and the need for unrestricted access to content are enhanced by e-learning platforms.

Engelbrecht (2003: 20), in her investigations on the hype of e-learning, realised that the synonymous terms "online learning", "virtual learning", "web-based learning", "internet-based learning", "resource-based learning" and "e-learning" all refer to the use of internet technologies to deliver education, yet “e-learning” was the most preferred term used because of its significance in education and its popularity. It is therefore not the terminology that influences how learning with technology impacts on student performance and the delivery of academic content. Re-designing lectures with a technological base will influence student retention, student activities, communication, collaboration and access to learning materials. Similarly, Kinuthia and Dagada (2008: 626) argue that e-learning is just another type of teaching and learning that is technology aided. They believe that e-learning is a “blanket term” for pre-existing technologies such as computer-based learning, web-based learning and online learning. Sharing this belief, Arkoful and Abaidoo (2015: 30) state that e-learning embraces information and communication technologies, thus enabling access to online learning and teaching resources.

The South African Department of Higher Education (2017: 362) maintains that the use of electronic devices in e-learning, namely computers and mobile devices are used as means of accessing learning materials, as well as interacting with peers and lecturers for discussions and assessments. E-learning can thus take place both online or offline.

Apart from the technology that is enshrined within the teaching and learning practices as discussed above, e-learning is also synonymous with the use of electronic devices for the delivery of educational content. Students are provided with educational services via electronic channels (Alsabawy, Cater-Steel and Soar 2016: 843). The South African Department of Higher Education and Training (2017: 362) further proclaims e-learning as ‘technology-enhanced learning'. This defines e-learning as a process using information communication technology to access programmes or courses.

While many investigations on the definitions and the concept of e-learning have swayed from technology-driven curricula to learning via electronic devices, Romiszowski (2003: 2) emphasises that e-learning is an activity, either on an individual basis or as a collaborative group activity, focussing on synchronous (real time) and asynchronous (flexi-time) communication modes.

The various definitions on the concept of e-learning point to the fact that technology has provided for flexible learning using ICT resources, tools and applications which contribute to collaborative and interactive learning. In investigations conducted by Noor-Ul-Amin (2013: 38-45) on the incorporation of technology as a change agent for education, the various definitions of e-learning above are captured in the results of his review. As mentioned above, the e-learning phenomenon extends from being defined as just an activity to technology-enhanced learning and to a type of teaching and learning, whilst enhancing collaboration and allowing for flexible learning without the constraints of time and distance.

The various definitions of e-learning presented indicate that the concept of e-learning simply articulates to the use of technology to support teaching and learning. E-learning encompasses the use of electronic media, educational technologies and information and communication technologies. Furthermore, e-learning can, via various technological devices, deliver curricula through mediums of text, audio, animation, live streaming, images and a host of other media applications, embracing the term "technology-enhanced learning". Hence, the concept of e-learning can be summed up to include a combination of face-to-face teaching and the use of technology (blended learning), or to virtual learning activities where students experience a flipped classroom through the use of technology, without being in a classroom physically. It simply allows for access, interactions with peers, participations in discussions and assessments, all through the mode of information communication technology.

The hype of this technology must certainly have a profound impact on the delivery of a curriculum, either as a complementary or alternative to traditional education (Ramraj and Marimuthu 2019: 37). The understanding of how e-learning revolutionises learning or how e-learning revolutionises teaching can be further understood by delving into the background of e-learning as a tool in pedagogy.

#### 2.4.1.2 The background to e-learning

While e-learning as a blanket term encompasses that which electronically or technologically supports learning and teaching, it is necessary to look at how this phenomenon has evolved in curricula (Wagner, Hassanein and Head 2008: 26). Muttappallymyalil *et al.* (2016: 588) state that from the 1800s to the 21st century, education, the delivery and its acceptance, has evolved from one type of blackboard to another. The authors maintain that in the earlier years, lecturers engaged students by delivering their lessons personally in a classroom and their visual content of their lesson was portrayed on a blackboard made of slate with writing done in chalk. Centuries later, the blackboard evolved into an interactive smartboard (Muttappallymyalil *et al.* 2016: 590), while the 21st century saw the Blackboard now being transformed into a Learning Management System (LMS) (Maphala and Adigun 2021: 1) for the purposes of e-learning. The calibre of students has also evolved. Maurtrin-Cairncross (2014: 567) maintains that generation Y students have a short attention span and prefer technology over the human instructor, thus preferring action over observation. Although different persons provide different definitions of the concept of e-learning, it is evident that the basic concepts are the same, i.e. learning, technology and access (Tucker and Gentry 2009: 44). McGrath (n.d) confirms that e-learning is but an education system coupled with technology to transfer skill and knowledge.

Clarke (as cited in Romiszowski 2003: 9) states that there have been failed attempts to change learning via innovative technology. The author maintains that technology can only improve learning if it fits into the students' lives, and not vice-versa. These attempts thus resulted in the birth of e-learning.

Cross (2004:104) identified that e-learning was not only becoming significant in education, but corporates also now engage staff in e-learning to improve performance and accomplish business goals and strategies. Staff at corporates learn via e-learning, thus improving how they perform their duties. In education, Duluta and Mocanu (2016: 286) affirm the idea of technology and its infiltration into student activity as there is no more time or space constraints in providing education, neither is the lecture hall a must to engage in teaching and learning as e-learning has become “a part of the modern teaching process”.

Before the “modern teaching process” was born, teaching and learning took place via the CD (Compact Disk) (Cross, 2004: 105-106). CD learning occurred from the mid-1980s via the computer, with realistic scenarios and videos on the desktop. However, CD-based teaching and learning did not provide for an instructor in class or interactive activities. With the challenge of not having an instructor to turn to, technology gurus began investigating learning via the use of the internet. E-learning was born to enrich conventional methods of teaching and learning, creating opportunities to improve performance and enrich knowledge. Gomathi (2016: 143) proclaims that although e-learning has only been in existence since 1999, the principles of e-learning have been documented throughout history, with early forms of e-learning dating as far back as the 19th century.

In order to provide education which was not only different to the “sage-on-the-stage” method of teaching, educational institutions began to incorporate technology into curricula, which grasped the attention of the technologically savvy students and maintained their interest. Information and communication systems, whether free-standing or based on either local networks or the internet in networked learning, underlie many e-learning processes (Learnframe n.d).

Furthermore, e-learning, being the virtual concept that it is, can be accessed in or out of a classroom. It can be self-paced or even instructor-led (Arkoful and Abaidoo 2015: 30). Over a decade ago, Hiltz and Turoff (2005: 60) posited that online learning was a new social process. The authors maintained that learning with technology could contribute a substitute for both distance learning and traditional face-to-face instruction. The concept of technology integrated with pedagogy resulting in e-learning has shown revolutionary changes in the behavioural attributes of higher education, thus contributing to the flexibility of learning and return on investment, with traditional classrooms becoming virtual universities (Perumal 2010: 86; Bozalek, Ng’ambi and Gachago 2013: 421; Bester and Brand 2013: 5).

From the discussion above, it is evident that e-learning has evolved through the decades. Mandala, Abdullah and Ismail (2013) describe this transition as a means of advancing a knowledge-based economy through computer and networking technologies, thus innovating the delivery of education. The advancement of technology in education provides a diverse means to support learning in a flexible, portable and more personalised manner.

To determine the effectiveness of e-learning in education, it is not only important to look into the discovery of e-learning, but also to understand the different categories or dimensions that e-learning has to offer. E-learning, as a singular concept, may only be understood when the various methods of implementing it are defined. Institutions may adopt different methods of e-learning implementation, depending on the needs that they (institutions) have to fulfil.

#### 2.4.1.3 Dimensions of e-learning

The extent or dimensions of how e-learning technology is used in curriculum delivery vary widely, thus providing diverse ways to classifying e-learning. As pointed out, there are varied dimensions entailed in e-learning, each deliberating a different approach to how e-learning is being used. Engelbrecht (2003: 23) foresaw the use of technology (such as e-learning) in education either supplementing the traditional classroom scenario or entirely replacing lecture-based courses. Chelladurai and Pitchammal (2016: 80) further explain that there are multiple approaches on how e-learning can contribute to pedagogy through means of blended and distance education methods. The authors maintain that whether teaching and learning in classrooms are supplemented by technology or replaced by technology, the benefits of eliminating time and geographical barriers, enhancing group collaboration and providing new educational approaches are positively overwhelming. It is therefore important to recognise the dimensions of e-learning and the key concepts which describe how this technological feature in education re-designs the traditional pedagogy structures.

#### 2.4.1.3.1 Synchronous vs asynchronous Learning

E-learning occurs either via a synchronous or asynchronous means, defining its interaction in terms of time.

Synchronous learning occurs in real-time, with students interacting with other students or with lecturers at the same time, exchanging ideas or receiving lecturer feedback or instruction. Synchronous learning can include chatrooms, skype conversations or virtual classrooms where students and lecturers are online and working in collaboration (Wagner, Hassanein and Head 2008: 26; Arkoful and Abaidoo 2015: 31; Mandala, Abdullah and Ismail 2013). Synchronous learning leads to learning communities, providing for benefits from traditional classrooms such as face-to-face interactions.

Synchronous learning is also beneficial in ensuring that learning activities can be logged or tracked. Continuous monitoring and correction is also possible, as well as personalised training for each student (Venkateshwari 2016: 226).

Asynchronous learning uses technologies and online activities such as email, blogs, discussion boards, wikis and web textbooks. This type of technology provides for students to be in consultation with lecturers over the internet, but at different times. Asynchronous technologies allow students the opportunity to proceed with their studies at their own pace in a low stress environment. This is a particularly beneficial method especially for students who are ill or have personal obligations (Wagner, Hassanein and Head 2008: 26; Arkoful and Abaidoo 2015: 31). Mandala, Abdullah and Ismail (2013) believe that many opt for asynchronous learning due to the flexibility it has to offer.

Both synchronous and asynchronous learning methods prove beneficial as instant learning and referencing, access to anytime, anywhere learning and the ability to reach larger groups of students is possible. Adding to the different types of e-learning is blended learning, which Venkateshwari (2016: 226) refers to as an amalgamation of synchronous and asynchronous methods of e-learning.

#### 2.4.1.3.2 Blended learning

The concept of blended learning, as the name suggests, incorporates a blend of face-to-face instruction coupled with the use of technology (Lim and Wang 2017: 3). Blended learning provides for a more "balanced" approach to learning as it combines the advantages of classroom instruction with self-paced instruction that is delivered via technology (Durban University of Technology 2014: 1; Engelbrecht 2003: 27). Moonsamy and Govender (2018: 3070) believe that many HEIs unintentionally choose to invest in blending learning in order to overcome the feelings of isolation that students experience when exposed to learning online. Britto, Murugeson and Subramanian (2016: 94) agree that designing a blended learning environment creates opportunities for harmonious learning which includes face-to-face interaction and online access.

Learning material can also be conveyed through virtual mediums, namely multimedia resources, video-conferencing and course-management applications. Students and lecturers communicate via these technologies, making virtual classrooms a substitute for the traditional classroom and creating a sense of community. Students do not attend classes physically, but a similar learning environment is produced via technology and is particularly inherent in distance education. Blended learning provides for adequate feedback, active participation, collaborative tasks and improved academic performance (Durban University of Technology 2014: 1; Zhao, Sintonen and Kynaslahti 2015: 7, Britto, Murugeson and Subramanian 2016: 94).

#### 2.4.1.3.3 Diversity amongst online course delivery methods

Literature on the different types of e-learning illustrate the means by which learning via online technologies can be conducted. Long (2017: 7) states that online learning has gained a firm hold on HEIs worldwide, shaping higher education. The author believes that it is therefore important for HEIs to make informed decisions on the type of e-learning offered as a key component, allowing for access to higher education within the reach of people who may not be privy to advanced education. To advance the e-learning initiative in HEIs, it is also important to base decisions influenced by the diversities amongst course delivery methods. Allen and Seaman (2015: 7) have adopted the following table to illustrate the diversity amongst the online course delivery methods used by lecturers.

**Table 2.2: Online Course Delivery Methods**

| *Proportion of Content Delivered Online* | *Type of Course* | *Typical Description* |
|---|---|---|
| 0% | Traditional | Course where no online technology used — content is delivered in writing or orally. |
| 1 to 29% | Web Facilitated | Course that uses web-based technology to facilitate what is essentially a face-to-face course. May use a learning management system (LMS) or web pages to post the syllabus and assignments. |
| 30 to 79% | Blended/Hybrid | Course that blends online and face-to-face delivery. Substantial proportion of the content is delivered online, typically uses online discussions, and typically has a reduced number of face-to-face meetings. |
| 80+% | Online | A course where most or all of the content is delivered online. Typically have no face-to-face meetings. |

*Source:* Allen and Seaman (2015: 7)

Table 2.2 above depicts the proportionate dissimilarities of methods adopted for teaching and learning. They range from the traditional methods to Web Facilitated (such as the use of LMSs or web pages to post syllabus and assignments) to Blended/Hybrid methods to online methods (where all or most of the content is online). As discussed in the literature presented, it is incumbent on HE institutions to determine which method/s best suit their curriculum delivery. Combinations of methods also exist to ensure the multiple benefits that technology has to offer to students (Vadivoo 2016: 59).

Conventional teaching methods provide for lecturers with different personalities and teaching styles. Teaching with technology ensures that each student is learning with the same technology (Vadivoo 2016: 60). Additionally, Priya (2016: 169) believes that e-learning methods consider individual learner differences by allowing students to concentrate on certain areas of the course whilst others concentrate on other areas. Online teaching and learning also provides for easy evaluation, reducing the time taken to evaluate tests and exams and removing partiality (Geetha 2016: 111).

Kunene and Barnes (2017: 127) posit that the advances in technology, although an external factor, have influenced HEIs to follow the business trends to attain competitive advantages. HEIs exploring this transformation therefore engage in methods moving away from conventional teaching to methods of online learning.

These transformations of the educational system need to be explored and the reasons for technology in education, and e-learning in particular, becoming more popular amongst institutions of higher learning need to be examined.

#### 2.4.1.4 The need for e-learning in higher education

E-learning has been expanding over decades, with HEIs investing in the significant migration to technology-based education. Bell and Federman (2013: 165) report that some of the reasons for the growth of e-learning in higher education are: the generation of new revenue streams, expanding access, offering students greater flexibility in terms of their timetables, curbing increasing costs and allowing students the freedom to work at their own pace. The authors add that HEIs can optimise their curriculum delivery via e-learning strategies, thus attracting future students.

Globally, the competition in the higher education sector is rife. Traditional HEIs have to compete with private colleges and a growing number of virtual HEIs in order to remain lucrative (Wagner, Hassanein and Head 2008: 27). The authors advocate that investing in e-learning technologies allows HEIs to expand their curricula, improving their position in the education sector. Esterhuysen and Stanz (2004: 63) agree that with a huge demand for online learning, universities are aware of competition from the commercial sector. Hence, faculties are being pressured to provide learning via technology.

King and Boyat (2014: 1272) claim that the workplace has adopted e-learning for supporting professional development and continuing education, but the use of e-learning technologies in higher education is predominantly a support tool for teaching. However, Bell and Federman (2013: 170) deliberated on arguments as to whether e-learning is advantageous to curriculum delivery or whether it is merely a tool delivering instruction and not influencing learning. The authors conclude that “e-learning should be no more or less effective than any other form of instructional delivery”. The authors further maintain that the effectiveness of e-learning depends on how well the system is designed in order to create the type of instructional experience that will make learning possible. Naidoo (2011: 114) argues further that technology as a solitary tool cannot teach anything. There has to be the presence of the human element, an essential component in the education process. Naidoo’s findings therefore imply that e-learning is an essential tool that can be used effectively to “leverage the lecturer’s time and energy” by aiding the learning process.

Kumar, Rahman and Daniel (nd: 32) believe that e-learning induces students to explore knowledge that they have already acquired. The authors maintain that in the teaching and learning process, the student’s ability (when collaborating with peers, independence, at knowledge production, involvement in an interactive learning process and project-based educational activities) is transformed when exploring information through e-learning. While e-learning provides a means of using technology to advance academic activities, students are equipped with technological skills which are necessary when they enter the work environment (King and Boyat 2014: 1272).

Apart from technology-enhanced delivery of teaching and learning, HEIs also envisage a technology-based curriculum as a means of attracting students. As much as teaching and learning is the core business of any educational institution, a business approach to education does exist, with the student being the customer. E-learning is an innovative way to deliver education and provide support to HEIs by adding value to their educational goals, reaping the rewards of increased student numbers, willing to "buy" the services offered by them (Long 2017: 2).

Finally, it is necessary to pay heed to how students from a few decades ago compare to the students of today, which shows a compelling need for e-learning in HEIs. Long (2017: 9) states that computers in classrooms were not commonplace 20 years ago. The author adds that currently, students are adept in the use of technology which is readily available to them, as these students have grown up immersed in a technological environment. Students enter HEIs with smartphones, tablets and laptops. It is thus their expectation of lecturers and HEIs to use these channels to re-invent teaching methodologies and for students to engage in fashioning their own acquisition of knowledge.

The diverse writings by various authors on the need for e-learning in higher education are indicative of how HEIs perceive e-learning, not only as a means to stimulate and develop skills for teaching and learning, but also as a means to improve business processes. E-learning has strengthened its importance in educational strategies, becoming the educational enabler of the 21st century and playing a critical role in the development of society, organisations and people (Aparicio, Bacao and Oliveira 2016: 58).

Acquiring knowledge and the development of skills are vital for growth and success. The effectiveness of using e-learning technologies for teaching and learning will be determined by the success rates of HEIs. Long (2017: 1) explains that the success of students and the advancements in technology are now intricately combined as a result of HEIs implementing e-learning technologies. It is therefore necessary to explore the teaching and learning ambit, as well as probe into the effects of e-learning for lecturers and students.

**2.4.1.5 E-learning for teaching and learning**

The concept of e-learning embraces both teaching and learning initiatives, thus providing the educational workplace with professional development for academics and continuing education for students (King and Boyatt 2014: 1272). Naidoo (2011: 106) believes that e-learning is a process which contributes to effective teaching as it bridges the distance between students and lecturers at institutions. The previous sections, particularly the need for e-learning in higher education, has surmised how e-learning strengthens curriculum delivery and contributes to attaining pedagogical goals. E-learning cannot be viewed as a concept in isolation which pertains only to learning or only to teaching. It is thus important to ascertain its significance for both lecturers and students.

Access to technology for teaching and learning is also vital in enabling e-learning as a pedagogical tool. However, McKnight *et al.* (2016: 194) argue that although access to technology is a critical element in converting traditional educational systems to digital, success lies in moving the focus beyond the technology itself and focussing on how technology enables teaching and learning. Tucker and Gentry (2009: 44) agree that although technology is an obvious component of e-learning, the focus should be on educational pedagogy.

Noor-Ul-Amin (2013: 38) believes that the use of technology in education is more inclined towards being student-centred, an approach that is different from education being a socially-oriented activity where teachers had high degrees of personal contact with students. E-learning therefore leans towards enriching students' pedagogical experiences and lessening the face-to-face interaction with lecturers.

In order to understand the challenges and best-practices of using e-learning for teaching and learning, it is necessary to understand the underpinnings of technology in pedagogy, more especially how e-learning impacts on student and staff practices in higher education.

#### 2.4.1.6 E-learning for students

HEIs implementing e-learning initiatives need to heed learning objectives and pay attention to good learning design, i.e. curriculum and course content planning, creation, delivery and implementation must expand the learning opportunities of students (Engelbrecht 2003: 29; Maphalala and Adigun 2021: 3). The intricacies of developing e-learning systems must focus on the ultimate result of student successes. It is necessary to determine how e-learning will impact on the process of learning for students. The ensuing discussion encompasses various capabilities of e-learning initiatives and their impact on the student domain.

##### 2.4.1.6.1 Visual Learning

Since the inception of schools and classrooms to facilitate education in communities, teaching and learning occurred with both lecturers and students meeting physically and in real time. This is the typical classroom scenario with face-to-face teaching (Alkhalaf, Drew and Alhussain 2012: 98). Traditionally, students were verbally instructed and then required to create a mental picture and comprehend what is required of them. Although traditional classroom settings did also allow for visual learning, technology enhances the visual demonstration of the tasks required to be achieved and has the ability to grasp the attention of any student and captivate the memory to the extent that a student is able to comprehend on a better level and deliver accordingly. In current times in academia, students exposed to a world of technology have become visual students. Hence, it is not surprising then that without visuals in a presentation, students may not learn effectively (Smaldino, Lowther and Russell 2008: cited in Bester and Brand 2013: 4). E-learning provides the flexibility and allows students to comprehend according to their own preferences while having access to instructions and materials at any given time.

#### 2.4.1.6.2 An improved system of higher education

While the application of e-learning is rapidly increasing in institutions of higher learning, there is a limited understanding of how this phenomenon has impacted on student experiences (Paechter and Maier: 2010). Naidoo (2011: 107) viewed e-learning as a process enhancing effective teaching, while Laurillard (2004: 1) questioned the importance of e-learning in higher education to determine the essence of how, if possible, a technology-driven curriculum can actually provide for an improved system of higher education. The literature reviewed thus far reveals how e-learning allows for students to download lecture notes and upload assignments, communicate with lecturers and, in turn, lecturers use e-learning as a tool to upload necessary information such as lecture notes, assignments, learner guides and past papers. Laurillard (2004: 1) therefore maintains that any student learning by means of information and communication technologies (ICTs) is using e-learning. Information communication technologies are interactive, supporting many different types of capabilities, including:

- internet access to digital versions of materials unavailable locally;
- internet access to search and transactional services;
- interactive diagnostic or adaptive tutorials;
- interactive educational games;
- remote control access to local physical devices, personalised information and guidance for learning support;
- simulations or models of scientific systems;
- communications tools for collaboration with other students and teachers;
- tools for creativity and design;
- virtual reality environments for development and manipulation;
- data analysis, modelling or organisation tools and applications; and

- electronic devices to assist disabled students.

#### 2.4.1.6.3 Refashioned study methods

The e-learning environment in HEIs has allowed students to have learning schedules more suitable to them and to enjoy the individualized support on this electronic network (Arkoful and Abaidoo 2015: 30). E-learning creates the opportunity for students to re-fashion how they learn, i.e. e-learning has re-fashioned students' studying methods with an emphasis on self-study and self-evaluation, student autonomy and self-reliance (Romiszowski 2003: 3). Whether e-learning occurs via synchronous, asynchronous (Wagner, Hassanein and Head 2008: 26; Arkoful and Abaidoo 2015: 31; Mandala, Abdullah and Ismail, 2013) or blended methods (Durban University of Technology 2014: 1; Zhao, Sintonen and Kynaslahti 2015: 7, Britto, Murugeson and Subramanian 2016: 94) of instruction, students are equipped to complete assessments independently; enjoy flexible learning and a self-paced method of study; participate in discussions; and become self-regulated learners.

Naidoo (2011: 107) maintains that e-learning can bridge the gap between stakeholders and educational institutions, thus encouraging a "self-determined learning process". E-learning, which is also viewed as a strategy in higher education, differentiates service provision, thus increasing the reputation of higher education institutions (Bauk and Jusufranic 2014: 29). Andrei and Stefan (2016: 286-288) confirm the array of possibilities of adopting e-learning as a revolutionary tool in the educational process. These stem from accessibility to material without being present in a classroom, to diversity pertaining to delivery of teaching material to a heterogeneous group of students and, of course, community, i.e. online communities that are socially interactive.

Re-fashioned study methods thus create opportunities for higher education students to have control over their own situations in learning in a self-paced and customizable manner (Arkoful and Abaidoo 2015: 30).

#### 2.4.1.6.4 Interactive learning

E-learning at HEIs enhances interactive learning as students gain momentum in collaboration and higher-order thinking when engaging in e-learning activities (Ramraj and Marimuthu 2019: 36). Bladergroen, Basson and Blaine (2018: 27) report that students are more inclined to reason, remember, connect and integrate their intake of information by being practically involved via blended learning opportunities. A study conducted by Bladergroen, Basson and Blaine (2018: 31) on the impact of technological innovations, i.e. a blended learning approach to pedagogy in a higher education institution, focussed on whether bringing in technology to facilitate learning would prove positive. The findings of the study indicated that students were in support of this innovation as it provided the opportunity for them to study in their own time, at their own pace and in their space, "having a back-up system during unforeseen circumstances or when consolidation, confirmation or revision for formal testing, tutorials and practicum were needed". Not only are the aspects of time, distance and self-paced learning attributes of e-learning, but scientific proof is available to support the fact that students are better educated and understand well through the interactive and motivating sessions of being taught via modern technological teaching aids (Deepalakshmi and Phil 2016: 68). Interactive learning with e-learning technologies thus enhances the willingness of students to engage in their courses.

#### 2.4.1.6.5 Motivated learners and improved understanding

Further studies conducted by Alkhalaf, Drew and Alhussain (2012: 98-104) on the impact of e-learning on university students resulted in positive outcomes for the process of learning. The analysis of the results showed that e-learning impacted positively on students' ability to understand and interpret information correctly. E-learning was a means of helping students to make important decisions effectively and accurately, ensuring an increase in overall productivity for teaching and learning processes. Another positive effect is the impact of e-learning on student motivation. The findings of studies conducted by Harandi (2015: 429) have proven that students are more likely to be motivated when applying e-learning. The author states further that motivated students are more likely to be engaged in the learning process and if engaged successfully, they will achieve successful learning outcomes.

#### 2.4.1.6.6 E-learning as an effective learning tool

Gomathi's (2016: 143-148) review of e-learning in its entirety sums up the effectiveness of e-learning as a learning tool in terms of easy access, qualitative learning, flexibility, self-learning and self-improvement. E-learning as an effective learning tool provides for the needs, abilities, learning styles and interests of students, allowing them to adapt to what is best suited to them (Arkoful and Abaidoo 2015 :36; Ramraj and Marimuthu 2019: 36; Lim and Wang 2017:3). The ease of access, breaking barriers of time and distance as well as the flexibility of enjoying a variety of learning experiences leads to more motivated and interested modes of curriculum instruction. Further to these accomplishments of e-learning, students who combine conventional learning methods with e-learning are successful in solving problems, gaining self-confidence and are propelled to continue further independent learning (Bednjanec, Tretinjak and Tretinjak 2015: 838).

Besides being effective in the learning process, e-learning is also deemed an effective teaching tool, as using technology to teach gives a better understanding of the curriculum, saves time and improves the communication skills of students and lecturers (Subramanian and Chitra 2016: 48). It is therefore necessary to determine the paradigms of e-learning for staff, and its effectiveness as a teaching tool.

#### 2.4.1.7 E-learning for Staff

Teaching has become more challenging as innovations in education are accelerating at a rapid pace. Ambedkar (2016: 12) claims that it is essential for teaching staff to incorporate innovative changes so that they can enjoy their teaching careers simply by incorporating new knowledge and technological advancements. E-learning has created a niche for teaching staff to expand and strengthen their knowledge and skills without remaining dormant with fixed teaching practices. Englund, Olofsson and Price (2017: 75) stress the importance of teachers using technology as a vital component in a student-centred approach to teaching if enhanced learning goals are to be achieved. The following themes focus on the various components offered by e-learning in the teaching ambit:

#### 2.4.1.7.1 Transfer of duties

Romiszowski (2003: 3) further emphasises that the introduction of any educational technology will transfer some of the duties of lecturers to online materials and instructional media, as in the case of e-learning. The author maintains that this thus changes the role of the lecturer from being the sole source of knowledge to now becoming a “guide-on-the-side” and managing an array of knowledge resources. The role of the lecturer now leans far from face-to-face delivery of subject content to being able to access e-resources around the globe and to fulfil their information needs, especially for teaching, learning and research and delivering relevant, up-to-date lesson plans (Saravanan 2016: 21). According to Sivagurunathan, Subramanian and Saravanan (2016: 89), using technology in teaching practices is an excellent way to supplement the teaching-learning process as this leads to lecturers integrating more interactive and effective methods and changing their role from “teaching” to “facilitating”.

#### 2.4.1.7.2 Flexibility of Time

Teaching with technology allows lecturers the flexibility of using social media, podcasts, video clips using hyperlinks and other technological platforms to provide students with a captivating lesson (Majanja 2020:319). This type of electronic teaching has transformed teaching methods and provided for the flexibility of lecturers to engage, assess and collaborate with students as and when arranged. Reif (2013: 14) maintains that lecturers are content with online courses and digital teachings since they allow them sufficient time to focus on providing quality education via detailed discussions, personal mentorship and project-based learning.

#### 2.4.1.7.3 Interactive teaching methods

Teaching methods need to evolve. E-learning will allow for interactive online teaching methods (Srivastava 2018: 24-25). Nhete, Sithole and Solomon (2016: 194) view traditional modes of teaching and learning as being irrelevant and outdated, with a view that teaching staff now need to adopt interactive teaching methods. The authors believe that interactive teaching methods include the adoption and exploitation of the latest technologies for teaching and learning. However, Moonsamy and Govender (2018: 3069) reveal that there still exists a "mis-alliance" between how teaching occurs in many HEIs, with traditional face-to-face lectures and the use of printed textbooks; while other institutions focus on investing in online learning technologies. The authors maintain that there needs to be a progression from the traditional blackboard to the interactive white smartboard.

#### 2.4.1.7.4 Curriculum Delivery

Although there has been a transition from traditional classroom scenarios to online classrooms, education still provides for collaboration, engagement, assessment, interactivity and accessibility. Majanja (2020: 319) confirms that lecturers find innovative and creative ways to deliver their lessons, thus motivating their students. An array of terms is used to describe how teaching and learning occurs in present times, such as "digital learning", "online learning" and "e-learning", whereby lecturers are using these online tools strategically. Curriculum delivery is now becoming more engaging and more effective in multiple institutions (Chelladurai and Pitchammal 2016: 83).

#### 2.4.1.7.5 Professionalism

E-learning offers the opportunity for professionalism for teaching staff. Enhanced resources to support teaching and learning; the planning and preparation of subject content; a sharing of resources, expertise and advice; as well as access to update students, will lend credit to professionalism in teaching (Manikandan 2016: 125). Anshari *et al.* (2017: 3066) believe that the effective use of e-learning systems will only be attained when lecturers learn how to interact and use the system properly, i.e. lecturers have to be responsive to online student requests; be able to deliver interactive and attractive teaching materials; and be able to assist students to achieve the learning objective of the lesson.

**2.4.1.7.6 Tracking student progress**

Zhang and Nunumaker (2003: 214) believe that e-learning is effective for teaching staff to keep track of the learning progress of individual students, thus allowing for the appropriate levels of materials to be disseminated to students. Such essentials in the teaching environment creates opportunities for teaching staff to effectively manage education and training, as well as tailor curricula to meet the needs of students. Kumar, Rahman and Daniel (nd: 34) agree that teaching via e-learning requires staff to comply with "customers' requirements" as staff need to create quality e-learning programmes in order for the transfer of knowledge to be efficient and effective. It is essential for teaching staff to carefully study students' expectations in order to provide the most appropriate learning tools for quality, successful e-learning programmes.

It must be borne in mind that in as much as institutions of higher learning are moving forward by endorsing e-learning as a core teaching and learning function, academic staff development in e-learning needs to be provided on an on-going basis (DUT E-learning Policy 2016: 4). Lecturers devising courses via e-learning now become designers of "experiences, process and contexts" that are essential in learning activities. The transition from the traditional classroom to the virtual classroom requires lecturers to not only have the "analytic and rational know-how", but also "creative abilities and psychological sensitivity" to design "engaging and effective" course content (Cantoni, Cellario and Porta 2004: 337).

The digital pedagogical environment and its impetus on e-learning has transformed teaching activities as lecturers transition from the whiteboard to teaching with technology. Majana (2020: 319) confirms that lecturers, from being the "all-knowing and almost the only authoritative source", can now create an enriched learning environment for their students though a blend of learning interactions and innovative and creative lessons. E-learning has thus enhanced the ability of lecturers to be professional, transfer some of their duties, track their students' progress and create captivating classes.

With the focus on how e-learning impacts on both students and staff, it is necessary to unpack the effectiveness of using e-learning in higher education.

#### 2.4.2 The effectiveness of using e-learning for teaching and learning in higher education

Various authors (Majanja 2020; Kumar, Rahman and Daniel nd; Manikandan 2016; Saravanan 2016; Srivastava 2018) have concurred that using e-learning is a convenient way to pursue higher education. The different areas in which the effectiveness of using e-learning technologies are highlighted and set out below.

##### 2.4.2.1 Promoting self-efficacy and self-regulated learning

Watts and Ibrahim (2016: 182) believe that e-learning promotes self-efficacy, i.e. how students feel, think, motivate themselves and behave. The authors believe that e-learning results in self-regulated students who respond to educational demands flawlessly.

E-learning also provides for a flexible, self-paced method of study. Students have the freedom to login to their workstations at any given time to complete tasks at their convenience (Gomathi 2016: 145). Flexibility also exists in terms of the technologies used to facilitate collaboration and interaction, enhancing communication, writing and problem-solving abilities (Long 2017: 10).

E-learning also facilitates improved interactions between students and lecturers, as well as peer-to-peer learning, allowing students to take collective responsibility for determining their own learning needs and how they can be addressed (Long 2017: 11; Duluta and Mocanu 2016: 288).

##### 2.4.2.2 Accessibility and flexibility

Duluta and Mocanu (2016: 286) believe that e-learning tools provide for the undoubtable advantage of overcoming time and space constraints, as is the scenario with traditional lecture-hall environments. The authors maintain that regardless of location or time, e-learning systems allow for student participation in courses through the use of multiple devices (desktops, laptops, smartphones, tablets) as well as via video conferencing (Duluta and Mocanu 2016: 288). Majanja (2020: 319) confirms that e-learning provides students with the space and time to select and process learning materials, while lecturers have the flexibility of uploading notes and course content for students to peruse before the next lesson.

Wright *et al.* (2017: 35) believe that using technology for teaching includes the "efficiency of communication, storage of materials, access to materials, discussion classes, engagement, instant feedback and out of class interactions", a paradigm which contributes to ensuring that lecturers have the flexibility to engage with students and learning materials at convenient times.

**2.4.2.3 Diversity**

Lecturers work with heterogeneous groups of students, which makes e-learning an ideal means of delivery as it provides for materials to be disseminated on different levels (Duluta and Mocanu 2016: 288). E-learning creates the flexibility for a lecturer to deliver his materials in multi-lingual formats as well (Bozalek, Ng'ambi, and Gachago (2013: 420). E-learning provides the ease of sharing prepared lessons as lecturers have the opportunity to address the diverse learning styles through platforms where students can communicate their ideas and lecturers can make informed decisions on curriculum delivery (Majanja 2020: 319).

**2.4.2.4 Creation of learning communities**

Lecturers create dynamic learning environments through e-learning via interactive elements, namely animation, simulation and the visual adaptation of learning materials, which are accessible to students who communicate with peers on ideas and perceptions (Majanja 2020: 319-320). These interactions result in the creation of learning communities. Duluta and Mocanu (2016: 288) state that e-learning systems provide basic tools that are accessible to all students, thus allowing information to be easily shared. Lecturers can communicate with students either via a "one-to-many" or "one-to-one" or "one-to-some" level. The authors add that students are at an advantage as all students can receive the same information at the same time. The initial creation of e-learning platforms provides for great communication channels as information about various events that impact on students or information pertaining to learning materials can be disseminated at the same time to all students (Laurillard 2004: 10). In the current available systems, students also contribute to the study materials which allow for updated materials to be available to all students all the time (Srivastava 2018: 25). Personalised web environments provide for joint discussion forums within classes or groups, creating greater flexibility.

#### 2.4.2.5 Evaluating process

According to Duluta and Mocanu (2016: 289), e-learning platforms allow for the uploading or downloading of information and materials. The authors maintain that students no longer need to submit printed hardcopies of work or projects to be assessed as these are simply uploaded to the e-learning system. Deadlines and due dates are no longer an issue. E-learning systems also have built-in software detecting plagiarism flaws. Evaluating students' tests and examinations via e-learning is advantageous to students as they receive their results immediately, thus contributing to improved learning and performance (Alruwais, Wills and Wald 2018: 35). The authors add that lecturers benefit from such services in an e-learning environment as it is less time-consuming than assessing hardcopies and improves the quality of feedback to students.

#### 2.4.2.6 Feedback

Duluta and Mocanu (2016: 290) confirm that it is easier for students to provide feedback to lecturers when done from behind a monitor. The environment provides anonymity, with no pressure from lecturers. Feedback is critical to a lecturer for improving his classes. Equally important is giving feedback to a student as a student needs to understand his strengths and weaknesses, thus allowing him the opportunity to improve his work.

E-learning has provided extensive opportunities to students, making it possible to participate in discussions similar to face-to-face settings. Students are encouraged to exchange ideas, increasing their learning experiences and providing for new visions and viewpoints (Alkhalaf, Drew, AlGhamdi and Alfarraj 2012: 1200). Apart from the collaborative learning that e-learning provides opportunities for, authors' writings reviewed in this study have viewed e-learning as an innovative tool for flexible and self-regulated, self-paced learning, thus allowing for intellectual development (Bladergroen, Basson and Blaine 2018: 27; Deepalakshmi and Phil 2016: 68; Alkhalaf, Drew and Alhussain 2012: 98-104).

It is interesting to note that e-learning is just one aspect of technology that has impacted so profoundly on teaching and learning. Technological innovations or digital technology offer new paradigms for university education (Cantoni, Cellario and Porta 2004: 334). Apart from assessing the impact of the e-learning evolution on teaching and learning, it is also important to assess the contribution of digital technologies and innovations generally and the role they have played in the transition of traditional HEIs to digital HEIs.

### 2.4.3 Digital technology and its impact on teaching and learning in higher education

Rapid technological changes in curricula and the awareness of such changes pose challenges to both lecturers and students in higher education. The success of technology deployment in HEIs depends on institutional-level characteristics and the capacity of the institution as a whole, as well as trained end-users (Long 2017: 5). McKnight *et al*. (2016: 194) deem technology integration into curricula as irrational if an institution does not portray elements of readiness in terms of its access to devices, infrastructure, the technological readiness of lecturers and students, and web-based curricula. The authors argue further that the determinants of successful technology integration in higher education ultimately focus on the reliable use of the technology for teaching and learning by staff and students. Access to the technology is important. However, it is imperative to focus beyond the technology itself to how it (technology) enables teaching and learning. The increasing influence of technology in HEIs has resulted in the "e-learning revolution", creating demands on stakeholders and making it impossible for them to ignore their roles and responsibilities (Choudhury and Pattnaik 2019: 1). This section thus discusses the impact of digital technology on HEIs and their stakeholders, with reference to the transformation of the higher education environment.

**2.4.3.1 Transition from the traditional classroom to the digital classroom**

Bester and Brand (2013: 1-2) believe that classroom teaching consists of “a teacher who teaches and learners who learn”. The authors surmise that this relationship is further enhanced by many internal and external factors that influence the significance and the excellence of teaching and learning. Such factors include the relationship between teachers and students. Teachers ensure that the focus of the student is targeted at learning. Once that is achieved, a student’s attention is captured and eventually leads to much desired concentration development. The authors add that if a student’s focus is diverted away from the target, then the concentration level has dwindled.

Besides internal factors of zoning in on the students’ attention and concentration levels, another factor influencing the “teaching and learning” relationship is the inclusion of technology in curricula. The incorporation of technology into teaching and learning lends focus to the abolishment of the ‘sage on the stage’ notion (Cowling and Brack 2015).

However, Bester and Brand (2013: 5) believe that although technology cannot replace the lecturer, it can be incorporated into the teaching and learning environment and curriculum, thereby maximising the learning experience since it has now become an integral part of the world of today’s students. Although technology appears to have profound implications for the education sector from kindergarten to doctoral studies and from schools to HEIs, Bhorat (2014: 19) believes that technology will not necessarily replace the “face-to-face method” traditional classroom or the physical campus infrastructure. Studies conducted by Bladergroen, Basson and Blaine (2017: 31-32) conclude that although students welcomed the technological innovations in teaching and learning, the need for face-to-face exposure is expected as it has been an expectation created from primary school education. The transition from traditional to digital classrooms may modify certain aspects of teaching and learning, but not all teachers or students may be willing to conform to the transition.

Education is important in ensuring a better quality of life. Having obtained an educational qualification is not only an aspiration for personal development, but also necessary in positioning oneself in the employment sector (Teare, Davies and Sandelands 1998: 9). The authors posit that education provides for ensuring equality in achieving routes for the betterment of livelihoods and HEIs can provide such education in a more viable way by the efficient use of new communications technology. The authors add that traditional education will contribute to gaining improvements in personal development, but education coupled with technology contributes to the recognition of qualifications globally.

Gumport and Chun (2000: 12) investigated how technology can impact on higher education, whilst also acknowledging its relevance and interdependence with the current opportunities and pressures applicable to HEIs. The authors state that transitioning from traditional to digital classrooms will bring with it various considerations because as much as technology is viewed as the reason for innovation in teaching and learning, considerations regarding acceptance, affordability and its effectiveness as a pedagogical tool should be regarded with the utmost attention. Studies conducted by Natow, Reddy and Grant (2017: 25) raise concern relating to not only implementing technology for innovation in education, but also acknowledging the reality of being circumspect in terms of organisational culture, organisational need, resource availability and the difficulties that end-users experience when using technology.

According to the South African Department of Higher Education (2017: 364), technology-enhanced learning is a combination of using fixed or mobile hardware devices coupled with software applications of text, audio and visual files and communication, thus offering structured learning.

Literature on the evolution of technology that was reviewed in this study has been discussed in some detail. It is evident that the focus remains on how digital resources such as smart watches, laptops, tablets and social networking have contributed to the transition of traditional classrooms to digital classrooms.

The South African Department of Higher Education (2017: 364) further maintains that learning through technology can be either synchronous (online), asynchronous (online) or offline. Synchronous learning can occur via real-time conferencing while asynchronous learning can occur via text-based discussion forums, while off-line learning can occur via interactive or resource-based CD/DVD/flash drive (The South African Department of Higher Education (2017: 364). The potential of technology in education ranges from maintaining the attention of students to motivating students to pay attention as students have the support of ICTs for in contact, blended and distance programmes (Sife, Lwoga and Sanga 2007: 1). The authors maintain that not only does technology contribute to the "captivating attention" aspect in teaching and learning, but students have the opportunity of anytime, anywhere, any device, self-paced, collaborative learning options. French and Kennedy (2017: 641) agree that the sophisticated technologies for education have led to innovations such as online video lectures, resulting in alternatives to campus-based learning. The pedagogic and socio-economic forces offered by technology enhanced education prompts HEIs to integrate technology into teaching and learning, with the outcomes of greater information access; greater communication; synchronous and asynchronous learning; increased cooperation; cost effectiveness; and pedagogical improvement (Sife, Lwoga and Sanga 2007: 1).

What are the implications then for incorporating technology, digital and online learning into teaching and learning? Technology in education supports current trends in learning design, ushering improvements with students' assessments, i.e. how they learn and what they learn. These technologies have "the capacity to draw students into wholly new and richly vivid learning experiences" (Grajek: 2018).

As much as various authors have discussed the wonders of technology in higher education with teaching erasing the "sage on the stage" component, arguments echo the sentiments of technology facilitating a shift from passive learning to more active learning. Classrooms transform from being faculty-centred to being more student-centred. Students become co-creators of content, enabling better interactions with their peers (Grajek: 2018).

Globally, the use of the internet and technology, and life, have been inseparable from each other. Ramraj and Marimuthu (2019: 35) indicate that recent trends in knowledge sharing and the learning systems at HEIs show tremendous growth in teaching and learning through technology applications in curricula. According to Kumar *et al*, (nd: 29), the learning ability of students has greatly improved owing to the use of web-enhanced technologies providing for advantages such as convenience, speed of communication, access to information, instant feedback and cost effectiveness. The authors argue that these factors have influenced the educational industry to delve further into the conversion of traditional classrooms into digital classrooms, with ever evolving and innovative methods of teaching and learning. Such factors can be investigated further to determine the influence that technology brings to the fore in the birth of digital classrooms.

#### 2.4.3.2 Factors influencing the incorporation of digital technology in classrooms

As discussed in previous sections, greater information access; greater communication; synchronous and asynchronous learning; increased cooperation; cost effectiveness; and pedagogical improvement are some the outcomes of incorporating digital technology in classrooms. The following discussion looks at the factors influencing digital technology for education and learning.

#### 2.4.3.2.1 The transitions from a “brick” university to a “click” university

Just as technology brings about competitive scenarios and triggers organisational change, HEIs are transforming their core function, teaching and learning in the same way to keep abreast with what is globally required.

The digital revolution has transformed the world of education and Collins and Harvelson (2009: 1) compare this transformation to that of the transition from apprenticeships to universal schooling that occurred in the $19^{th}$ century as a result of the industrial revolution. They conclude that new technologies have created learning opportunities that challenge traditional schools and colleges. Dennis (2018: 3) reiterates the unavoidable pollination of technology in higher education. The author states further that traditional methods should be replaced with innovative methods. It is necessary to replace what has been done in the past with what is necessary for the future.

Long (2017: 9) posits that there is a shift in how HEIs function currently, i.e. HEIs are moving from being one-dimensional traditional campuses to becoming multi-dimensional, embracing physical and online delivery systems. The author further states that online degree programmes are now mainstream and widens access to education; expands new markets for delivering content; and increases revenue potential for HEIs.

#### 2.4.3.2.2 Enhanced learning

Technology enhances learning through the aid of new technologies. Collins and Harvelson (2009: 1) conclude that learning with technology has enabled people of all ages to pursue learning at their convenience. The author posits that children can indulge in complex video games; workers are interact with simulations that put them in challenging situations; students enrol at online high schools and colleges; and adults consult with Wikipedia. Over the decades, technology has contributed to the “re-design of teaching and learning activities”, thus transforming the learning experience of students (Kirkwood and Price 2013: 24).

The traditional teaching methods revolved around content in textbooks, with emphasis on rehearsing such content through presentations and tutorials. Technology has enhanced learning through the use of technological devices for learning, transforming pedagogy and changing the emphasis from curricula that focussed on "what information is" in textbook scenarios to how "information will be used" in the digital age (Noor-ul-amin 2013: 39).

Enhanced learning can be achieved via digital technology through peer-to-peer learning, collaboration amongst students and active or participative learning (Long 2017: 11). The author further believes that active learning enhances student achievements as students work in a "learn by doing" environment, while peer-to-peer learning is achieved by online interactions to reach mutual consensus and discussions and collaboration also enhances learning as it is a team-based approach.

Enhanced learning as an outcome of digital technology in education is further enriched by competency and performance.

**2.4.3.2.3 Communication and collaboration**

Technology facilitates the use of communication tools such as email, online group discussions and team-building. Technology is re-shaping knowledge, literacy and pedagogy in the present-day classroom (Jewitt 2006, cited in Bester and Brand 2013: 4). The author adds that integrating technology into higher education can prove beneficial to students as well as teaching staff. Access to learning material on digital devices eradicates the need to carry around books. Long (2017: 18) states that it is evident that having access to information on the world-wide-web, tutorials, email facilities and other media whilst on the go is escalating significantly with increased technological advancements. The author further maintains that the number of mobile computers and cellular phones is on the increase and ease in accessing information is certainly one of the crucial advantages of using technology in education, thus enriching lifelong learning and collaboration skills amongst students.

Agbatogun (2013: 333) looks at interactive digital technologies in education as an effective means of widening educational opportunities. The author mentions further that technological devices allow students to annotate texts, making virtual notes and defining unknown words with ease using digital dictionaries. These capabilities of digital technologies do not only impress upon good communication, but create further advantages, for instance, the reduction of costs as digital books is sometimes far cheaper than purchasing hard copies.

According to Anshari *et al.* (2017: 3063), in as much as learning in HEIs is imperative, so is communication. Communication is enhanced through the use of technological devices such as smartphones and HEIs want to embrace such devices as a learning aid. The authors also state that these devices enrich communication and collaboration as they provide for convenience, portability, comprehensive learning experiences, multi sources and multitasks, and are environmentally friendly.

#### 2.4.3.2.4 Flexible learning

Discussions in the previous sections mentioned the flexibility of teaching and learning with digital technologies. World-wide practice portrays people taking their education out of school into homes, libraries, Internet cafes and workplaces, allowing them the flexibility to decide what they want to learn, when they want to learn and how they want to learn. Flexibility is a concept which is difficult to quantify, but appeals to both students and lecturers. Traditional classes require students to gather at the same time and same place, while digital learning allows students to engage in classroom activity and materials at any given time and as often as needed (Collins and Harvelson 2009: 1; Reif 2013: 44).

Borboa *et al.* (2014: 18) comment on the “new age of learning” and the profile of the modern student. The authors point to the fact that students are saddled with obligations of family, work and society, thus forcing them to change their study habits, which includes integrating new technologies into studying and into communications. Technology empowers students to engage in their learning processes, enhancing their interest in their personal education

(Manikandan 2016: 125). The author also surmises that the flexibility of collaboration and the ability to learn more effectively is beneficial to students who have other responsibilities and obligations, thus allowing them to focus on their studies at times convenient to them.

**2.4.3.2.5 Distance**

The rapid advancement in instructional technology has abolished the barriers that existed in education, thus providing educational opportunities to "anyone-anytime-any place" (Beaudoin, Kurt and Eden 2009: 275). Students today have integrated technology into their lives in some way or the other. Bester and Brand (2013: 4) believe that although technology cannot replace the teacher in the classroom, it can "maximise the learning experience". The idea of integrating technology into traditional educational structures brings with it not only an array of possibilities to overcome limitations in terms of distance and time, but also aspects such as feedback, communication and diversity of materials (Duluta and Mocanu 2016: 286). Technology not only bypasses geographic constraints, but also those financial boundaries which impact on students accessing educational resources.

**2.4.3.3 Moving forward**

In reporting on the proceedings of the conference of the International Association of University Presidents (IAUP) in Japan's port city of Yokohama, Kakuchi (2014) stated that innovation and technology in higher education to meet the world's rapidly changing needs emerged as the main focus of higher education leaders. Globally, the concept of technology in education is perceived as being of utmost importance and will transform higher education to further produce students who will be ready for the world of work. The author adds that digital technologies enable technology savvy students to have an advantage in a business world which is riddled with tough career choices and competition. Collins and Harvelson (2009: 7) believe that the technological revolution will lead to a golden age of learning, enabling people to find resources to pursue any education they may want. Long (2017:18) agrees that digital technologies enable a way forward by providing students with new and readily available technology, improving learning outcomes, with HEIs producing self-sufficient world-class citizens.

So where are we now? According to Grajek (2018), technology has become so advanced that our understanding of how to use digital tools has become more sophisticated and new technologies that have emerged in teaching and learning spaces and educational institutions are now beyond tools like digital projectors and flat-screen display. Emerging technologies for teaching and learning opened doors to rich, vivid and active learning potential and experiences. In 2020, the rapid growth of education with the adoption of ICTs for education shows the illustrious nature of e-learning and how its adoption has become mainstream in HEIs (Al-Fraihat *et al.* 2020: 67).

### 2.5 Conclusion

Chapter 2 was an in-depth evaluation of the literature and findings of previous studies. The review of related literature in Parts A, B and C of Chapter 2 summed up the relationship between technology in higher education, teaching and learning in higher education and the use of e-learning in teaching and learning in higher education.

This chapter reviewed the use of technology in HEIs and its role in academia in institutions in other countries as well. A historical review of the establishment of UoTs in South Africa set the stage for the transformation of technikons to degree awarding UoTs. UoTs, as the name suggests, need to embrace the use of technology for their pedagogical practices, thus fulfilling their purpose of producing social and technological innovations via graduates.

The ever-evolving and sophisticated technologies were discussed, with an overview of devices and how their use is embedded into the paradigm of teaching and learning. To acknowledge how technology impacts on teaching and learning, it was important to understand the concepts and paradigms of teaching and learning in a higher education environment. The use of technology in HEIs over the years has resulted in the adoption of e-learning as a tool to promote digital pedagogy. The definition, background, dimensions, effectiveness and overall role of e-learning in teaching and learning have also been discussed.

The next chapter focuses on the use of e-learning technologies at UoTs and illustrates the challenges and best-practices of e-learning for teaching and learning. The chapter also discusses the impact of the Covid-19 pandemic on the higher education sector and its implications for e-learning.

# CHAPTER 3: LITERATURE REVIEW

# THE USE OF E-LEARNING TECHNOLOGIES AT UOTs- CHALLENGES FOR TEACHING AND LEARNING, AND BEST-PRACTICES

## 3.1 Introduction

Chapter 2 presented a literary analysis on the broad spectrums of higher education and innovative technologies. The discussion emphasised teaching and learning within the higher education ambit, focussing specifically on how teaching and learning takes place, with an overview of the challenges experienced by lecturers and students. The discussion then elaborated on the infiltration and impact of technology in relation to the pedagogical environment, followed by an overview of how teaching and learning practices have digitally evolved.

Although it is evident that mobile and wireless technologies are evolving rapidly to influence teaching and learning processes, the acceptance and implementation of technology in teaching and learning does reveal certain challenges. John and Wheeler (as cited by Bester and Brand 2013: 5) state that despite the innovative tendencies of teaching staff, they are still grappling with the use of technology in their teaching practices. The authors add that although some teaching staff have decided to grasp the latest trends in technology, others are just not bothered, whilst still others do not have any technology at all to use. However, in 2020, the enforcing factor for teaching staff to engage with and adopt technology in their teaching practices was the worldwide spread of the Covid-19 pandemic (Bao 2020: 113). Although this study began in an era where Covid-19 was non-existent, the challenges in adopting technology for teaching and learning were just as rife.

It is not only lecturers who are subject to technology challenges, as was evident in a study by Paechter and Maier (2010: 297) which focussed on students' experiences and preferences in using technology for learning. The authors indicated that information on e-learning platforms are merely just presented, resulting in a lack of interactive learning material which could provide for exercises, self-tests and self-regulated learning, amongst other opportunities. When compared to the face-to-face learning format, e-learning requires students to dedicate more time to learning the subject matter. Biswas (2020: 2041) argues that students lack self-discipline and a good learning attitude, as well as a good learning environment, to engage in e-learning.

Challenges for teaching and learning with technology can be overcome if the appropriate measures are applied and best-practices are inherited (King and Boyatt 2014: 1272-1280). The authors state that institutional infrastructure, staff attitudes and attributes, as well as perceived student expectations, are what contribute to the successful implementation of e-learning technologies for teaching and learning.

This chapter is therefore divided into three parts, the first of which highlights the challenges with teaching and learning with technology, and the second examines the best-practices that lecturers and students deem important for the success of e-learning. In the third part, the chapter presents the impact of the Covid-19 pandemic on teaching and learning in HEIs, with specific focus on e-learning practices.

### 3.2 Part A: Challenges with the use of technology for teaching and learning at HEIs

This section focusses on the challenges that lecturers and students experience when engaging with a digital curriculum. Amutha and Sudha (2015: 98) affirm that the landscape of education has changed and that technology has permeated almost all disciplines and courses, rendering education more of an online environment. The authors add that higher education institutions are challenged by the effective use of technology, whilst still trying to maintain their commitment to academic quality. The technological hype is real, with great investments being made by institutions trying to determine the most feasible platform to educate their students. However, the question of this new and infiltrating educational development still needs answers on the effectiveness that it renders (Willging and Johnson 2009: 115).

### 3.2.1. Teaching challenges experienced with the use of technology at HEIs

Converting conventional learning material to an e-learning platform will require minimum essentials for e-learning. Mouyabi (2010: 1187) does not consider e-learning an optimal solution for HEIs, but argues that it does have potential challenges and problems which HEIs need to take cognisance of. The author further notes that unreliable technology; technical issues for both teachers and students; time and commitment to training in e-learning; resistance to change; and adapting to new teaching approaches are just a few challenges in this process. Kebritchi *et al.* (2017: 5) agree that the critical issues of communication, time management, pedagogy and assessments are areas of concern that affect the quality of online education.

#### 3.2.1.1 Challenges for lecturers in adapting to change/reluctance to invest additional input

Some lecturers are less eager to adopt e-learning to support their teaching as they find it difficult to adapt to change, whilst yet others question the benefits of e-learning in relation to conventional teaching. King and Boyatt (2014: 1275) posit that staff who are already established in an organisation's teaching environment may find it difficult to adapt to new teaching approaches. The psychological impact for academics, i.e. the change in mindset, becomes the fundamental cog in accepting the revolution of pedagogical principles and practices (Stigler and Givven 2017: 84). The conjecture by the authors is that academics need to be convinced that a method that is different from the traditional is more feasible for their students, before they are actually willing to adopt any such method. Moonsamy and Govender (2018:3071) add that although technology is beneficial for communicating with students, lecturers are concerned also about losing their face-to-face interaction with them.

The inability to adapt to innovative methods of teaching with technology can render challenges for lecturers' teaching environments. Allen and Seaman's (2015: 6) investigations aver that delivering curricula via technology is inhibited due to the reluctance of lecturers to invest the additional effort. Faculty members vary in practice, with dissimilar attitudes, making the acceptance of technology systems in traditional teaching that much more difficult. Chimbo and Tekere (2014: 68) also believe that in any implementation of academic innovations, the willingness of lecturers to adopt such is imperative for the innovation to be deemed successful. Depending on their fields of specialisation, lecturers evaluate whether technology makes their jobs easier, or not. It is therefore important to engage lecturers to be flexible and adapt to the changes in emerging pedagogical technologies.

#### 3.2.1.2 Rigid teaching practices

Teaching practices are highly influenced by lecturers' pedagogical beliefs and their tried and tested methods of course delivery. Results of a study carried out by Buchanan *et al.* (2013: 8) indicate that faculty members doubt how technology enhanced learning methods would be best suited for their subjects. Many felt that using new methods were risky, thus creating inhibitions on how "useful or useable e-learning approaches" would be for the various areas of teaching.

Lautenbach (2010: 699) posits that lecturers comprehend with and can divulge more to students in traditional classroom settings as there is always the "ownership" of learning materials by the lecturers. Most teaching staff are not comfortable when engaging in technology for teaching practices, hence the preferred traditional methods of teaching are still practised. In this way, lecturers have control over the teaching environment, as well as the content delivered.

Mapuva (2009: 7) posits that lecturers are no longer only the knowledge source but also the knowledge navigator, using technological tools to deliver content. It is therefore incumbent upon lecturers to be receptive to changes and embrace technology to deliver effective learning. Moreover, lecturers are considered to be responsible for instructing, designing and implementing course content in e-learning environments in HEIs (Choudhury and Pattnaik 2019: 8). The authors believe that the failure to infuse modern and traditional methods of teaching leads to an ineffective teaching environment. In investigations carried out by Blin and Munro (2008: 487) on why technology had not on impacted lecturers' teaching practises, it was proven that technology for teaching was used mainly to disseminate notes online, which apart from saving institutional costs of printing and photocopying, only replicated what lecturers did in face-to-face delivery. Kebritchi *et al.* (2017: 11) argue that lecturers are not willing to change their teaching strategies from face-to-face instruction to online instruction as generating new learning content or adjusting learning materials for online delivery is challenging, especially if there is a lack of support and training. However, Dhawan (2020: 7) states that e-learning is no more an option, it is a necessity, as the Covid-19 pandemic has fiercely urged lecturers who were reluctant to change to now accept modern technology. This enforces the transformation of teaching practices.

#### 3.2.1.3 Lack of skill/knowledge in the use of technology

Teaching with technology is not as simple as using an email system or browsing the web. Moonsamy and Govender (2018: 3071) portrayed the challenges expressed by lecturing staff in terms of "usability and technical issues" of teaching with technology. Navigation using technological tools in educational programs proved challenging. Asabere *et al.* (2017:168) agree that lecturers have inadequate knowledge of using technology for teaching. In addition, with the constant advancements in technology, lecturers do not have the necessary skills to cope with new technologies. Mouyabi (2010: 1187) concurs, stating that lecturers may not be prepared to implement activities for students due to their lack of skill with the technology, thus students can be "left in the lurch" without support.

Mapuva (2009: 6) argues that the success of e-learning methods can only be measured according to the effectiveness of its delivery. However, the dynamic nature of technology proves challenging as staff need to be constantly trained in e-pedagogy. The author further explains that inadequately trained lecturers delivering lessons in an e-learning environment can become an obstacle in the application and perception of students. Bozalek, Ng'ambi and Gachago (2013: 433) explain that it is imperative for lecturers to have the appropriate facilitation skills and develop technological skills for effective e-learning delivery. The authors add that as much as emerging technologies are deemed important and useful across all educational platforms, the lack of digital literacy skills hampers the ability to enhance teaching via technology. The fast-paced nature of technology applies pressure on lecturers who lack technological skills as feedback to students, the preparation of course content and lecturers' availability online become a requirement for teaching with technology (Roddy *et al.* 2017: 4). Lecturers tend to not use the technology available to its full potential due to the lack of their skills in developing interactive e-learning activities (Maphalala and Adigun 2021: 9). Improving technological skills and knowledge is a crucial priority to ensure success in teaching with technology (Dhawan 2020: 16).

#### 3.2.1.4 Lack of engagement with technology

Technological ability and complacent attitudes may impact negatively on how lecturers perceive technology for purposes of teaching (Dhawan 2020:16). Lautenbach (2010: 702) looked at factors that could affect teaching with technology stemming from lecturers' engagements with technological tools. The author further states that although all lecturers may want to engage with educational technologies on a daily basis, the outcomes for each will differ, hence reflecting on their teaching practices.

Mapuva (2009: 7) explains that lecturers may not be resistant to technological application, but are simply confused as to how to implement technology into their formal teaching methods. The author further states that lecturers who have just joined the profession are more likely to be engaged in the information age, as compared to those in previous years, thus they are more likely to engage in and accept technological advances in teaching methods. However, Majanja (2020: 319) adds that apart from knowing the technology, lecturers need to be able to plan, select, combine and direct skills and the use of technology for educational purposes.

Although new age lecturers are more inclined to use technology to support students' capacity to apply knowledge and skills, Bozalek, Ng'ambi and Gachago (2013: 433) believe that teaching with emerging technologies requires engagement with the new digital pedagogical paradigms and approaches, thus ensuring collaboration in an educational space where searching, connecting, collecting and creating via technology is enhanced.

#### 3.2.1.5 Poor infrastructure and the lack of access to technology

The results of studies conducted by Tarus and Gichoya (2015: 3) on the implementation of educational technologies in Kenyan Universities leaned towards reliable access to computers and to the e-learning environment. The authors focussed on how the lack of proper devices and proper infrastructure creates barriers for lecturers to engage successfully with e-learning initiatives. Lautenbach (2010: 702) adds that teaching with technology proves challenging with outdated desktop computers and laptops when lecturers attempt to engage in innovative methods of teaching.

Buchanan, Sainter and Saunders (2013: 1) believe that although faculty training and digital literacy initiatives play a major role in teaching with technology, it is also important to strategize on structural factors such as the provision of resources and technical support. Similarly, Islam, Beer and Slack (2015: 106) believe that technical support for academics is lacking in HEIs, yet the desire of learning success and the profound use of e-learning technology is the core focus. It is apparent that the developing countries struggle with e-learning initiatives due to the insufficient investments in equipment, infrastructure and resources (Asabere *et al.* 2017: 167). There needs to be sufficient access to Wi-Fi and bandwidth to access resources. Maphalala and Adigun (2021: 2) affirm that infrastructural requirements are fundamental for success in e-learning. However, efforts to engage in e-learning by lecturers of HEIs in developing countries are hampered by the low rate and speed of network connectivity. The quest for learning success via technology in HEIs is therefore met by "insufficient investment in infrastructure and technological assistance" (Islam, Beer and Slack 2015: 106). The authors further declare that critical to the success of e-learning technology is the absence of technical errors and hindrances, slowness in systems and bugs. If systems do not function appropriately, this creates a negative impact on e-learning teaching outcomes.

#### 3.2.1.6 Lack of comfort in using technology

There have been major discussions on educators and technology focussing on the level of comfort or fluency with technology experienced by those who taught for 10 years or more (Maphalala and Adigun 2021: 3). Teaching staff are more proficient with common technologies like word-processing software, email systems, web browsers, etc. In terms of field-specific technology, there is a decline in how proficient teaching staff actually are (McKnight *et al.* 2016: 198). The authors add that some technologies, e.g. Smartboards, which are commonly found in educational institutions, have not been utilised by more than half of the teaching staff.

The lack of comfort in using technology is further increased due to the ever-evolving nature of technology. Changing work patterns, techniques of traditional teaching and lesson plans need to be continuously adjusted to accommodate upgrades and innovations in technology for teaching (Mapuva 2009: 6). Kebritchi *et al.* (2017: 18) affirm that the level of comfort plays a major role in the willingness of lecturers to teach online as lecturers may attempt to add technology to their curricula, but they may question the value that online courses hold as compared to their traditional courses. The authors also believe that the lower levels of comfort in using technology can also be attributed to the lack of training for lecturers in HEIs.

#### 3.2.1.7 Challenges with integrating technology into teaching practices

Mouyabi (2010: 1187) delves into the technology issues, stating that managing learning software comprises a learning curve. Delivering learning material, coupled with compatible software and hardware components and an erratic internet connection, can be frustrating.

According to Grajek (2015: 13), various new technologies and upgrades to existing technologies create overwhelming stresses for lecturers who still struggle to research and integrate existing technologies into their teaching practices. Academic staff are expected to incorporate technologies into their teaching practices. A common error committed by lecturers is where they try to “replicate their physical classroom online” (Grajek 2015: 13).

Teaching with technology proves difficult if lecturers cannot successfully integrate technology into curricula (Mouyabi 2010: 1187). The author states that the real value of technologies is determined by the integration of technologies into the teaching and learning practices of lecturers and the ability of the lecturers to further refine their curriculum delivery and student engagement. Islam, Beer and Slack (2015: 105) agree that lecturers who are not technically savvy to handle the development of materials and deliver online modules are actually hampering progress and require extensive skills development. Kebritchi *et al.* (2017:18) argue that some lecturers are adamant in pushing forward their traditional styles of teaching into the online environment, which does not appear to work. The authors state that is imperative for lecturers to use the online tools provided to present content for best student learning outcomes.

Similarly, Rienties, Brouwer and Lygo-Baker (2013: 123) believe that lecturers need to be aware of the “complex interplay between pedagogy, technology and discipline specific content knowledge”. The inability to incorporate and balance these integral components results in unsuccessful curriculum delivery via e-learning. The authors elaborate further that in order to address student needs and learning outcomes effectively, lecturers need to pay attention to the significant combination of “content knowledge, pedagogical knowledge and technological knowledge”. Many research undertakings have concluded that lecturers align their content with their pedagogical approach, but the link between the lecturers’ pedagogical approach and technology proved limited (Rienties, Brouwer and Lygo-Baker 2013: 124).

Having technical expertise alone is not the imperative tool needed for the successful implementation of e-learning. Mapuva (2009: 6) states that lecturers need to effectively apply their technical knowledge in curricula as it is not the technology but the lecturer that facilitates students' learning experiences.

**3.2.1.8 The perception of lecturers that technology is not useful as a tool**

The perceived usefulness of technological tools for teaching impacts on whether or not technology is easily adopted for the purposes of teaching (Lautenbach 2010: 702). Uncertainty as to whether technology is useful and relevant proves an important aspect in adoption, as concluded by Chimbo and Tekere (2014: 82) in studies that they conducted. The authors noted the reservations of teaching staff in adopting technology as solutions for problems in teaching and learning. Similarly, Mapuva (2009: 7) believes that lecturers are reluctant to accept technology in their teaching methods as they lack understanding and confidence in the new technological innovations as a useful teaching tool. The author argues that the commitment and positive attitudes of lecturers towards e-learning is crucial for the successful implementation of e-learning initiatives, thus yielding positive results for students as well. The author points further to the fact that the dynamic nature of the IT industry coupled with evolving e-learning technologies creates challenges and tension for lecturers, thus making them less receptive and more reluctant to integrate e-pedagogy. Kebritchi *et al.* (2017: 18) confirm that this reluctance is due to the lack of understanding and lack of confidence in new technologies. The authors add that training staff in e-learning methods is therefore of the utmost importance in order to ensure success.

**3.2.1.9 The perception of lecturers that e-learning and the use of technology entails more work**

It is imperative for lecturers to accept that teaching with technology is fundamentally different from traditional teaching methods, thus requiring a commitment of time and training (Lim and Wang 2017:9). However, the amount of time taken by lecturing staff to provide online versions of course content takes almost twice as long as compared to traditional delivery (Wagner, Hassanein and Head 2008: 29). If lecturers are not encouraged to engage in e-learning, then resistance to the additional workload can occur.

In studies conducted by King and Boyatt (2014: 1275), it was determined that lecturers perceive that teaching with technology entails additional responsibility and that the time taken to develop online materials is often not recognised by the institution's management. Moreover, King and Boyatt (2014: 1275) have found that lecturers spend more time in: -

- The exploration of available tools and the development of the skills to use them;
- creating resources/activities and piloting them;
- developing students' skills in using the tools;
- engaging with students in synchronous and asynchronous activities; and
- monitoring and updating resources.

The authors add that these factors create additional investments of time and effort, thus lecturers portray negative attitudes towards engaging with technology for the purposes of teaching, but yet are expected to use technology effectively. The change in pedagogy by lecturers in conventional institutions is complex and the challenges arise when lecturers' teaching practices that were previously complementary to their academic expertise are now required to become innovative teaching practices (Arinto 2016: 163). The author further states that designing learner courses is time-consuming as e-learning requires that learner differences (backgrounds and personalities) need to be acknowledged (2016: 177). HEIs need not only to provide staff with direction, guidance and support, but sufficient time is also necessary for lecturers to design and implement e-learning courses (King and Boyatt 2014: 1278; McGill, Klobas and Renzi 2014: 25; Islam, Beer and Slack 2015:108).

#### 3.2.1.10 (Mis)Understanding Students' Learning Styles

There are various teaching styles and learning styles, thus an understanding of students' learning styles enables academics to develop learning materials accordingly (Islam, Beer and Slack 2015: 103). The authors further conclude that the inability to interact with students physically due to the online environment and the distance factor creates challenges whereby lecturers are unable to understand the different learning styles of students for better outcomes. Furthermore, Kim *et al.* (2013: 84) state that the primary belief of all academics is to improve student learning, but the levels of lecturers' technology integration into their curricula were not the same. The authors conclude that teaching beliefs about learning and learning styles differed, thus impacting on educational innovations. Lecturers are required to understand and recognise the individual learning styles of students (i.e. how they learn and how they perceive) in an online environment, but the technology practice does not help in this context (Islam, Beer and Slack 2015: 104). Darby (2020: 9) maintains that teaching in a physical classroom allows for lecturers to observe non-verbal clues shown by students. The author states further that e-learning contributes to misunderstanding students' learning styles as the lecturers are unable to view whether they have lost the students' attention or whether their instructions are clear.

### 3.2.2 Learning challenges experienced with the use of technology at HEIs

The primary focus of education is to develop the economic and social spheres of any country. The demand for education is an important bridge of economic, political and social mobility (Fisher and Scott 2011: 1). Education needs to be of good quality, accessible and affordable to all. Biswas (2020: 2042) separates the plight of students into those who are privileged and those who are unprivileged in accessing e-learning, as the inequality of digital divides still exist within the higher education sector. Grajek (2015: 14) lists the benefits of a good education to include "higher lifetime earnings, greater levels of happiness and increased civic engagement and reduced health risks". However, the last two decades have seen an increase in technology- driven curricula and the demand for technologically enhanced pedagogy. Vadivoo (2016: 60-61) maintains that there are various factors which create a barrier to the acceptance of technology in education. Technological factors, education factors, human and administrative factors and economic factors are amongst those that contribute to the growth of technology in education. The author further iterates that the appropriateness of technology in education is determined by the geographical conditions of a country and that accessibility depends on the financial standing of the education sector. As much as technology-enhanced innovations are now promoting educational institutions, the challenges experienced by teaching staff are just one of the areas requiring attention. Students also experience challenges in learning with technology. The literature reviewed below reveals challenges that stem from a lack of access, insufficient technological skills, adaptability, poor infrastructure and networks, and the affordability of devices, to a lack of face-to-face interactions.

#### 3.2.2.1 Technology is perceived as a distraction to weaker students

Internet overuse, addiction and inappropriate risky activities have been cited as being problematic to students who learn via digital technologies (Selwyn 2016: 1007). The author further maintains that risky activities such as cyber-bullying, gambling and pornography misuse, online plagiarism and other forms of academic cheating and malpractice are means of distracting students in a technological academic environment. Ali, Uppal and Gulliver (2017: 160) argue that online learning contributes to social loafing, whereby students are distracted by the technology and work less diligently in the absence of lecturer-student interactions or student-student interactions. Similarly, digital technologies allow for procrastination. Selwyn (2016: 1011) explains that technological devices and access to the internet resulted in students procrastinating in completing academic tasks. Students are distracted and their attention is diverted away from study material to social media and other entertaining content on the internet.

While evidence points to the technology being a distraction to weaker students, students infer that teaching with technology lacks innovation, thereby creating dissatisfaction amongst students (Raghunath, Anker and Nortcliffe 2018: 184). This poses a major challenge for academics, as they (academics) do not have strategies to overcome this setback. Raspopovic, Cvetanovic and Jankulovic (2016: 136) indicate that e-learning courses need to be interactive to improve the quality of learning; increase student motivation; increase student satisfaction with published materials and new technological systems; and enhance student attention. The authors add that students who face academic challenges are vulnerable to the hype of technology-aided instruction and become side-tracked by the various elements of digitalisation.

#### 3.2.2.2 The perception that the online environment is a greater problem in retaining students than face-to-face interaction

Although the benefits of online courses provide for convenience and flexibility, there are many reasons why students withdraw from online courses, or perform poorly. Britto and Rush (nd: 30) examined the factors impacting the poor retention of students in online courses, which included affordability, personal problems, and insufficient time to study. The authors maintain that further investigations into student challenges revealed that students have large course loads, lack of experience in online course work and lack access to computers and technology. Hence, online learning cannot replace face-to-face interactions in a classroom.

Britto, Murugeson and Subramanian (2016: 94) conclude that face-to-face instruction fosters a sense of “community belonging”. Body language, tone of voice and eye contact are the elements that are crucial in communicating with students. The authors concur that this is absent in online classrooms, creating frustration and contributing to lower student numbers. The feelings of being alone and isolated contribute to the high rates of withdrawal and dropout in the technology empowered classroom (Power and Gould-Morven 2011: 21).

#### 3.2.2.3 E-learning destroys the interaction between learners; between learners and instructors; and learners and content

Studies conducted by Johnson, Hornik and Salas (2007: 356-369) on the factors that contributed to the creation of successful e-learning environments focussed on the efficacy of e-learning systems. However, the authors revealed numerous challenges with successful e-learning implementation. For instance, they found that e-learning defeated the interaction between learners and content; learners and peers; and learners and instructors, as all interactions are technology-based.

Similarly, Kanwal and Rehman (2017: 10976) believe that challenges to the success of e-learning also relate to the interactivity of the contents of e-learning systems. The authors believe that developers and designers of online course content must increase the interactivity of content in order to sufficiently engage students with more interactive material.

Mapuva (2009: 9) believes that a barrier to the successful implementation of e-learning is the absence of networked learning. Students need to communicate and share knowledge and skills with each other through networked initiatives, thereby creating a more accessible and interactive online environment. Ali, Uppal and Gulliver (2017: 159) conclude that a sense of isolation certainly contributes to the challenges of e-learning as face-to-face interactions between students and lecturers and between students and students is clearly absent.

#### 3.2.2.4 The lack of interactive learning material

Henderson, Selwyn and Aston (2017: 1567-1579) conducted a study on digital technology for university teaching and learning. The study found that the activities of students online focussed mainly on locating literature, submitting assignments, accessing course content and scheduling issues. The authors surmised that digital technology just created a comfortable learning environment, without interactive learning activities. Although students were assisted by the technology, there was an absence of creative, collaborative, participatory and connected learning materials.

Selwyn (2016: 1013) established further that the lack of interactive learning material is a result of lecturers uploading a poor standard of visuals, unstimulating presentations and low-resolution images and videos. Ali, Uppal and Gulliver (2017: 161) express the view that such practices allow for students to disengage from online learning as the course content contains less quality in terms of interactivity.

#### 3.2.2.5 The use of technology/e-learning requires more time

Selwyn (2016: 1012) confirms that online learning requires additional time as compared to traditional methods of learning. The author posits that time-consuming activities relate to note-taking on technological devices (especially aspects such as diagrams and mathematical symbols), as well as challenges of retrieving information from the institutions' learning management system. Some of these challenges arise from the unmethodical manner in which lecturers arrange individual courses and content.

Although online learning decreases distance, personal factors can hinder time to participate in online activities. Online activities require more time for participation in regular schedules. Gillet-Swan (2017: 27) therefore posits that some students are sometimes unable to engage in live sessions due to responsibilities such as family and work, thus questioning the viability of flexibility in accessing online education.

#### 3.2.2.6 Assessment of students using technology may be more challenging

Although technology provides for assessing students' work online, it also proves challenging. Veena (2016: 105) states that students who are not comfortable with using technology will not be accustomed to an online testing environment. The author believes that online testing lacks creativity and is not suitable for certain educational programmes (e.g. physical education). Mouyabi (2010: 1187) also concurs that assessing students can be difficult in some courses (such as traditional hands-on courses) and is difficult to simulate, thus unenthusiastic students tend to fall behind. Further obstacles relate to technical glitches, complexity, learning a new medium or even access to computers, which may prove a challenge for online assessments (Gillet-Swan 2017: 23).

Difficulties arise when students who are engaged in group presentations online need to be assessed. Inhibiting factors to online group assessments arise from no face-to-face interaction to non-verbal cues and the absence of body language, resulting in the absence of clear, concise and focussed communication skills (Gillet-Swan 2017: 26).

#### 3.2.2.7 Lack of human contact

E-learning produces an environment that may be flexible and convenient. Furthermore, e-learning can be simultaneously interactive and isolating (Choudhury and Pattnaik 2019: 6). The authors affirm that peer-to-peer absence in an e-learning environment is a major disadvantage, while Hornick and Salas (2007: 357) agree that e-learning does not provide a conducive learning environment as students feel no social presence when isolated from their peers. The camaraderie experienced within the confines of a classroom, the civility of classroom discussions and the personal rapport and personal attention is absent in an online environment (Mansour and Mupinga 2007: 247). In their findings on students' perceptions of e-learning, King and Boyatt (2014: 1276) iterate that students may resent e-learning if "it's just pushed out at them and they're not getting that human contact." E-learning lacks interpersonal and direct interaction amongst students and lecturers, making it impossible to get immediate feedback as the availability of students and lecturers differ.

Another important factor proving challenging in adopting technology for teaching and learning is the reluctance of students to adapt without face-to-face teaching as well as with the absence of books (Vadivoo 2016: 60-61). Kebritchi *et al.* (2017: 9) state that students need to feel a "shared sense of belonging", as they feel isolated and disconnected in e-learning activities.

#### 3.2.2.8 Students do not develop problem-solving skills

The lack of human contact in online learning results in students not developing adequate problem-solving skills as feelings of isolation prevail (Moonsamy and Govender 2018: 3070). The digitisation of the curriculum hinders students from engaging and problem-solving with peers. Gillet-Swan (2017: 27) posits that students have an ongoing desire to learn and develop practical skills. The online educational landscape sometimes does not cater for practical work experience opportunities, thus hampering the tools and techniques used for problem solving.

Levy and Ramim (2016: 57) hypothesized that one of the substantial challenges in e-learning was the skills gap in online educational activities. The authors confirm that the findings from Phase One of a four-phased study showed that students were not completing online tasks as the focus was more on submitting assessments just for a pass mark rather than using online course resources to communicate, comprehend and memorise. It is therefore the lack of problem-solving skills which results in a learning process that is less efficient (Levy and Ramim 2016: 61).

#### 3.2.2.9 Students' lack of technological skills/knowledge of how to use technology

Subramanian and Uchimahali (2016: 313) believe that not all students are technology savvy, hence for students to benefit from online courses, it is imperative for them to be knowledgeable on how to operate technological devices to facilitate a smooth learning curve. Mapuva (2009: 8) iterates that the lack of IT skills is one of the reasons why students are not willing to participate in e-learning courses. Olutola and Olatye (2015: 303) aver that students who are not trained in using technological devices for learning will not experience the full benefits offered by the e-learning environment. The authors conclude that the combination of equipment, software and reliable infrastructure are futile if students are not trained for the e-learning environment. Furthermore, those students who are more accustomed to traditional learning environments, or those who are from non-technical backgrounds, will experience difficulties in absorbing e-learning course content. Similarly, Natow, Reddy and Grant (2017: 13) confirm that students who lack sufficient skills (e.g. keyboarding skills) will not use technology effectively.

#### 3.2.2.10 Lack of confidence in using technology

Many students lack confidence in using technology for learning. Choudhury and Pattnaik (2020: 7) affirm that constant innovations and the upgrades in technology render a lack of motivation in students' usage of technology for learning. Mapuva (2009:8) believes that this could be the result of untimely e-learning initiatives that impact on the students' preparedness to adapt to the advances in technology. Such developments pose difficulties in accessing course material and uncertainty on how to prepare for online assessments. The author also states that students lacking confidence in using technology will be reluctant to contact lecturers for assistance.

Mahmodi (2017:3) points out that the lack of confidence in using technology for learning also stems from students' fears about electronic communication, computer self-efficacy ratio and the initial experience of technology. Thus, the internal and psychological factors affecting learning outcomes also contribute to the lack of confidence in using technology. Similar thoughts are expressed by Wang (2014: 10), who also believes that students are fearful when engaging in online learning as there are risks associated with losing submitted work, disclosure of sensitive information, wastage of time and money, as well as the absence of face-to-face interactions.

#### 3.2.2.11 Lack of access to technology

Lembani *et al.* (2020: 79) maintain that e-learning initiatives are hindered if access to technology is constrained, thus the access to a computer can evoke either a positive or negative experience of students. Mapuva (2009: 102) argues that the concept of e-learning is beneficial to higher education as students gain access to knowledge via distance education. However, in this case, it is not only necessary to consider access to education, but also access to the technology where computers become a fundamental requirement for effective e-learning courses. Human and economic factors intertwine, with some students not being able to afford computers or other technological devices, whilst the cost of implementing technology in education can be exorbitant (Vadivoo 2016: 60-61).

Gomathi (2016: 146) explains that e-learning exceeds the cost of traditional education, making learning accessible to only a particular group of students. HEIs stand to fail in e-learning initiatives if students cannot afford or gain access to technological devices such as computers. The author further states that some institutions display a lack of willingness and are not equipped to adopt e-learning in the proper interest of teachers and students.

#### 3.2.2.12 Inadequate/unavailable technological infrastructure and resources

According to Grajek (2015: 19), when technology changes, institutions face various challenges in adapting to the new circumstances. HEIs struggle with the pace of change as well as the volume of change. These impact on infrastructure and services, resulting in challenges with laboratories, computers, online facilities and the staff within the e-learning environment. Technical difficulties, software problems and the unavailability of the internet also impact negatively on learning activities in online classrooms (Raspopovic, Cvetanovic and Jankulovic 2016: 123; Tondeur *et al.* 2017: 468)

Teaching and learning via e-learning requires consistent up-time in terms of technological resources. Power outages, technical glitches, limited or the lack of network connectivity and limited quality or “fit for purpose” software adversely affects the continuity of e-learning (Gomathi 2016: 146; Natow, Reddy and Grant 2017: 13-14; Olutola and Olatoye 2015: 303). For e-learning to be successful, there must be adequate technological infrastructure to ensure the continuity of learning programs. Students are adversely affected by the lack of proper resources and infrastructural connectivity (Nortvig, Peterson and Balle 2018: 50-51; Olutola and Olatoye 2015: 303, Mapuva 2009: 8-10; Lembani *et al.* 2020: 73).

#### 3.2.2.13 Students in online courses earning lower grades than students in face-to-face groups

Studies conducted by Natow, Reddy and Grant (2017: 4) have indicated that students in online learning environments complete courses at a lower rate and achieve lower grades than those in traditional face-to-face learning environments.

Willging and Johnson (2009: 115) attribute dropout rates in online education to the fact that students can feel isolated, perceive disconnectedness and face an array of technological glitches. The authors emphasise that feeling isolated as individuals (unlike the educational environment that is created in a traditional classroom), students encounter e-learning as a less effective teaching and learning tool. Learning with technology creates anxiety and resistance to learning, making some students feel overwhelmed by the new innovative pedagogical methods (Willging and Johnson 2009: 115). This contributes to dropout rates of online students at a much higher level that than that of traditional students (Moonsamy and Govender 2018: 3070).

#### 3.2.2.14 Teaching strategy (pedagogy) – lecturer does not integrate e-learning successfully

Apart from having technical skills to integrate technology into teaching practices, lecturers require skills in content development, learning activities, teaching strategies and assessment (Arinto 2016: 173). The absence of these pre-requisites impacts negatively on delivering a technologically innovative curriculum. Online lessons thus lack proper integration of learning content. Educational factors for the adoption of technology stem from lecturers not being involved in planning and preparing subject content, to not being able to cover an entire syllabus with one technology (Vadivoo 2016: 60-61).

Gillet-Swan (2017: 21) believes that teaching with technology is not a “one-size-fits-all” approach. Moreover, lecturers do not consider factors that impact on incorporating technology into the curriculum. The author posits that learning enhancement and student engagement must be considered for collaborative teaching strategies.

#### 3.2.2.15 Poor quality of online/e-learning systems

Aparicio, Bacao and Oliveira (2016: 392) hypothesized that e-learning success is dependent on the system and service quality of e-learning systems. When students perceive that a system is responsive and available, then the e-learning experience is more enjoyable. Poor service quality and poor system quality contribute to negative teaching and learning outcomes.

Liaw (2008: 865) suggests that a proper e-learning environment will enable students to share information, as well as determine how to retrieve useful information. If these concepts are not entirely satisfactory to a student, i.e. if students are less confident in using the technology, they will also perceive the technology in a negative light. While traditional e-learning systems are used to organise and publish materials, new e-learning systems focus on the personalisation and interactivity of learning materials for each student (Raspopovic, Cvetanovic and Jankulovic 2016: 124). The authors comment further that e-learning systems must be considered in terms of their usability and accessibility in order to achieve educational goals effectively. E-learning systems which are not usable enough obstruct the learning process and students spend more time learning how to use the software, rather than learning the contents (2016: 127). This portrays an absence of a learning atmosphere in e-learning systems.

#### 3.2.2.16 End-user difficulties

Students who lack sufficient skills in using technology effectively will encounter difficulties in learning online. Natow *et al.* (2017: 13) state that there are students who lack simple keyboarding skills, which are a requisite for using a computer. Similarly, Islam, Beer and Slack (2015: 107) state that not all students who enrol at HEIs are equipped with end-user computing skills and that students who are novices or who have intermediate skills will need to have proper training in the e-learning environment. Mapuva (2009: 8) argues that the difficulties that students encounter with using technology will lead to their non-participation in e-learning courses. It is therefore imperative for students to be trained in using technological devices in order to experience the full benefits of the e-learning environment.

### 3.3 Sum up and observations on challenges with the use of technology for teaching and learning

Hence, in summing up the challenges with the use of technology for teaching and learning, certain observations may be noted. Islam, Beer and Slack (2015: 109) maintain that all the challenges of learning in an online environment will impact on the overall delivery of a technologically enhanced curriculum. The authors comment further that these challenges have a permanent relation to each other and, if not resolved adequately, learning will be deficient. Lembani *et al.* (2020: 81) and Gillet-Swan (2017: 21) affirm that a "one-size-fits all" solution on the use of technologies for teaching and learning will definitely have limitations. Kebritchi *et al.* (2017: 12-13) acknowledge that the challenges experienced by lecturers with creating, shaping and integrating course content to proper training and support, with appropriate access and flexible schedules, have to be addressed by HEIs to ensure the smooth delivery of a digitally enhanced curriculum.

With respect to the challenges faced by students, Mapuva (2009: 8) states that learning with technology can only be enhanced when students overcome their lack of confidence in using technology; their lack of IT skills; their feelings of isolation and their non-willingness to participate freely in online classes. HEIs need to take cognisance of the challenges experienced by lecturers and students when implementing new technologies for e-learning. Lembani *et al.* (2020: 81) argue that HEIs need to recognise that integrating technology into pedagogy must take into account the concept of "same course, different access", as not all students enjoy the same geographic and socio-economic backgrounds.

### 3.4 Part B: Best-practices in the use of technology for teaching and learning at HEIs

The following section reveals some of the best-practices in the use of technology for e-learning activities in teaching and learning in HEIs. The evolution of knowledge, technology and dynamic global activities have influenced how higher education institutions manage and govern pedagogical activities. According to Choudhury and Pattnaik (2020: 1-3), the “e-learning revolution” has infiltrated the higher education sector, keeping the interest of the students and their learning styles in mind – instructional strategies and the choice of technology influence teaching and learning. A decade ago, Perumal (2010:1) confirmed that higher education policies were dictating the influence of HEIs in embracing business-like approaches for sustainability in the competitive global market place. The author further iterated that a competitive advantage in education was required for a country to experience phenomenal growth. Education is now the tool that is at the forefront of new businesses and venture capital.

However, apart from maintaining a firm standing in the global marketplace, it is imperative for HEIs to recognise the best-practices in the education ambit to secure their goals of teaching and learning. Filho *et al.* (2018: 287) believe that the sustainability of higher education will thrive under the influence of content, learning outcomes and pedagogy with technology-enhanced learning (TEL), reshaping the teaching and learning activities. However, Keppel, Suddaby and Hard (2015: 1) maintain that while technology provides for radical changes to education, issues in disseminating good practice, impedes a successful transformation. The Collins English Dictionary (2012) defines “best-practice” as the recognised methods of correctly running a business or providing services. Depending on the type of industry, best-practices would differ. Potgieter, Botha and Lew (2005: 160) believe that best-practice is a means of continuous improvement of the operations of organisations, “the pursuit of world class performance”, focussing on what successful organisations do to manage their organisation and their operations. Best-practices in the use of technology for teaching and learning at HEIs should focus on the training of staff and students; the provision of resources; technical support; instructional technology; online access; and the identification of problem areas (Natow *et al.* 2017: 10-11; Mapuva 2009: 10; Keppel, Suddaby and Hard 2015: 1-2; Martin 2018: 1-16).

### 3.4.1 Institutional Reasons for adopting best-practices

Tarus and Gichoya (2015: 9) illustrate that, apart from student support and motivation by e-learning instructors, student and lecturer skills on e-learning pedagogy are necessary for e-learning to be successfully implemented. Adequate and quality e-learning content is imperative as a pedagogical component for successful e-learning.

Apart from lecturers and students acquiring the necessary skills for successful e-learning implementation, King and Boyatt (2014: 1272-1280) conclude that three main factors actually influence the adoption of e-learning in higher education, namely: -

- **Institutional infrastructure**: institutions need to develop a supportive institutional culture which would take into account the integration of available technologies with existing pedagogic systems and practices;
- **Staff attitudes and attributes**: staff need to be made aware of the technologies that exist and how such technologies can provide for high quality learning experiences for their students; and
- **Perceived student expectations**: Students nowadays are enjoying technological advances in education, and e-learning is improving their understanding. Instead of spending exorbitant amounts on hardcopy resources, students have access to digital resources.

The current pedagogical practices must take cognisance of various types of technological literacies which make education and learning more exciting, capturing the attention of students and improving concentration, knowing that academics are using tools relevant to their world (Choudhury and Pattnaik 2019: 3, Lembani *et al.* 2020: 81)

### 3.4.2 Best-practices in the use of technology for teaching at HEIs

Technological, organisational and pedagogical components are necessary for the successful implementation of e-learning initiatives (Johnson, Hornik and

Salas 2007: 356-369). It is therefore necessary to heed how technology allows for innovative curriculum development for successful teaching practices.

#### 3.4.2.1. Use of faculty training opportunities for staff

Martin (2018: 1) argues that staff development is essential when developing innovative practices for teaching. The author further advocates that HEIs allocate time for developmental activities and the dissemination of innovative practices, iterating that practices such as “peer observation” can be directly linked to staff development. Teaching staff can be observed regularly while effective staff development policies promote academic, professional and pedagogic skills. Staff sharing their e-learning experiences with each other provides a basic support mechanism which encourages colleagues and promotes knowledge sharing (King and Boyatt 2014: 1272-1280).

Keppell, Suddaby and Hard (2015: 5) believe that engaging academics over sustained periods of time in workshops and seminars will enable academic development and ensure that staff are engaged and supported in technology-enhanced practices. Britt and Paulus (2016: 49) have identified that teaching staff improve their professional development by reaching out to colleagues in online sessions or by email and blogs. Although informal, these techniques allow for engagement and ways to improve existing practices.

It is also critical for institutions investing in online technologies to build teacher competencies as the technological skills of teaching staff can be developed to the benefit of students for quality education. Roddy *et al.* (2017: 4) believe that teaching staff can develop a range of skills by conforming to the TPACK (Technological Pedagogical Content Knowledge) model as proposed by Mishra and Koehler (2006). The authors further state that the TPACK model promotes a meaningful integration of technology, content knowledge and pedagogy. Technical competencies, content proficiency and pedagogical knowledge for teaching staff must be highlighted if technology is to be inherently embedded in content delivery. The integration and interdependence of the TPACK model components is illustrated below (Figure 3.1), as cited by Roddy *et al.* (2017: 4).

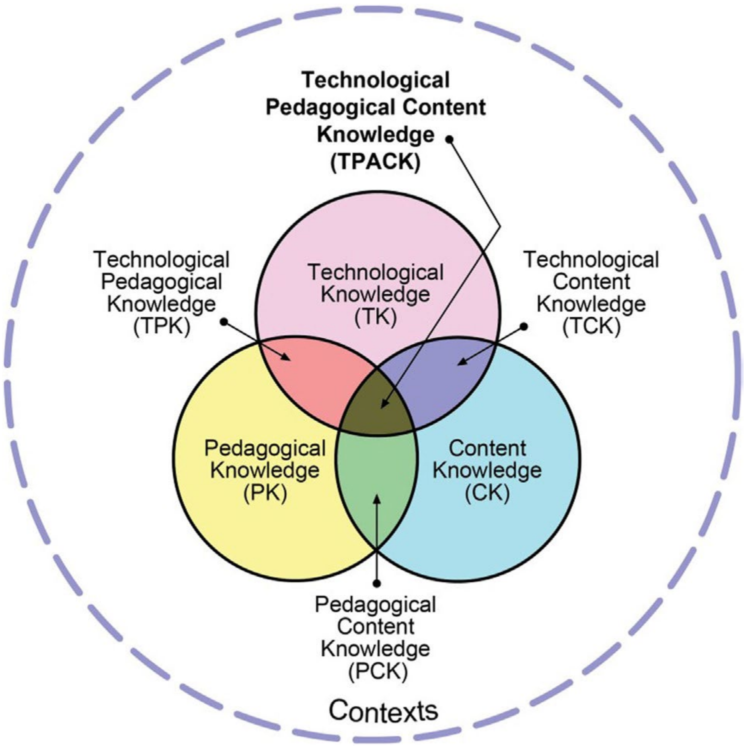


**Figure 3.1: The TPACK Model**

*Source:* Mishra and Koehler, 2006 (cited by Roddy *et al.* 2017: 4)

The TPACK model demonstrates a combination of the technical competencies, content knowledge and pedagogical knowledge of lecturing staff. This combination coupled with lecturers' technological pedagogical knowledge, technological content knowledge and pedagogical content knowledge results in technological pedagogical content knowledge, a framework for successful teaching practices in an online environment. Brinkley-Etzkorn (2018: 29) discuss faculty development for online teaching based on the TPACK model (and have referenced such studies conducted by Shulman 1986 and Mishra and Khoehler 2006). The authors believe that knowing how to use technology differs from teaching with technology. The TPACK model thus addresses the integration of pedagogy with technology as depicted above.

#### 3.4.2.2 Provision of resources and technical support

King and Boyatt (2014: 1272-1280) believe that consulting with staff on the technologies they require will provide for reliable and consistently available resources. This is a factor which will influence the adoption of e-learning in higher education on a positive level. The authors further conclude that institutions need to provide for proper resources and technical support, guiding and supporting staff in the implementation of e-learning. Maphalala and Adigun (2021: 2) confirm that the provision of resources and technical support cannot be over-emphasised. The authors maintain that resources such as uninterrupted internet services are a powerful tool for the access and dissemination of the content necessary for educational growth and development.

Lecturers need to be made aware of the technologies that exist and how such technologies can provide high quality learning experiences for their students (King and Boyatt 2014: 1278). Crajek (2015: 22) states that staff have different requirements of technology, different levels of expertise, different communication styles and different service expectations, hence needing the complexity of IT support to increase accordingly. Providing support to staff, including self-service support, can increase user satisfaction. Institutions therefore need to develop a supportive institutional culture which would take into account the integration of available technologies with existing pedagogic systems and practices.

#### 3.4.2.3 Use of instructional technology

Natow, Reddy and Grant (2017: 10) suggest the use of software and various technologies to present the instructional content of courses to students. The authors believe that instructional technology such as online video lectures, electronic textbooks, interactive tutorials, animations and other similar practices enhance the preparedness of students even before they enrol at tertiary institutions. Such technologies can be used in pre-enrolment programs to ensure the readiness of prospective students. Grajek (2015: 11) maintains that teaching staff would be more effective in their practices by integrating web-based content, e-books, lecture recordings, social media, simulations and online collaboration tools into their courses.

Britto and Rush (nd: 36) found that assessing student readiness in technology enhanced curricula was one of the fundamental aims of Lone Star College located in Texas. The system devised provided for students' strengths and deficiencies in learning with technology. Instructional technology that was available provided for the assessment of students via the completion of online courses.

#### 3.4.2.4 Use of course management technology – using technology to organise and present course structure and materials

Blackboard, Moodle, WebCT, Sakai, Canvas and similar course management technologies provide for the electronic storage of and access to important course materials (Natow, Reddy and Grant 2017: 10). The authors state that HEIs invest in course management technologies (also known as learning management systems or LMSs) to ensure organisation, course structure and the delivery of course material. The authors add that institutions investing in these technologies use these systems to deliver either part of or their entire course content online, with the scheduling component considered as useful to those students who lack self-regulation skills. According to Maphalala and Adigun (2021: 3), the use of course management technologies enables the facilitation of large classes enhances assessment strategies and can be fundamental in meeting the learning needs of a diverse cohort of students. Studies carried out by Sackstein *et al.* (as cited in Maphalala and Adigun 2021: 3) illustrate the high level of satisfaction by lecturers who use the LMS, which provides for "ease-of-use for student monitoring, content uploads, communication, assessments and student tracking".

Students expect engagement and teaching staff using technologies such as the LMS to refine course delivery to present course structure and materials will provide for optimum teaching with technology (Grajek 2015: 10).

#### 3.4.2.5 Use of student support technology

A key indicator of satisfaction when learning via technology is the instructor responsiveness that students receive in e-learning environments (Roddy *et al.* 2017: 30). The authors state that teaching with technology enables communication via live chat, video/webcam interactions and virtual classrooms. This type of student support technology has been found to positively influence student engagement and course completion.

Similarly, Natow, Reddy and Grant (2017: 12) posit that student support technology is a means of monitoring the academic behaviour of students (including course attendance and performance). Roddy *et al.* (2017: 3) believe that student support technology provides for the effective monitoring of student progress. Moreover, online access to remote tutors ensures academic assistance to students (Natow, Reddy and Grant 2017: 12) and facilitates the resolution of key learning queries, contributing to the establishment and maintenance of rapport (Roddy *et al.* 2017: 3).

The use of student support technology is also fundamental in assisting students who engage in practical courses (Elhaty *et al.* 2020: 2872). The authors view concepts such as recorded lessons and simulations as a means of supporting students who engage in practical lessons, taking online practical work to a different level if supported by the pedagogical foundations in design and evaluation.

Roddy *et al.* (2017: 5) believe that technical skills, effective time management, individual differences (especially self-directed or self-regulated learning), financial means and online self-efficacy are elements for success in students engaging in online learning. To ensure the success of these students, Natow, Reddy and Grant (2017: 12) aver that the use of specifically designed software as an early alert system can identify students who are at risk of failing. The early detection of those struggling with their academic activities can be monitored and lecturers informed accordingly.

#### 3.4.2.6 Community Practice

Brit and Paulus (2016: 48-59) describe the practice of community chats which assist in recognising the informal professional development of lecturers who conduct classes online. The authors further recognise that professional development can occur by lecturers using their own online space for their professional learning. It is a way to reach out to colleagues via social learning and understanding different environments with an exchange of professional knowledge, which can be put into practice. The authors postulate that e-mail, blogs and other technologies allow for “mutual engagement, a negotiated enterprise and a repertoire of negotiable recourses accumulated over time.” Community chat groups can focus on various issues from general practices, dropout rates and devices for students, to how students learn online. Darby (2020: 24) concludes that engaging with other colleagues on e-learning teaching practices results in important new insights and ideas for creative thinking and stimulating students’ learning and success.

Similar practices are prevalent in the Open University of Scotland (Cornelius and Macdonald 2008: 52). The authors posit that forming forums for discussions and ideas contribute in teaching staff sharing information and helping each other in their development. Shared practice and the exchange of stories and experiences, although informal, result in professional development while teaching staff come to terms with changing roles induced by e-learning and online technologies. Assisting each other to recognise the changing field and organise the mix of learning technologies in support of learning ensures the promotion and sharing of good teaching practices (Keppell, Suddaby and Hard 2015: 2).

### 3.4.3 Best-practice in the use of technology for Learning at HEIs

Although the success of students in HEIs can be partially attributed to technology enhanced teaching and learning strategies, as Grajek (2015: 14-15) states that opportunities embellished by technology exist to support student success initiatives. Many institutions of higher learning have incorporated blended learning into their curricula. This addresses the challenges that students encounter, especially that of isolation in online learning activities. It also creates a more comfortable learning environment and provides for access to online learning material with a human component (Moonsamy and Govender, 2018: 3070). Liaw (2008: 865) maintains that "understanding users' attitudes toward e-learning facilitates the creation of appropriate e-learning environments for teaching and learning". This will entail understanding the targeted population, i.e. it is important that student characteristics are identified, e.g. self-efficacy and self-directed behaviour. Students will need to have the ability to reason and infer, as well as apply their knowledge and skills to lessons. Apart from making students comfortable in an online environment, numerous authors list multiple variables in improving student learning outcomes and what constitutes best-practice. These are deliberated in-depth in the discussion that follows.

#### 3.4.3.1 Implementation of training courses/orientation programmes

Grajek (2005: 14-15) states that the development of training courses and/or workshops enables students to understand the technology landscape of the institution and how they can use those tools to succeed in learning areas. Studies by Roddy *et al.* (2017: 6) show that orientation programmes have improved student retention and the academic performance of online students. The authors believe that targeted training programmes as well as easy access to comprehensive resources are vital to improving student success in intensive online learning environments. They further state that successful orientation entails a "comprehensive overview of course structure, recommended time commitments and expectations of students, familiarization with required instructional media and software, and guidance on the communication tools needed for student–staff interactions".

Britto and Rush (nd: 31) concur that offering orientation to students who engage in online learning will boost confidence levels, provide a sense of belonging and communication and help with learning with technology, thus preparing students for online classes, connecting them with peers and instructors and reducing the number of technical problems faced online.

#### 3.4.3.2 Enabling the effective use of technology through access, usability and support

Barriers to access, usability and a lack of support are listed as impediments to the effective use of technology for learning (Grajek 2015: 15). Roddy *et al.* (2017: 6) believe that ongoing technical support must be provided for online learning in order to ensure that course expectations are met timeously. The authors iterate that HEIs need to ensure that all technology requirements are communicated to students in order to eradicate technical-based hurdles. Furthermore, flexible online technical support is critical for a user-friendly environment, thus contributing positively to student retention and engagement.

Tarus and Gichoya (2015: 7), in their findings, attribute the success of e-learning initiatives to the access to computers and other e-learning technological access devices. The authors maintain that respondents also placed emphasis on network connectivity and internet bandwidth - both being important technological components contributing to e-learning success.

Furthermore, a reliable learning management system (LMS) is imperative for any e-learning initiative to be successful. Lim and Wang (2017: 14) believe that the LMS is more than just a repository for uploaded documents and collecting assignments. The authors affirm that it (LMS) serves as a “rich, real-time collaborative learning environment”.

Britto and Rush (nd: 31) argue that technical support is critical when offering online classes to students - a “help desk” for technical support via phone, email and chat is an essential resource. The authors suggest that a single point of contact is essential as a help desk entity so that students know how and whom to contact for technological learning problems to be resolved. Lim and Wang (2017: 12) suggest that just-in-time and ongoing student support is necessary and should be readily available in HEIs to guide students. The question however remains as to whether HEIs are willing to invest in technical support on a 24/7 basis.

#### 3.4.3.3 Using technology to recast large lecture courses and support pedagogical transformations

Innovations in learning with technology can be provided for by delivering master classes to students. Martin's (2018: 9) investigation of universities in the United Kingdom and Northern Ireland provided a focus on Lancaster University and how students accessed material via the use of social networking platforms, external platforms (such as micro-blogging and other tools, and applications to recast courses) and how these improved the student experience. Srivastava (2018: 25) explains that using technology to support pedagogical transformations is evident in the use of video and audio materials which allow students to remember their learning content for a longer time. The authors affirm that accessing these materials on a repetitive basis or whenever needed assists students with the retention of the learning content.

#### 3.4.3.4 Using technology to provide flexibility for students to match the course with their learning style

Martin (2018: 9) further revealed the various innovations in technology-enhanced learning in HEIs in the United Kingdom, which focused on using technology to match student requirements. The author posits that innovative and technology-focused learning hubs provide designated support, create tools and develop applications to improve learning with technology. Radha *et al.* (2020: 1089) state that apart from learning styles, the flexibility offered by technology in education improves the students' self-study skills. The use of technology in programmes, such as sport use gaming technologies and badges for teaching and learning, while performing arts students showcase their work via micro-blogging sites, creates a flexibility for students to match the course with their learning style (Martin 2018: 9). Furthermore, the author adds that students are loaned tablet computers for these purposes while creative media students engage in learning with technology via graphic design, moving image, games design and photography. Such innovations improve the student experience and provide innovative approaches to prospective students.

### 3.4.3.5 Using technology to distribute learning content in multiple ways

The real value of technology in learning can be seen in how lecturers refine their course delivery via online lectures (live and archived for review), electronic texts and learning management systems (Grajek 2015: 11-12). The author reveals further that students achieve and engage on higher levels when technology is integrated in various ways, such as free web-based content, LMS, online collaboration tools, social media as a learning tool, lecture recordings, online educational games, e-portfolios, and non-keyboard or non-mouse computer interfaces. Srivastava (2018: 24) explains that using technology to distribute learning materials allows for convenience whereby students' access to learning materials is self-paced and learning materials can be accessed from technological systems for future purposes at any given time.

### 3.4.3.6 Encouraging Collaborative Learning

Using technology such as online peer tutoring, discussion boards and group video-conferences (e.g. Google hangouts) to facilitate synchronous and asynchronous interactions with others and to promote collaborative learning reduces the feeling of isolation experienced by online learners (Grajek 2015: 14-15). HEIs need to prioritise effective communication amongst learners and avoids them being inhibited by geographical and physical segregation. Similarly, Roddy *et al.* (2017: 7) argue that it is important for online learners to feel a "sense of community" and adopting the use of video conferencing, online discussion forums and social networking forums (Facebook, Twitter) are essential for successful online course implementation.

Collaborative learning with computer technology ensures productive learning by promoting a good social rapport between students (Sumtsova *et al.* 2018: 163). The authors posit that the ability to interact with other members of a group, and expressing ideas logically and clearly, creates an educational community with knowledge-sharing and a synergetic effect on learning.

### 3.5 Sum up and observations on best-practices in the use of technology for teaching and learning at HEIs

The various authors have delved into the successes of how e-learning as an online learning initiative contributes towards the development of students, as well as the staff development of those engaging in online teaching activities. The authors have further reiterated that best-practices for e-learning practices entail a flexible, responsive approach by lecturers and their ability to navigate through technology while students have to interact with the learning environment through technological navigation and an understanding of online offerings.

Romiszowski (2003: 10) maintains that a successful e-learning initiative will result in:

- Reduced costs over the long-term;
- Improved individual and business performance;
- Capitalisation on core competencies; and
- HEIs successfully overcoming competitive pressures and market needs.

The author believes that a successful e-learning initiative motivates people, escalates productivity, enhances skill development and ensures retention. Retention can be guaranteed when institutional and academic leadership provide learning opportunities to ensure the competencies of their staff, irrespective of the overwhelming volume of new technologies and the upgrades to existing technologies (Grajek 2015:11). A combination of technological, organisational and pedagogical components is critical for the successful implementation of e-learning, especially since these factors enhance best-practices. Institutional changes that align technology integration support and faculty professional development, as well as improved student engagement and success, will reduce the challenges of teaching and learning with technology and improve retention rates (Grajek 2015: 12).

Johnson, Hornik and Salas (2007: 356-369) state that the perceived usefulness of best-practices of e-learning expands the quality and quantity of information accessed by students, i.e. students can access additional course content via audio or video files and they can enjoy peer-to-peer sharing of information. Time and venue constraints are reduced since students have flexibility over the learning process at their own pace. The authors add that e-learning contributes to the synchronous interaction between students, as well as between students and lecturers. Synchronous communication allows students to engage and gain immediate feedback and evaluation on work they have submitted.

King and Boyatt (2014: 1278) conclude that best-practices will entail the development of students' technological skills so that there can be successful engagement with e-learning. Institutions need to understand the diversity in student populations, thus providing mechanisms to enhance student confidence and abilities. Strategies to ensure best-practices for teaching require HEIs to exhibit a range of relevant and practical engagement techniques to ensure that academics are equipped with technological and multi-literacy skills. Lecturers have the ability to influence the effectiveness of teaching and learning, and must be actively engaged (Keppell, Suddaby and Hard 2015: 10).

### 3.6 Part C: Covid-19 and its impact on higher education

Part A of this chapter illustrated the challenges of using technology for teaching and learning in HEIs. Part B comprehensively explored the best-practices applicable to HEIs in the integration of technology in teaching and learning. However, apart from the challenges listed, one of the greatest challenges facing higher education since the commencement of this study was the Covid-19 pandemic. Global higher education came to a halt when Covid-19 became a world-wide pandemic, with every continent re-thinking its approach to the delivery of education. This section explores the impact of the Covid-19 pandemic and the challenges inflicted on educational institutions.

The challenges of teaching and learning with technology, as discussed in the previous sections, focused on the lack of access to devices and technology; the lack of skills sets; the lack of infrastructure and resources; the dearth of human interactions; and the change in mindset towards teaching and learning with technology. The objectives of this study were to investigate these challenges, with recommendations on how they can be overcome and a workable framework to be developed for the implementation of best-practices for e-learning. The challenges are areas that can be assessed and solutions can then be derived and worked towards.

### 3.6.1 Background - The Global Pandemic

In December 2019, Wuhan City in the Chinese province of Hubei became the centre of a 'pneumonia-like' disease, which called for the isolation of people suspected to be suffering from the disease as it seemed to spread by human-to-human contact (Wang *et al.* 2020: 470). The authors state that by 7 January 2020, Chinese scientists discovered this outbreak to be a novel coronavirus (Covid-19). The World Health Organisation (WHO) declared the coronavirus outbreak a global public health emergency of international concern (Stacey and Richards 2020: 1) as the virus evolved rapidly and spread to other countries worldwide (Liu, Kuo and Shih 2020: 1).

Stacey and Richards (2020: 2) believe that with Covid-19 causing "new cases of respiratory disease and mortality on five continents", the African continent and South Africa itself will definitely not be spared.

### 3.6.2 The Global Lockdown

With the surge of the virus across the globe, countries around the world implemented strict lockdown measures to curb the spread of the deadly pandemic. Schools and educational institutions, places of worship, bars and restaurants and sporting facilities were closed, with only those businesses essential to a country's supply chains and essential services were allowed (Tobias 2020: 1-2; Koh 2020: 1 and Mahlanga and Moloi 2020: 1).

### 3.6.3 Covid-19 and South Africa

On 15th March 2020, The South African President Cyril Ramaphosa declared a national State of Disaster in response to the rising Covid-19 cases in the country and thereafter the nationwide lockdown was imposed on 26th March 2020 for a period of 21 days (Singh 2020: 1). The national lockdown not only contributed to the stagnancy of the economy, but also severely impacted on the academic year for schools and institutions of higher learning (Mahlanga and Moloi 2020: 3).

### 3.6.4 The impact of Covid-19 on Higher Education Institutions

Due to the threat of Covid-19, HEIs are faced on a daily basis with the decision of how to continue with the academic year whilst keeping staff and students safe. The dilemma of opening up institutions to students for face-to-face teaching versus delivering curricula online is a difficult decision for HEIs. Hodges *et al.* (2020: 1) state that the list of HEIs who have opted to cancel all face-to-face classes and move their courses online has been growing each day. However, Mahlanga and Moloi (2020: 2) declare that Covid-19 is a new occurrence, thus there has not been sufficient investigations into the roll-out and adoption of online learning platforms. Hodges *et al.* (2020: 5) observe that the time-frame for planning, preparing and developing a fully online university course extends from six to nine months before the actual course is delivered.

Twenty-six (26) member institutions in the South African higher education environment had no choice but to embark on emergency teaching and learning in a bid to save the 2020 academic year. Institutions who were less ready for the digital teaching and learning environment had to gear themselves to engage in exercises for the progression of online learning (Universities South Africa 2020).

### 3.6.5 The impact of Covid-19 on teaching

Institutions of higher learning are considered "the key sources of a skilled workforce upon which a knowledge society is built" (Soomro *et al.* 2020: 4). The processes and foundation thereof are imbedded in how significantly ICT contributes to this. However, teaching staff at HEIs are at different levels of adopting ICT for teaching; their capabilities of using technological devices; their motivations to accept technology for teaching; and their actual usage of these devices in their practices (Soomro *et al.* 2020: 4). However, the Covid-19 pandemic is unleashing digital transformation in teaching in higher education and the education sector is preparing against disruptions in the academic calendar by enforcing online classes (Mhlanga and Moloi 2020: 7).

Hodges *et al.* (2020: 5) explain that it is impossible for every faculty member to become an expert in online teaching and learning, given the current Covid-19 situation. The authors believe that although institutions will put into place systems of support, the scale of change in teaching practice will stress systems and increase pressure on their capacity.

Van Dyk (2005: 21-22) explains that in order for successful technology integration, there has to be the fulfillment of four stages, as depicted in Figure 3.2 below.

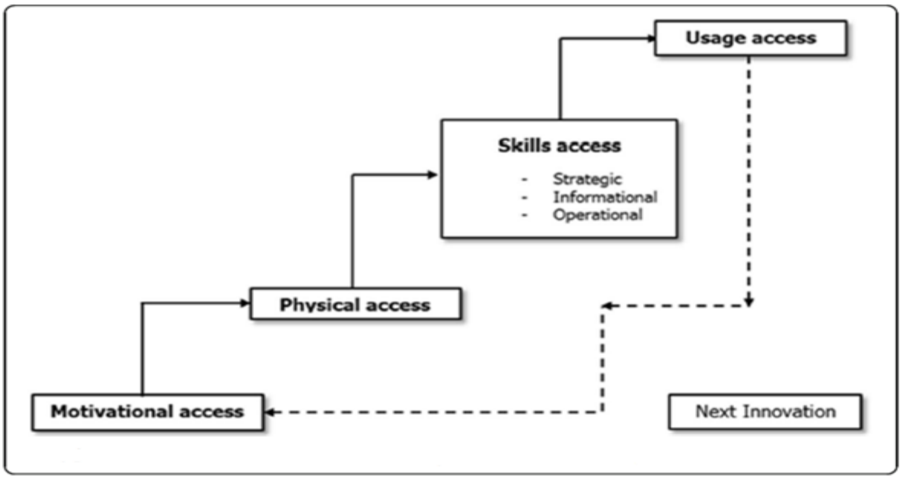


**Figure 3.2: Successive kinds of access to digital technologies**

*Source:* Van Dyk (2005: 21-22)

Lecturers would need to have overcome the mental anxiety of using technology, hence motivating themselves. Once that is solved, access to technology (devices and connectivity) is important. Skills access is the third stage, whereby lecturers would need to operate, search, select information and apply knowledge (Van Dyk 2005: 21-22).

The objectives of this study focus on the challenges facing teaching staff in incorporating technology into their teaching practices, and these challenges are once again highlighted in the changes that have been enforced by this unprecedented pandemic. Usage access, being the last stage, would encompass new technologies and applications.

### 3.6.6 The impact of Covid-19 on learning

With Covid-19 being the “wake-up” call to the education sector in South Africa, Mahlanga and Moloi (2020: 5) state that “it will be difficult for the education sector to go back to the old ways of teaching as the issues of social distancing will remain active to avoid the spread of the virus”. The pandemic is a driving force towards digital curricula in HEIs.

Institutions have no choice but to engage in the inevitable progression to technologically-driven curricula, although many lag behind with issues of lack of devices for students, data challenges and students residing in totally unconnected localities (Universities South Africa 2020). Lembani *et al.* (2020: 70) state that access to technology is “spread unevenly across different spaces, populations and households”. The authors have compared internet access in more developed countries, namely the United Kingdom (92%) and the United States (89%), to South Africa (22%) where only a minute proportion of the population can connect technologically.

This highlights a major challenge for students engaging in online classes, without which (online classes) the academic year will be lost. The Emergency Online Teaching and Learning during the Covid-19 Era report compiled by Universities South Africa (2020: 1-9) highlights the challenges faced by the twenty-six higher education institutions in South Africa in relation to their readiness for online teaching and learning. While some HEIs reported that access to technological devices for their students was a problem, others highlighted connectivity and data being a huge challenge. A major concern was also environments that were not conducive for students to engage in online learning (Universities South Africa 2020).

### 3.6.7 Challenges as a result of using online technologies for teaching and learning during the COVID-19 pandemic

This section provides an overview to the various challenges experienced by lecturers and students engaging in e-learning at HEIs during the Covid-19 pandemic.

#### 3.6.7.1 Challenges with online learning during the pandemic

Many students do not have access to high-speed internet and not knowing a student's living, learning or health conditions creates a challenge in terms of how they engage in online learning (Lee 2020). The author further states that it is challenging to maintain the interest of students in online classes. Melane (DUT student) conveyed (via an online chat on 16 June 2020) that online learning was difficult due to an unstable network, problems with electricity and living in a disruptive environment.

Students also lack good learning attitudes (Bao 2020: 113). Concerned academics saw a decline in online attendance from 50% of a class to just one student eventually (Lee 2020). Moorhouse (2020: 2) reflects on the online learning challenges at a Hong-Kong University, whereby interactive face-to-face sessions were replaced by online classes, with less than ten students engaging in the lesson. Students rarely talked and preferred communicating via the chat function.

Until face-to-face courses can be fully adapted for online methods of delivery (Moorhouse (2020: 1) and the challenges experienced by students (Lee 2020) minimised, the education sector will need to unite to ensure that students are supported digitally and that the academic quality of courses and standards of the curriculum are not compromised (Crawford *et al.* 2020: 12).

#### 3.6.7.2 Challenges with online teaching during the pandemic

Teaching during the Covid-19 pandemic has been challenging for most faculty members as they lack online teaching experience, especially with the early preparation of material and support from educational technology teams (Bao 2020: 113). Although technology integration into teaching practices was previously developing, little attention was paid to the online assessment and evaluation of students (Sahu 2020: 1).

Teaching staff in online discussions on the DUT's Curriculum Conversations platform (26 May 2020) have indicated the challenge with converting a three-hour face-to-face preparation and delivery of a module to a now nine-hour conversion of the module for delivery online. Crawford *et al.* (2020: 11) agree that curriculum design is challenging, without understanding if teaching staff are provisioned with sufficient recording and internet bandwidth or whether teaching staff have the necessary skill sets to "professionally design and offer online education".

Furthermore, uncertainty arises in the procedures for administrating outstanding assignments, projects and continuous assessments. Sahu (2020: 3) adds that it is not possible to assess lab tests, practical and performance tests via online methods. Online learning for group work can be difficult with the challenges that students may experience in engaging in online classes. The author stresses further that assessment thus becomes challenging for teaching staff once again (Sahu 2020: 1).

With the massive shift from teaching face-to-face to the online delivery of modules, teaching staff need to engage in elaborate lesson plan design and teaching materials which include audio and video contents to ensure successful delivery of the curricula (Bao 2020: 114). The initial contention of e-learning as a feasible option of being complementary to mainstream face-to-face teaching and learning has now become almost a compulsory method of mainstream education.

### 3.6.8 The impact of Covid-19 on this study

Given the impact of the challenges that already exist in higher education as discussed in Part A, Covid-19 has highlighted the plight of teachers and students in engaging in a technologically-driven curriculum.

The researcher needed to administer the survey on the challenges and best-practices of e-learning with students in a classroom environment. Due to the constraints of social distancing and health and safety standards, the method of conducting the survey needed to be re-visited.

## 3.7 Conclusion

Part A of Chapter Three covered an array of challenges experienced by lecturers and students with the use of e-learning technologies. Although e-learning is an effective method to impart knowledge, the resources, planning and implementation of such systems need to be critically evaluated so that the challenges of their usability are overcome. Focus on resources and training needs are imperative areas. The best-practices in using technology for learning provide some innovative strategies to expel some of the challenges experienced. These best-practices can be adapted to the current educational systems, which are now under the constraints of the Covid-19 pandemic.

The literature review of this study has informed the surveys for the data collection from DUT, the case study UoT. The data collection instruments had been finalized and the collection of data had already commenced prior to the surge of the Covid-19 pandemic and before the university was forced into lockdown. Hence, the content of the data collection did not incorporate the observations of the respondents which would have been influenced by the Covid-19 pandemic. Chapter Four explores the research methodology adopted for this study and illustrates the techniques employed for the analysis and interpretation of the data collected.

# CHAPTER 4: RESEARCH METHODOLOGY

## 4.1 Introduction

This chapter outlines the research paradigm of this study and describes the research design, the justification for the methodology adopted, the population, the sample selection, the instruments and the analysis of the data. After having examined the literature and theory applicable to a study, Kumar (2019:49) believes that this exercise is the sixth step in conducting a research study. The author further posits that research is a process which requires working within a "framework of a set of philosophies", using "methods that have been tested for validity and reliability", with every attempt by the researcher to be "unbiased and objective" (Kumar 2019: 34).

Furthermore, Welman, Kruger and Mitchell (2005: 2) explain that the research methodology is that which encapsulates the logic behind the research methods and techniques adopted by the researcher. To address the aims and objectives of this study, i.e. to determine the challenges and best practices of teaching and learning with technology in higher education, the researcher had to consider the most appropriate approach for data collection and interpretation. It is for these inherent reasons that the researcher adopted an empirical approach which would emphasize the challenges and best practices of e-learning for teaching and learning.

The ethical considerations essential for this study are also discussed, providing insight into the procedures adopted for ethical clearance at DUT.

## 4.2 Empirical research

A study of this nature was not conducted previously at DUT. Data gathered and the findings revealed are direct observations by the researcher, i.e. the results are based on real-life experience. Schwartz-Shea and Yanow (2011: 25-26) state that it is not uncommon for researchers to engage in research exercises which return them to familiar activities, or from engagements and interactions with people. Such a phenomenon can be described as empirical research. Kumar (2019: 12) confirms that an empirical approach to research provides for conclusions which are based on "hard evidence" that is collected from real-life experiences. Although the researcher reviewed literature on the trends, challenges and best practices of e-learning in national and international HEIs, evidence regarding these phenomena was gathered from teaching staff and students at DUT, thus exhibiting their experiences with teaching and learning with technology. Dziuban *et al.* (2016:23) state that a study that is conducted within a theoretical framework contributes volumes to the extant body of knowledge on any phenomenon, issue or topic. It is anticipated that the theoretical framework and the data gathered in this study will provide insight into the factors which contribute to the trends, challenges and best practices of e-learning at DUT. An empirical approach was adopted as there have been no previous investigations into the e-learning phenomenon at DUT with reference to teaching and learning.

### 4.3. Objectives of the Study

The objectives of the study are listed below, guiding the researcher to engage in research methods that contribute to the objectives, while drawing significant inferences from the data collected.

- Objective 1: To explore the practices and trends in the use of e-learning technologies for teaching and learning in higher education, particularly at UoTs (through a review of related literature);
- Objective 2: To investigate the effectiveness of using e-learning technologies in teaching and learning in higher education (through a review of related literature);
- Objective 3: To ascertain e-learning practices and trends in the use of e-learning technologies for teaching and learning at DUT;
- Objective 4: To determine the challenges encountered in the use of e-learning technologies for teaching and learning at DUT;

- Objective 5: To determine the most feasible strategies to address challenges with e-learning technologies in teaching and learning at DUT; and
- Objective 6: To develop a suitable framework to address challenges in respect of e-learning technologies for teaching and learning and the best practices that could be applicable in higher education.

**4.4 The Research Design**

Bearing in mind the different approaches to research, the researcher had to consider the paradigm that would be most beneficial and appropriate to address the research questions. Welman, Kruger and Mitchell (2005: 8) identified the differences between both quantitative and qualitative approaches to research. The authors believe that while quantitative research evaluates objective data consisting of numbers, qualitative research deals with subjective data, i.e. data that is derived from the minds or opinions of the respondents and is presented in language rather than numbers (Welman, Kruger and Mitchell, 2005:8). According to Gray (2014: 161), qualitative research encompasses theoretical stances and methods (observations, interviews, questionnaires and document analysis). Although regarded as less valid and reliable than quantitative research, Gray (2014: 161) argues that qualitative data can be a powerful source of analysis.

However, the researcher believed that a quantitative approach would be most suitable for her mode of enquiry. Quantitative data can be discrete or continuous and can be represented by real numbers (Maree 2016: 8). The decision to embark on a quantitative study was influenced by the need to determine the knowledge, feelings, opinions, attitudes and behaviour (Graziano and Raulin 2013: 318) of teaching staff and students at DUT with respect to e-learning and the challenges they experience, as well as the best practices of teaching and learning with technology. Although surveys explore opinions, feelings and behaviours within a qualitative study, they (surveys) also form a research technique within quantitative studies, thus allowing the investigation of a phenomenon through questions which reflect the opinions, perceptions and behaviors of a particular group of individuals (Queiros, Faria and Almeida 2017: 381). The researcher's decision to adopt a quantitative approach is further enforced by Kumar's (2019: 16) belief that the quantitative approach is "rooted in the philosophy of rationalism", and that the quantitative approach: -

a) *Is rigid, pre-determined and structured*, thus quantifying the extent of a variation in a phenomenon: this will allow for the researcher to determine variations in the number of staff and students who are affected by the challenges of teaching and learning with technology; the number of best practices that have been adopted; and the extent to which e-learning has either enabled or inhibited pedagogical practices at DUT;

b) *Emphasises the objectivity of the process* as well as the measurement of the variables: the information gathered is provided purely by the research sample i.e. the lecturers and students - the questionnaire allows for no bias;

c) Provides impetus to the *validity and reliability of the findings*; and

d) *Communicates results* in an analytical and aggregate manner.

The researcher will collect and analyse numerical data in a systematic and objective manner, which is an attribute of carrying out quantitative research (Maree 2016: 8).

**4.5 Study population**

This section focusses on the complete list of the population under study from which the sample will be drawn, i.e. the target population as listed below and the sample population.

**4.5.1 Target population**

Salkind (2010: 1303) states that the entire population considered in sampling is often referred to as the theoretical or target population because it includes all participants who are of theoretical interest to the study and the researcher. Denscombe (2010: 27) also refers to the target population as a “known population”. The author believes that the researcher must be knowledgeable about the composition of the overall population from which the sample is to be taken, implying that the researcher should know about the total number of the population, who they are or where they exist.

### 4.5.2 Population for this study

Maree (2016: 164) posits that the “research question is always linked to a specific group of sampling units”. The target population of staff for this study comprised 516 full-time lecturers from all faculties and all campuses of DUT. The target population of students comprised 16 914 full time students from all six faculties at DUT from Level 1(1st year) to Level 3 (3rd year). Students from the Pietermaritzburg and Indumiso campuses of DUT were not selected as part of the population as it would have been difficult for the researcher to co-ordinate data collection at these distant campuses.

| FACULTY | NO. OF FULL TIME ACADEMIC STAFF |
|---|---|
| FACULTY OF ACC AND INFORMATICS | 93 |
| FACULTY OF APPLIED SCIENCES | 70 |
| FACULTY OF ARTS AND DESIGN | 82 |
| FACULTY OF ENG & THE BUILT ENV | 103 |
| FACULTY OF HEALTH SCIENCES | 78 |
| FACULTY OF MANAGEMENT SCIENCES | 90 |
| **Grand Total** | **516** |

**Table 4.1: Target Population- Staff**

*Source*: Ravjee (2019)

| FACULTY | NO. OF FULL TIME STUDENTS (LEVEL 1-3) |
|---|---|
| FACULTY OF ACC AND INFORMATICS | 5048 |
| FACULTY OF APPLIED SCIENCES | 2180 |
| FACULTY OF ARTS AND DESIGN | 1426 |
| FACULTY OF ENG & THE BUILT ENV | 2463 |
| FACULTY OF HEALTH SCIENCES | 1591 |
| FACULTY OF MANAGEMENT SCIENCES | 4206 |
| **Grand Total** | **16914** |

**Table 4.2: Target Population- Students**

*Source*: Ravjee (2019)

### 4.5.3 Sample population and sample size

Salkind (2010: 1295) defines a sample as a sub-set of a population. Hence, a sample population is representative of the target population. The sample population for this study was selected from all full-time lecturing staff at DUT and students of the six Faculties, namely, Engineering and the Built Environment; Management Sciences; Applied Sciences; Accounting and Informatics; Art and Design; and Health Sciences.

Jonker and Pennink (2009: 155) aver that the purpose of sampling is to be able to infer, from the sample taken, the attributes of the population as a whole. Salkind (2010: 1295) states that researchers obtain samples from their target population as they do not have the resources, i.e. time, money or access, to measure or observe all members of the population.

The sample size for this study was established using Sekaran and Bougie's (2013: 268) sampling table. The sample size for lecturers was 220 full-time lecturers. The secondary sample comprised 375 full-time students from all six faculties on the Durban campuses. The sample sizes selected thus depicted Kothari's (2004: 56) theory that the size of the sample should be optimum, neither excessively large nor too small. The optimum sample of lecturers and students from the faculties thus ensured that the requirements of efficiency, representativeness, reliability and flexibility were complied with.

### 4.5.4 Sampling method

Sampling methods can be differentiated into probability and non-probability methods. Salkind (2010: 1296) defines probability sampling as "a sub-set of a population in which each member of the population has a precise probability of being included in the sample". However, non-probability sampling differs from probability sampling in that the researcher exercises discretion or has the option of choice at some point in the selection process (Denscombe 2010: 25). The sample selection in this study had to be two-fold as both staff and students were selected participants in the study.

In keeping with Schwartz-Shea and Yanow's (2011: 87) concept of purposive sampling, i.e. the intentional selection of persons thought to have something to contribute to the study, the researcher chose her samples in terms of the approaches listed below.

#### 4.5.4.1 Sample selection: teaching staff

Teaching staff were selected via probability sampling while adopting a systematic sampling technique. Every 3$^{rd}$ staff member within each faculty in the sampling frame was selected as a participant in the sample. Kumar (2019: 298) identifies that samples selected via probability sampling represent the total sampling population, therefore inferences can be drawn from such samples and generalised to the total sample population.

#### 4.5.4.2 Sample selection: students

Students were selected via non-probability sampling while adopting a convenience sampling technique. Denscombe (2010: 25) confirms that non-probability sampling is cost effective and involves an element of expediency (convenience) and is not restrictive, as is the principle of random selection. Convenience sampling allows for the sample selection process to continue until the required sample size is reached (Welman, Kruger and Mitchell 2005: 69). The authors also state that there is very little variation in the population selected. Apart from the convenience sampling technique offering affordability in terms of money and time, Denscombe (2010: 37) states that this type of sampling technique is based on voluntary participation by the subjects in the sample. The researcher thus determined that non-probability sampling was best suited for the selection of the secondary sample within the scope of this study.

## 4.6 Data collection instrument

The design of the data collection instruments was informed by the quantitative methods employed to explore the trends, challenges and best practices of e-learning in this study. Questionnaires, being a primary source, provide primary data extracted from respondents themselves (Kumar 2019: 215). For this study, the questionnaires included both open-ended and closed-ended questions. Graziano and Raulin (2013: 5) state that a question is one side of an idea, on the other side of which is an unknown – a potential answer. The authors also believe that every question points to an unknown, to some area of human ignorance or uncertainty and that questionnaires are an inherent source of extracting information in survey research. Cresswell (2009: 12) views survey research as providing a quantitative description of the trends, attitudes or opinions of a population by studying a sample of that population.

Data collected from the survey questions provided the researcher with information on existing technologies used by lecturers and students, the challenges experienced, as well as intervention strategies and best practices. The expectations of lecturers and students of technology in higher education were analysed, thus contributing to the aim and overall objectives of this study.

**4.7 Design of the questionnaires**

For the purposes of this study, data was collected via self-administered surveys comprising solely of primary data. Salkind (2010: 1095) states that primary data is an original data source, one in which data are collected first hand by the researcher for a specific research purpose or project. The survey, in the form of questionnaires, will comprise open-ended (unstructured) and closed-ended (structured) questions based on the aim and objectives of the study.

The survey questions were designed by taking into account the following themes: -

- trends in teaching and learning practices;
- technologies for teaching and learning;
- challenges in teaching and learning with e-learning technologies; and
- best-practices for teaching and learning with technology.

The content of the surveys was designed in accordance with the literature reviewed regarding the aforementioned themes.

### 4.7.1 Structure of the questionnaires

The researcher had to determine the most appropriate questions within the scope of the aims and objectives of the study to elicit the most appropriate responses. The themes as listed above had to be categorised further into sub-themes in order to extract a range of responses necessary to contribute to the aims and objectives of the study.

The sub-themes comprised closed-ended questions with a Likert scale rating, as well as open-ended questions. The researcher believed that using a Likert scale rating was best to measure the opinions, attitudes and perceptions of both lecturers and students. The Likert scale consisted of 5 categories (strongly agree, agree, neutral, disagree and strongly disagree), ensuring an optimal number of choices for respondents. Providing an odd-numbered Likert scale with a "neutral" choice provided the respondent with the option for "indecision or neutrality" (Croasmun and Ostrom 2011: 20). The authors further emphasise that, in this way, the respondents are able to be neutral and not feel forced to show that they have an opinion if they actually did not. An even numbered Likert Scale would not allow for this. The researcher also opted not to restrict the respondents with closed-ended questions to some of the themes, therefore including the option for fuller explanations using open-ended questions as well.

#### 4.7.1.1 Layout of the questionnaires

The layout of the questionnaires was structured into factual questions and themes and sub-themes according to the aims and objectives of the study. Van Zyl and Pellisier (2017: 141) emphasize the importance of systematically and carefully designing questions that allow for the researcher to collect reliable and valid data in order to produce relevant conclusions.

Factual questions in the student questionnaire covered the faculty, programme and level of study; while the factual questions in the staff questionnaire covered only the faculty in which staff were employed. Other characteristics like gender, race and age were considered irrelevant in the study.

The student questionnaire was structured using the following themes and sub-themes:

a) Background information to technology in education:

    - Technology in secondary school;

b) Trends of learning with e-learning;

c) Challenges experienced with e-learning:

    - Distraction in respect of weaker students;
    - Use of technology requires more time;
    - Interactions between peers, lecturers and learning materials;
    - Lack of human contact;
    - Lack of access to technology;
    - Technological skills challenges;
    - Working online;
    - Poor quality of e-learning systems;
    - Poor effort from lecturers;
    - Training/workshops/orientation;
    - Technical support; and

d) Best practices

The staff questionnaire was also structured along similar themes and sub-themes covering the following:

a) Teaching practices:

    - Methods relating to teaching practices;
    - Importance for teaching and learning;

b) General teaching challenges;

c) E-learning practices/trends;

d) Challenges of teaching with technology:

- Rigid teaching practices;
- Lack of skills/knowledge/engagement in the use of technology;
- Lack of access to technology;
- Challenges relating to poor infrastructure;
- Challenges with integrating technology into teaching practices;
- Use of technology entails more work;

e) Best practices:

- T-pack model;
- Resources and technical support;
- Use of instructional technology; and
- Significance of community chat groups.

#### 4.7.1.2 Closed-ended/structured-questions

Based upon the review of the literature and with the aims and objectives of the study in mind, the researcher drafted closed-ended questions with a range of foreseeable answers on current trends, challenges and best practices of teaching with technology.

Ready-made categories are prevalent in closed-ended questions. Kumar (2019: 232) therefore states that closed-ended questions ensure that the information required by the researcher is obtained and responses become easier to analyse. Basias and Pollalis (2018: 93) agree that the closed-ended questions provide for simple questions and short answers that can be easily quantified and compared. However, the consequences of closed-ended question analysis prove disadvantageous. Respondents are restricted to choosing answers that have been provided by the researcher. Kumar (2019: 232) states that this could condition the thinking of respondents, not reflecting the respondents' true beliefs or opinions. To overcome this limitation, the researcher added the option, where necessary, for respondents to engage fully in open-ended questions in particular sub-themes.

Closed-ended questions indicate the attitude of respondents towards a particular issue. To measure the attitude and opinions of lecturers and students to technology as a teaching and learning tool, the researcher devised questions guided by the Likert scale analysis. The range of questions were categorised by a ranking of 1 to 5 as per the following options: -

a) Strongly Disagree = 1;

b) Disagree = 2;

c) Neutral = 3;

d) Agree = 4; and

e) Strongly Agree = 5.

Likert scales provide vital statistics in determining attitudes which are prevalent in respondents, the intensity of those attitudes and the number of respondents who have those inherent attitudes towards a particular situation (Kumar 2019: 252).

#### 4.7.1.3 Open-ended/unstructured questions

Open-ended or unstructured questions are more difficult to analyse as an open-ended question requires lengthy responses from research participants, with either phrases or comments (Maree 2016: 180). The advantages of open-ended questions are numerous. Maree states that with open-ended questions, respondents' thinking processes are revealed, complex questions can be adequately answered and a thematic analysis of responses provides for interesting detailed information (2016: 180). Although open-ended questions provide for a wealth of information, Kumar (2019: 231) states that the analysis of responses proves difficult for the researcher. The author also believes that allowing "free choice" in open-ended questions allows for respondents not being able to express themselves, resulting in a loss of valuable information. However, the researcher allowed for respondents to express their thoughts and beliefs on the trends, challenges and best practices of e-learning at DUT. This also overcame the limitation of responses in the structured close-ended questions.

### 4.7.2 Administration of questionnaires

This study uses two different methods to conduct the survey.

#### 4.7.2.1 Online questionnaires to staff

With the developments in web-based technologies, many web-based survey tools are available. Software companies have designed various online surveys, namely Qualtrics, SurveyMonkey, Snap Surveys, QuestionPro, Pollfish, SurveyGizmo and Kwiksurveys (Fricker 2016: 165). Greenfield and Greener (2016: 210) have also classified Survey Writer, Instant Survey, Zoomerang, Create Survey and Response-o-matic as other online questionnaire and design tools. Evans and Mathur (2018: 854) further elaborate on the popularity of online surveys and believe that online surveys have matured as a research technique, changing survey methodologies and possibilities. However, with the various web-based tools available, the researcher opted to design the staff questionnaire using the Microsoft Forms software application. DUT's IT environment is currently on a Microsoft platform enabling the use of Microsoft software as more feasible. These advancements in technology have created a unique opportunity for creating online surveys for social research as well (Kumar 2019: 191). The online questionnaire was administered to staff via the following link https://forms.office.com/Pages/ResponsePage.aspx?id=0TAZS_QStUC0jL2GEXQp2MmPjMZjOCxNhULvlHTjBkIUREVUOVk4OEJPRlg0TzNERlFHRUtKNkpDTC4u

Since the Microsoft platform is utilised for information technology services at DUT, the respondents were able to access the online survey using their DUT login credentials. This proved an uncomplicated process as the University is currently using the MSO (Microsoft Office)365 application and the interface to access Microsoft forms is the same. The survey could be accessed on a desktop computer, a laptop, tablet or any other mobile device, including cellular phones.

#### 4.7.2.2 Advantages of administering online surveys

According to Parsons (2007: 24), Granello and Wheaton (2004: 388-389) and Evans and Mathur (2018: 856-858), the benefits of online or web-based surveys are:

- Timely and quick dissemination of surveys;
- Flexible formats;
- No paper waste;
- Respondents can complete surveys at their own pace;
- Larger sample sizes can be selected, with no restriction on the number of respondents that surveys can be administered to, or extra costs if surveys are administered to a larger sample;
- Reduced response time;
- Ease of data capture – some web surveys (such as Microsoft forms) allow for the survey to be configured to export data to a database or spreadsheet; and
- Ability to track respondents' answering behaviours.

#### 4.7.2.3 Disadvantages of administering online surveys

Parsons (2007: 24-25), Granello and Wheaton (2004: 389-390) and Evans and Mathur (2018: 858-859) attribute the following as limitations to online surveys:

- Technical difficulties – not all respondents have access to the latest technologies or technological devices, neither are they extremely computer literate;
- Lower response rates;
- Abandonment of the survey – respondents can quit or abandon the survey at any time;

- Potential culture and language issues; and
- Technology glitches can also hinder access to surveys.

After deliberating on the advantages and disadvantages of online surveys, the researcher was certain that an online survey would prove most appropriate for the study. Respondents have access to technology at the university and the use of Microsoft Forms software was most acceptable due to the ease of access and the lack of cost.

#### 4.7.2.4 Questionnaires to students

Student questionnaires were to be administered personally by the researcher. Data collection via the administration of questionnaires is speedy and economical, with the only cost resulting from its preparation and printing (Bryman 2016: 222).

The researcher took the decision to administer hard-copy questionnaires to students and not conduct the survey online as she was unsure of the access to online activities that students do engage in, i.e. whether they have access to devices and to data or Wi-Fi to complete the survey. Kongsved *et al.* (2007) conclude that studies conducted in populations with known access to the internet show higher response rates than do studies of populations without known access.

However, the initial decision to administer surveys personally to students had to be revisited. Further details are discussed under the section "The Impact of Covid-19 on administering the Student Survey."

#### 4.7.2.5 Advantages of paper-based surveys

The researcher believed that administering paper-based questionnaires to students under a controlled environment would yield a higher response rate. Lalla and Ferrari (2011: 351) advise that environmental control is necessary for higher response rates as the survey is conducted in a classroom in the presence of an instructor, unlike those conducted outside the classroom setting where collective answers can be provided by groups of students.

The researcher was unaware of how many students would have access to devices to complete an online survey, hence conducting a paper-based survey would not impact negatively on response rates to the study. Student judgements can be influenced by the availability of devices or access to links and network difficulties (Lalla and Ferrari 2011: 351).

Conducting a paper-based survey in a controlled classroom environment allowed for the researcher to ensure that no privacy issues were experienced by the students. Unlike online surveys, paper-based surveys are nearly devoid of security concerns with data integrity and privacy. Lalla and Ferrari (2011: 351) therefore believe that surveys conducted online are less transparent as compared to paper-based surveys.

#### 4.7.2.6 Disadvantages of paper-based surveys

Paper-based questionnaires result in scores and data taking a long time to capture, especially when used for a large-scale survey (Kusumoto *et al.* 2017: 2100).

Unlike online surveys, where it is possible to have a “forced answer” where a respondent cannot move to the next question without providing an answer to the initial question (if so set up by the researcher), paper-based questionnaires allow for a respondent to skip questions and leave specific items incomplete in the questionnaire (Denscombe 2009: 284). The type of survey used thus impacts on non-responses to certain items.

De Rada and Dominguez (2014: 337) believe that paper-based questionnaires are more likely to receive a higher item non-response rate than online questionnaires. The authors also believe that the quality of information received via online responses differs to that of paper-based questionnaires.

Comparisons between online and paper-based questionnaires in a study conducted by Touvier *et al.* (2010: 287-296) indicate that abnormalities in values in paper-based surveys were higher than those in online surveys.

#### 4.7.2.7 The impact of the Covid-19 lockdown on administering the student survey

As highlighted in the literature review, the disruption created in the educational environment by Covid-19 impacted severely on the collection of data from students. Only 6% of student data was collected before the Covid-19 pandemic and ensuing lockdown by administering paper-based surveys. The Durban University of Technology began the academic year with students returning on 3rd February 2020. By mid-March 2020, the academic programme was suspended due to Covid-19. The uncertainty of a return to normality in academia made it difficult to judge whether the student survey could be conducted as planned.

As South Africa moved from Lockdown Level 4 to Lockdown Level 3, a maximum of 33% of the student population was allowed to return to campuses (Department of Higher Education 2020: 10). The Department further emphasised that only students registered for the final year of their programmes as well as final year students who required access to laboratories, technical equipment, data, connectivity and access to residence and private accommodation, and students in all years of study that required clinical training in their programmes were allowed to return to campuses.

The researcher could not conduct the survey with this cohort of students only as this would not provide a credible reflection of the sample selected. Consequently, it was not possible for the researcher to continue with administering paper-based surveys. The researcher had to reserve a second option as student activity did not return to normal and she was compelled to consider online questionnaires as an alternative. The online survey was conducted with the same instrument in an online format and administered to students via the following link:

https://forms.office.com/Pages/ResponsePage.aspx?id=0TAZS_QStUC0jL2GEXQp2MmPjMZjOCxNhULvlHTjBklUN0tDRk83RTFRSVhEWjdYSFNDNlpSWklyMi4u

## 4.8 Pre-testing

Maree (2016: 174) states that pre-testing a survey instrument is imperative to determining whether the respondents interpret the questions correctly, as well as to ensuring that the response categories provided for the questions are suitable. The feedback from the respondents in the pre-test phase may lead to some adjustments being made to the questionnaire. Bryman (2016: 260) believes that pre-testing a questionnaire will highlight the weaknesses (if any) of the questionnaires and also of the survey techniques, thus improving the techniques and reducing considerable wastage as questionnaires are administered in bulk. Kumar (2019: 237) agrees that the research instrument in a pre-test will involve a critical examination by the respondents in understanding the questions.

Venter and van Zyl (2017: 151) infer that pre-testing is a key component in ensuring validity and reliability. The authors further state that a research instrument should be pre-tested with people who are knowledgeable and experts in the field being studied. Venter and van Zyl further advise that it would also be beneficial for a survey statistician to evaluate the instrument "against the data analysis plan developed by the researcher" (2017: 151). The researcher had both survey instruments (staff and students) evaluated by the statistician to ensure that the instruments were void of errors and would measure what was intended to be measured.

Both survey instruments were then subjected to a pre-test to ensure that questions were clearly understood, correctly interpreted and would solicit responses that could be analyzed. The pre-test questionnaire to staff was conducted online. Kumar (2019: 237) states that the pre-test of a research instrument should be executed with a group of respondents similar to the study population and under actual field conditions. Selected staff were invited via email to participate in the pre-test exercise.

The following link directed staff to the pre-test questionnaire:

https://forms.office.com/Pages/ResponsePage.aspx?id=0TAZS_QStUC0jL2GEXQp2MmPjMZjOCxNhULvlHTjBklUQVRaOVJCRVpBU1dHT1laVzZGQkFIR0FQMy4u

Parsons (2007: 29) advises that piloting an online survey not only indicates how well the questions work, but also how well the survey flows. The author suggests further that the URL for the pre-test should be different to the URL of the final survey, although the pre-test survey portrays the same features as the final survey. This step ensures that the pre-test data does not get mixed up with the final data collection.

Following these guidelines, the researcher conducted the pre-test with 18 staff from the various faculties. The online questionnaire was well received and the responses indicated that the questionnaire was free from errors and ambiguities.

The researcher handed out hardcopy questionnaires personally to 20 students from the various faculties for the pre-test phase because she had to ensure the comprehensibility of the questionnaire administered to students. Responses indicated that the questions were understood and were void of errors. Rahi, Alnaser and Ghani (2019: 1158) believe that pre-testing ensures the ease of understanding of the questions by respondents and if questions are easily understandable, respondents are motivated to participate in the study.

With the reliability and validity of both survey instruments tested, both questionnaires proved worthy for the final data collection to be conducted.

**4.9 Delimitations/scope**

Although the target population included all full-time lecturing staff at all campuses of DUT, the data collection for students was limited to the Durban campuses only. The geographical location of both the Pietermaritzburg and Indumiso campuses would have been difficult for the researcher to access in order to administer questionnaires to students. Hence, the survey undertaken with the students was limited to all full-time undergraduate students at the Durban campuses.

The survey for staff was easily accessible due to the online nature of the survey, although it was a large and geographically diverse sample inclusive of all campuses at the DUT. However, the sample was limited to full-time staff members. Part-time and contract staff were not included in the study as the researcher was unsure of the terms of office for these staff.

**4.10 Ethical considerations**

Plagiarism and (dis)honesty in research activities impact on ethical behaviour. Welman, Kruger and Mitchell (2005: 181) state that ethical issues also arise when research activities involve human participants, both in biological and social sciences studies. Brynard, Hanekom and Brynard (2014: 94) believe that it is essential for the conduct in carrying out research activities to be morally acceptable. The authors state further that researchers need to adhere to the following guiding principles when engaging in research projects: -

a) The researcher has to maintain the highest possible technical standards in the implementation of the research;

b) The researcher needs to indicate the limitations and constraints of the research and the validity of the study findings;

c) The researcher has to divulge his/her exact area of specialization and degree of expertise in the field; and

d) The researcher's final presentation of the research report should be void of misinterpretation or a lack of the disclosure of findings.

Research ethics provide a degree of protection to research participants so that no harm befalls participants; there is no lack of informed consent; there is no invasion of privacy; and no deception (Bryman 2016: 125).

It is for these reasons that the Institutional Research Ethics Committee (IREC) at DUT specifies ethical requirements for each faculty. The researcher had to comply with these requirements, indicating that the study would have minimal risks to humans, animals and the environment. The initial proposal was scanned for ethical issues and an Ethical Issues Checklist had to be adhered to. The researcher had to obtain clearance from IREC to continue with the study once the proposal was accepted by the Faculty Research Committee at DUT. Full ethical clearance approval from IREC was awarded to the research project once the pre-test was conducted.

#### 4.10.1 Anonymity and confidentiality

Respondents had to be assured of anonymity and confidentiality by the researcher. Anonymity ensures that the data collected in surveys cannot be linked to the respondents. Respondents are de-identified and all possible identifying characteristics are separated from the publicly available data (Lavrakas 2008: 27).

The researcher had to ensure that no data linked to any respondent was revealed publicly. Lavrakas (2008: 202) states that confidentiality ensures that the disclosure of a respondent's identity or identifying information is prohibited in the absence of specific, informed consent. Sensitive information will not be published if anonymity and confidentiality are threatened.

#### 4.10.2 Voluntary Participation

Participants were informed of the study via a "Letter of Information" (Annexure 3) which accompanied each survey instrument and consent was obtained via a Consent Form (Annexure 4). Research participants were informed on the purposes, methods and possible intended use of the research results and the implications thereof for e-learning at DUT. Potential respondents were informed that they could withdraw consent to participate in the study at any time and any answers would always be treated as confidential by the researcher.

The emailed invitation to participate in the study highlighted the purpose of the study and the Letter of Information and Consent Form were included as attachments. The link to the survey was also included within the body of the mail.

### 4.11 Hypotheses formulation

Mligo (2016: 33) identifies the main function of the hypothesis statement as "bringing the theory into a form that can be tested through the identification of concepts within and turning those concepts into empirically testable variables". The hypothesis is a statement derived from the research problem. The author (2016: 37) further indicates that the importance of a hypothesis statement reveals that:

i. It allows the researcher to define precisely what will be investigated;
ii. It allows for the reader to evaluate the research work according to the criteria laid down by the researcher in the hypothesis statement;
iii. It provides the researcher with clear boundaries on what needs to be focused on, as well as the tasks to be carried out in a proper way to reach the conclusions; and
iv. It allows the researcher to be analytical and argumentative.

A hypothesis can either be an alternative/alternate or null hypothesis. Mligo (2016: 33) further states that the alternate hypothesis shows an asymmetrical relationship between variables, whilst the null hypothesis indicates a symmetrical relationship between the variables. The alternate hypothesis proves whether a relationship exists between the variables and the null hypothesis proves that there is no relationship between the variables.

Larini and Barthes (2018: 77) state that in order to confirm or invalidate hypotheses, a number of tests can be undertaken, all of which are designed according to the nature of the variables and the situations that are being investigated. In this empirical study, the chi square test was conducted to determine whether the scoring patterns per statement were significantly different per option. The null hypothesis claims that similar numbers of respondents scored across each option for each statement (one statement at a time). The alternate states that there is a significant difference between either the levels of importance or levels of agreement. The Structural Equation Model (SEM) methodology was also implemented for hypothesis testing.

Hypothesis testing for this study is discussed further in the next section and in the next chapter.

**4.12 Validity and reliability**

Saldana (2011: 134) links validity and reliability to credibility and trustworthiness. Validity and reliability are constructs which are used to evaluate the quality of quantitative research. Valid and reliable data ensure replicability and accuracy. The section below is a discussion on validity and reliability as sound measurement tests for the research instruments used in this study.

**4.12.1 Validity**

A valid test is one which measures what it is intended to measure (Denscombe 2010: 328). Research instruments administered thus needed to ensure adequate testing of all the relevant criteria of the study. Habib, Pathik and Maryman (2014: 29) state that "validity refers to the accuracy of a measure or the extent to which a score truthfully represents a concept". The authors state further that validity is composed of "internal validity" and "external validity". While internal validity measures what it is intended to measure (as in this study), external validity focuses on "generalizability to populations, settings, treatment variables and measurement variables".

Denscombe (2010: 328) states that in order for data to be valid, it needs to reflect the truth, reflect reality and cover the crucial matters. The methods and methodology employed for this study must allow the researcher to measure that which is intended to measure. There are various forms of validity that can determine the relevance of the measuring tool.

**4.12.1.1 Content validity**

Content validity speaks to logic, i.e. to ensure that content validity is achieved, the researcher may approach those who are knowledgeable or experts to review the content of a particular instrument in order to determine if it "covers all potential dimensions" (Venter and van Zyl 2017: 150). Habib, Pathik and Maryman (2014: 57) agree that apart from the instrument adequately covering the topic under study, content validity can be achieved if the instrument takes into account a representative sample of the total population being studied. In this study, content validity was achieved by ensuring that both the staff and student survey instruments were pre-tested and included representative samples of both populations. The questionnaires were reviewed by staff within DUT who are familiar with a technology-driven curriculum.

#### 4.12.1.2 Face validity

Face validity refers to the validity of an instrument at face value (Bolarinwa 2015: 196). Venter and van Zyl (2017: 150) state that "an assessment can be said to have face validity if it 'looks like' it is going to measure what it is supposed to measure". Validity was assessed by means of the Pearson's co-efficient analysis technique.

#### 4.12.1.3 Construct validity

Welman, Kruger and Mitchell (2005: 142) emphasise that construct validity is "of special importance to research". The authors further add that the instrument used in measuring variables in a research study must measure that which it is meant to measure, i.e. the degree to which it (the instrument) measures the "intended construct rather that the irrelevant construct". In order to reduce the threats to construct validity in any study, the researcher needs to ensure that the hypotheses are built on well-validated constructs (Graziano and Raulin, 2013:180). The hypotheses for this study are clear and validated by a well-supported theoretical basis. An example for this study would be to ensure that the instrument intended to measure the construct of "challenges experienced by teaching staff in using technology for teaching" actually measures this construct that it was designed to measure. In order to ensure that the instrument measured the construct it was intended to measure, the factor analysis statistical technique was adopted. Kline (2014: 3) describes factor analysis as a statistical technique, “the aim of which is to simplify a complex set of data”. The author states further that factor analysis is applied to correlations (relationships) between variables and in the social sciences, is usually applied to correlation matrices. In the next chapter, the matrix table is preceded by a summarised table that reflects the results of Kaiser-Meyer-Olkin and Bartlett's Test and the discussion ensues with the factor analysis/loading, which illustrates the inter-correlations between the variables.

### 4.12.2 Reliability

In order to ensure reliability, the research instrument had to produce the same data time after time on each occasion that it was used. If there are any variations in the results obtained through using the instrument, this will be due to variations in whatever is being measured (Denscombe 2010: 326). Reliability ensures that a test provides a consistent set of scores for a sample if it was administered independently on several occasions (Ayiro 2012: 39). To ensure that the reliability of the instrument is void of errors, the pre-testing of the instrument conducted tested the efficacy of the research instruments. Reliability can be ensured in various ways. Venter and van Zyl (2017: 165) and Tavakol and Dennick (2011: 53) maintain that using the Cronbach’s alpha co-efficient technique is a most frequently and most widely used objective measure of reliability. According to Tavakol and Dennick (2011: 53), Lee Cronbach developed alpha in 1951 – alpha provides a measure of the internal consistency of a test or scale and is expressed as a number between 0 and 1. Higher values indicate greater reliability, but the recommended minimum value for alpha should be 0,7 (Venter and van Zyl 2017: 165). To ensure the reliability of both instruments for staff and students at a pre-testing stage, the Cronbach alpha co-efficient and factor analysis techniques were applied.

Pre-testing the survey instruments by selecting a small number of respondents (from both groups- lecturers and students) was the principal consideration in ensuring that respondents understood the questions and that they had sufficient knowledge to respond to the questions. The research questions were created bearing in mind the terminologies which staff and students were familiar with, as well as what was found in the relevant literature reviewed. The researcher had to ensure that questions were unambiguous and yielded consistent results which would be relevant to the research objectives.

### 4.13 Data analysis

The data collected and the analysis thereof is presented in the next chapter. The data collected relating to the various themes set out in the objectives was tabulated in Microsoft Excel. The subsequent analysis was then conducted using the Statistical Package for the Social Science (SPSS) Version 26 for Windows.

The results are discussed and findings are presented via sectional analyses. The quantitative data analysis was conducted on the numeric data collected from both the staff and student surveys. The few open-ended questions provided for the qualitative representation of the study. Data was analysed and discussed using Thematic Analysis. Maguire and Delahunt (2017: 3353) state that thematic analysis is used to identify important or interesting patterns in the data which address the research or point to an issue, i.e. themes are identified. The authors posit further that in thematic analysis “a theme is characterised by its significance” (2017: 3356).

#### 4.13.1 Response rate

Microsoft Forms revealed a response rate of 73% for staff returns (161 responses received from the sample of 220 respondents selected). A response rate of 78% was received from the student survey (256 responses received from the sample of 330 respondents selected). The initial response rates were low. The researcher conducted follow-up reminders via emails to all respondents. An appeal was also made to non-respondents, with an extended due date. The response rates increased as a result of the researcher conducting two follow up exercises with the non-respondents.

#### 4.13.2 Statistical techniques/procedures

Once the researcher collects data, Welman, Kruger and Mitchell (2005: 227) state that he/she has to make sense of it. According to Graziano and Raulin

(2013: 98), the researcher thus needs to engage in statistical procedures which relate to describing the results of the study (descriptive statistics) and helping understand the meaning of the statistics (inferential statistics). The authors add that the data generated from research studies, i.e. the scores of individual responses on each of the study's measures, can be difficult to manage. It is through descriptive and inferential statistics that data can be organised and the relationships between the measures understood.

### 4.13.3 Descriptive statistics

Davis (2013: 13) reveals that "a statistic is a number which represents or summarizes data". The author adds that in a research study, it is the descriptive statistics which show how much data is involved, as well as its shape. Data can be described with summary statistics in the form of charts, percentages, means and medians (Venter and van Zyl 2017: 157 and Larini and Barthes 2018: 15). The "description and/or summary of data obtained for a group of individual units of analysis" is shown in an example by Welman, Kruger and Mitchell (2005: 232) as a university principal's annual report whereby the student community can be described in numbers in the different faculties. Descriptive statistics therefore provide a summarised, simplified description of large sets of measurements (Graziano and Raulin 2013: 98).

Descriptive statistics for this study entailed the presentation of the results from the lecturer and student surveys. Larini and Barthes (2018: 15) state that descriptive statistics enable the researcher to comment on the results obtained, formulate hypotheses and also draw conclusions in relation to the samples that were studied. The descriptive statistics section was divided into the analysis of staff data and the analysis of student data. The descriptive statistics based on the staff survey focused on teaching practices, general teaching challenges, e-learning trends and practices, challenges of teaching with technology and best practices. The descriptive statistics based on the student survey focused on the background information to technology in education, e-learning trends and practices, challenges experienced with e-learning and best practices.

The next chapter provides an in-depth analysis of the descriptive statistics, i.e. an analysis of the importance of each of the statements relating to the themes and sub themes is included.

### 4.13.4 Inferential statistics

Davis (2013: 13) concludes that inferential statistics is basically drawing conclusions by generalising from limited data, i.e. inferences can be drawn from a sample of a population. Inferential statistics provides for the interpretation of what the data actually means (Graziano and Raulin 2013: 98). Inferences can be drawn about a population by seeking conclusions and testing hypotheses from the samples obtained within the population (Bryman 2016: 691; Welman, Kruger and Mitchell 2005: 236; Venter and van Zyl 2017: 157). In addition, inferential statistics provide for reliability and validity.

To ensure the validity and reliability of the survey instrument in this study, as well as to ensure the statistical significance of the results obtained, the following techniques were adopted:

- **Cronbach's alpha (α) coefficient technique**: tested the reliability of the survey instrument of this study. Bryman (2016: 158) states that Cronbach's alpha is a commonly used test of internal reliability.
- **Factor analysis** ensured that the survey instrument measured the constructs that it was designed to measure.
- The **Kaiser-Meyer-Olkin (KMO) and Bartlett's test** ensured that the conditions necessary for the factor analysis procedure were fulfilled. Factor analysis was conducted only for the Likert scale items.
- A **rotated component matrix** illustrated the components, with certain components being divided into finer components. Bryman (2016: 168) states that the main goal of factor analysis is to "reduce the number of variables with which the researcher needs to deal" in relation to multiple-item measures, such as Likert scales.

- Furthermore, the validity of the survey instrument is indicated by the **Pearson coefficient** results that were obtained. This technique examined the direction of the relationship between the co-efficients, which resulted in either a negative or positive relationship (Bryman 2016: 341).
- **Cross tabulations** consisted of **chi-square tests** to determine statistically significant relationships between the variables (Bryman 2016: 347).
- **Triangulation:** to increase the credibility and validity of the results, the researcher also adopted triangulation as a technique to draw up valid conclusions. Bryman (2016: 386) states that “triangulation entails using more than one method or source of data in the study of social phenomena". Triangulation allows for confidence in the findings of a study as the technique uses more than one way of measuring a concept (Bryman 2016: 643).
- **Correlations:** in order to determine the relationship between the variables, a bivariate correlation can be performed on the data. Positive values indicate a directly proportional relationship between the variables, and a negative value indicates an inverse relationship.
- **Hypothesis testing**: as stated earlier in the study, the research hypothesis consists of the null hypothesis and the alternative hypothesis, and is concerned with the relationship between the variables. Habib, Pathik and Maryam (2014: 55) reveal that the hypothesis is “an unproven proposition or supposition that tentatively explains certain facts or phenomena and is empirically testable”. Using SPSS, the hypotheses were tested based on the data gathered through the survey. After statistical analysis, if the null hypothesis is rejected, then the alternative hypothesis is accepted, and vice-versa (Habib, Pathik and Maryam 2014: 16).

- **The Structural Equation Model (SEM)** methodology was used to analyse the structural relationship between the measured variables and latent constructs of the study. Habib, Pathik and Maryam (2014: 60) state that “SEM enables the researcher to answer a set of interrelated research questions in a single, systematic and comprehensive analysis by modelling the relationships amongst multiple independent and dependent variables simultaneously”. The authors argue further that SEM is widely used as a research technique to answer the research questions emanating from the hypotheses.

### 4.14 Case study research

This study focused on the challenges and best-practices for teaching and learning with technology at DUT, thus making use of a case study research methodology. Although case study research design can be derived from a qualitative methodology, the quantitative methodology also embraces case study research design (McCombes 2019). The author also states that due to times or resource constraints of conducting large scale research, case study research keeps the study focused and manageable. Bryman (2016: 61) states that a “case study entails the detailed exploration of a specific case, which could be a community, organization or person”. The author further argues that the researcher will provide an in-depth examination of the case, as it is an object of interest. The researcher had to determine her method of data collection either by observing, conducting interviews, examining documents or administering questionnaires. The researcher chose to conduct her method of data collection via the administration of questionnaires.

### 4.15 Gate-keeper’s Permission

A request to conduct research at DUT was submitted to the Director: Research and Post Graduate Support. The request detailed the aim and objectives of the study and requested approval for the research study to be conducted with lecturers and students. The Gate-keeper’s permission for this study is attached (Annexure 1).

## 4.16 Summary

This chapter detailed the research design and methodology employed in this study to address the research objectives on the challenges and best practices of teaching and learning with technology.  Online surveys were administered to both lecturers and students. The initial data collection method for students was the administration of questionnaires, but due to the Covid-19 pandemic, the researcher had to resort to an online survey. Teaching staff were selected via probability sampling while adopting a systematic sampling technique. Students were selected via non-probability sampling while adopting a convenience sampling technique. Once the pre-test was conducted to ensure that the instruments were both valid and reliable, the researcher began the data collection process. Ethical clearance had to be obtained via the Institutional Research Ethics Committee (IREC). Chapter Five discusses the data analysis, interpretation and findings of the study. Based on this discussion, conclusions and recommendations are drawn up by the researcher.

# CHAPTER 5: ANALYSIS AND INTERPRETATION OF RESULTS AND DISCUSSION OF FINDINGS

## 5.1 Introduction

Chapter Four outlined the research design and methodology adopted for this research study. This chapter focuses on the analysis and the interpretation of data findings from the empirical study on the challenges of teaching and learning with technology, as well as on best-practices. The focus of the study was firstly to determine the challenges that lecturers and students encountered in using technology for teaching and learning, not only on the logistical challenges, but also the underlying inhibitions of skills, attitude and acceptance of a technologically driven curriculum. Secondly, the researcher aimed to determine the best practices adopted in using technology as a tool for teaching and learning.

The findings are analyzed and interpreted by the researcher in accordance with the specific objectives outlined earlier in the study. The discussion which ensues presents the data obtained for this study from the surveys administered to both teaching staff and students. The surveys comprised mainly Likert scale questions. The results are presented in terms of the themes that the questionnaires focused on.

The quantitative raw data responses were coded and captured on a Microsoft Excel spreadsheet. This data was analyzed with the Statistical Package for the Social Sciences (SPSS) Version 26 for Windows. The statistical techniques used to analyse the data included descriptive and inferential statistics, thus ensuring that data could be organised and the relationships between the measures understood. The next section presents the descriptive statistics using graphs, cross-tabulations and other figures for the quantitative data that was collected. The descriptive statistics have provided a summarised, simplified description of the data collected, with an indication of the amount of data collected and its shape (Graziano and Raulin 2013: 98, Davis 2013: 13). Inferential techniques provided for an interpretation of what the data actually meant (Graziano and Raulin 2013: 98), therefore including the use of correlations and chi square test values, which are interpreted using the p-values.

Where possible, the findings reported in this chapter are linked to the literature reviewed in Chapters Two and Three. The themes within the questionnaires, as derived from the literature reviewed, are therefore highlighted in the findings of the data. Each question, with sub-questions, tables and/or charts and the analysis is documented in this chapter.

A discussion on the findings, interpretation and analysis of data gathered from staff will precede that of the students.

**Section A: Analysis of staff data**

**5.2 The sample and response rate**

The sample was inclusive of 220 full-time teaching staff from all six faculties. There was no distinction between gender and race. The total number of staff who responded to the survey was 161, which yielded a 73% response rate. The questionnaire was administered online and the 73% response rate was achieved by sending out two follow-up reminders to staff thereafter.

**5.3 The Research Instrument**

Twenty-four questions were designed on an online platform, with Microsoft forms being the chosen application. The research instrument consisted of 71 items, with a level of measurement at a nominal or an ordinal level.

The questionnaire was divided into 24 questions which measured various themes as illustrated below:

| | |
|---|---|
| 1 | **Biographical data** |
| 2 | **Teaching practices**<br>➢ Methods Relating to Teaching Practices<br>➢ Importance for Teaching and Learning |
| 3 | **General teaching challenges** |
| 4 | **E-learning practices/trends** |
| 5 | Challenges of teaching with technology<br>➢ Rigid Teaching Practices<br>➢ Lack of Skills/Knowledge/Engagement in The Use of Technology<br>➢ Lack of Access to Technology<br>➢ Challenges Relating to Poor Infrastructure<br>➢ Challenges in Integrating Technology into Teaching Practices<br>➢ Use of Technology Entails More Work |
| 6 | **Best practices**<br>➢ Resources and Technical Support<br>➢ Use of Instructional Technology<br>➢ Significance of Community Chat Groups |

### 5.4 Sectional Analysis

This section analyses the scoring patterns of the respondents per variable per section. The results are first presented using summarised percentages for the variables that constitute each section. Results are then further analysed according to the importance of the statements. The results for the various categories are also presented collectively. For instance, the options for "strongly agreed" and "agreed" have been combined.

#### 5.4.1 Biographical Data

This section summarises the biographical characteristics of the respondents in terms of the number of respondents within each faculty who responded to the survey.

#### 5.4.1.1 Number of respondents per faculty

Figure 5.1 indicates that there were similar and higher numbers of respondents from the faculties of Engineering and the Built Environment, Management Sciences and Applied Sciences. On average, the remaining faculties had half of these representations (p = 0.004).

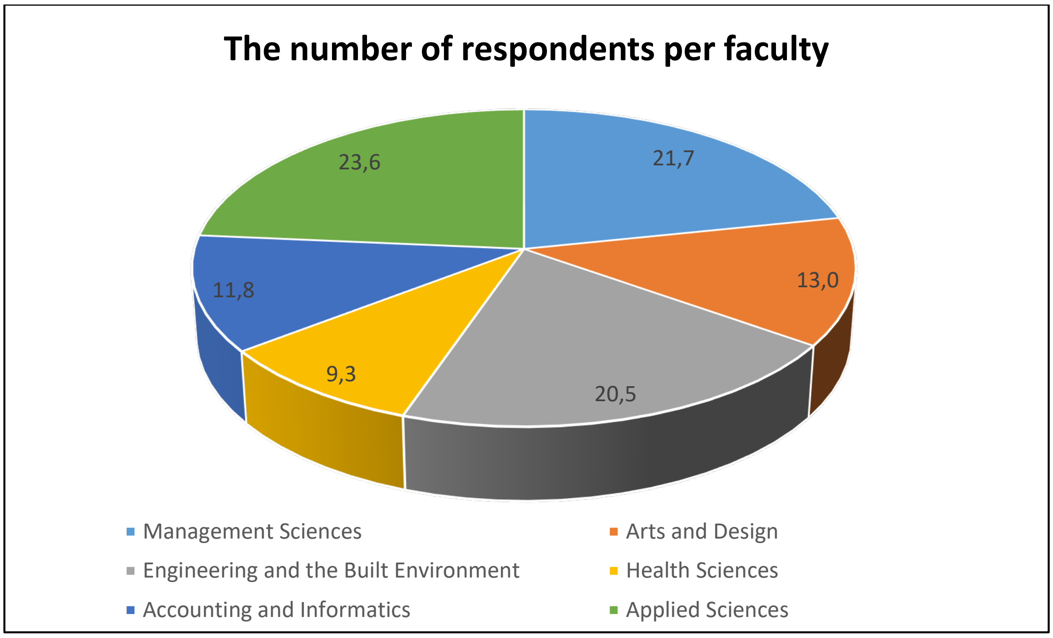


**Figure 5.1: Number of respondents per faculty**

Figure 5.1 above indicates that the Faculty of Applied Sciences yielded the highest response rate (23,6%), with 21,7% of responses from the Faculty of Management Sciences and 20,5% of responses from the Faculty of Engineering and the Built Environment. Additionally, the Faculty of Arts and Design yielded a 13% response rate and the response rate from the Faculty of Accounting and Informatics was 11,8%. The lowest response rate (9,3%) was from the Faculty of Health Sciences.

### 5.5 Descriptive Analysis

This section provides the descriptive analysis of how much data is involved and its shape. The data is shown by means of graphs and percentages, thus providing a summarised and simplified description on large amounts of the data collected (Venter and van Zyl 2017: 157 and Graziano and Raulin 2013: 98). Thereafter, an analysis on the importance of the statements is included. The analysis below pertains to five sections which are further dissected into sub-sections, namely:

- teaching practices;
- general teaching challenges;
- e-learning trends and practices;
- challenges of teaching with technology; and
- best-practices.

### 5.5.1 Teaching Practices

Brew (2006:21) maintains that teaching is that which embodies the transference of knowledge from one individual to another. This section deals with the methods that lecturers embrace as being important in their teaching practices.

#### 5.5.1.1 Level of importance of specific teaching practices

Respondents were asked to rate the level of importance/unimportance of specific teaching practices that they deem necessary in ensuring that students are stimulated, guided and encouraged. The results are indicated in Figure 5.2 below.

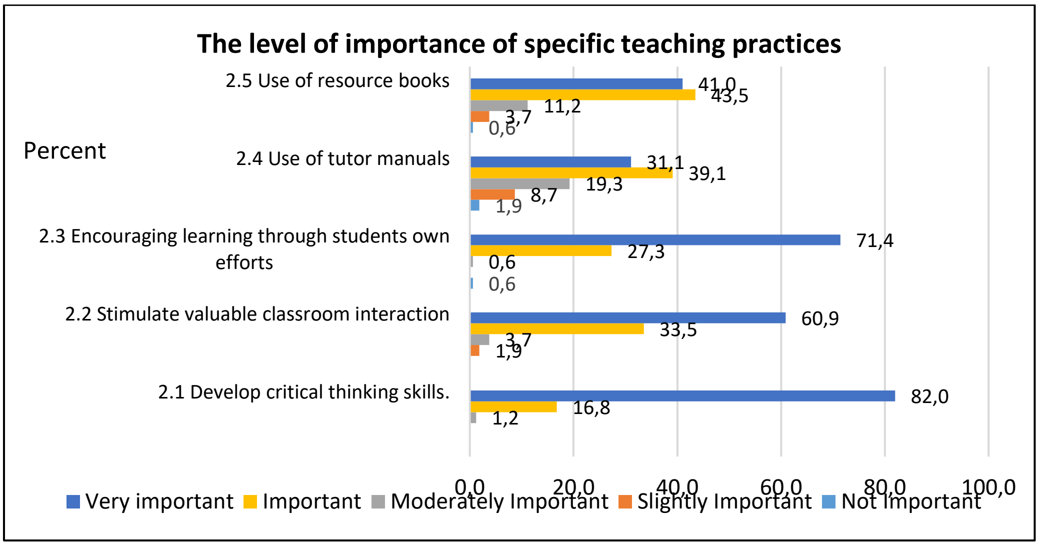


**Figure 5.2: Level of importance of specific teaching practices**

The following patterns are discernible from the results shown in Figure 5.2:

- Statements 2.1, 2.2 and 2.3 indicate a high level of agreement; and
- Statements 2.4 and 2.5 show a slightly lower level of agreement.

Statements 2.1 and 2.2 indicate similar scoring patterns, whilst statements 2.4 and 2.5 also indicate similar scoring patterns, but at a lower level compared to the first two. This implies that respondents have placed more emphasis on the development of the critical skills of the students, as compared to resources that will assist.

The results show a high level of agreement for statement 2.1 (82%) and statement 2.3 (71.4%). This shows that developing critical thinking skills and stimulating valuable classroom interaction were viewed as quite important.

Figure 5.2 shows the following results on each of the sub-themes relating to the importance of specific teaching practices in stimulating, guiding and encouraging students: -

- **Statement 2.1 – Teaching practices that develop critical thinking skills:** Collectively, a significantly high percentage of respondents (98,8%) believed that the development of the critical skills of the students is important (82,0% very important and 16,8% as important). Those respondents who attributed a “moderately important” score totalled 1,2%.

- **Statement 2.2 - Stimulate valuable classroom interaction:** Collectively, 94,4% of respondents either believed that stimulating valuable classroom interaction is very important (60,9%) or important (33,5%). However, 3,7% of respondents believed it is moderately important and 1,9% believed it is slightly important.

- **Statement 2.3 - Encourage learning through students’ own efforts:** Collectively, 95,75% of respondents either believed that encouraging learning through students’ own efforts is very important (71,4%) or important (27,35%). Whilst 0,6% of respondents believed this as being moderately important, a further 0,6% of respondents indicated that it is not important.

- **Statement 2.4 - Use of tutor manuals:** Collectively, 70,2% of respondents either believed that the use of tutor manuals is very important (31,1%) or important (39,1%). In addition, 19,1% of respondents indicated that it is moderately important, while 8,7% indicated that it is slightly important and 1,9% believed it is not important.

- **Statement 2.5 – Use of resource books:** Collectively, 84,5% of respondents either believed that the use of resource books to assist in teaching practices is very important (41%) or important (43,5%). In addition, 11,2% of respondents believed that it is moderately important, with 3,7% indicating that it is slightly important. A low percentage of respondents (0,6%) indicated that it is not important.

The findings indicate that the majority of respondents felt that developing critical skills, stimulating classroom interaction and encouraging learning through the students' own efforts were important as teaching methods. These findings concur with the views expressed by Ambedkar (2016: 12) and Subramanian and Chitra (2016: 45) who argue that encouraging students to learn through their own efforts, developing critical thinking skills in students and stimulating interactions in the classroom are necessary teaching practices to engage students in learning.

#### 5.5.1.2 Level of Importance of specific concepts for teaching and learning

The respondents were asked to indicate the level of importance of specific concepts for teaching and learning. The results are indicated in Figure 5.3.

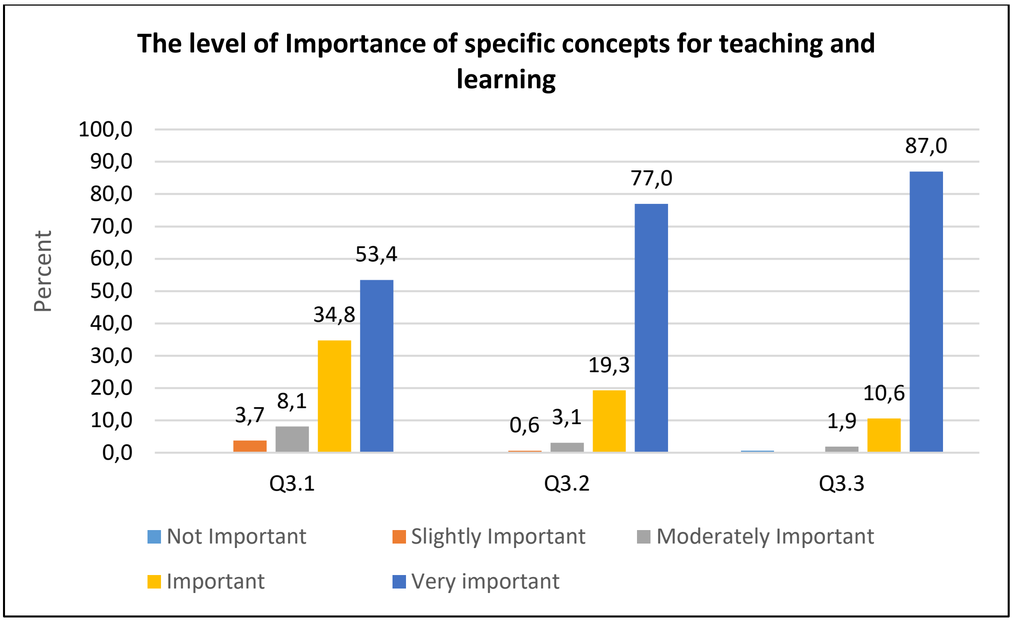


**Figure 5.3: Level of Importance of specific concepts for teaching and learning**

The following patterns are discernible from the results shown in Figure 5.3 above:

- Statements 3.2 and 3.3 show a high percentage of respondents who regarded the concepts as "very important" for teaching and learning; and
- All 3 statements indicate a very low percentage of respondents who regarded the concepts as "moderately important" for teaching and learning.

Statements 3.2 (77%) and 3.3 (87%) show a high level of agreement, which implies that the respondents viewed developing the skills and attitudes of students and promoting the development of the students' own conceptual understanding as quite important.

Figure 5.3 illustrates the results on each of the sub-themes relating to the level of importance of specific concepts for teaching and learning:

- **Statement 3.1: Transmission of information:** Collectively, 88,2% of respondents either believed that the transmission of information to students was very important (53,4%) or important (34,8%). A minor percentage (3,7%) believed that the concept was slightly important, while 8,1% of respondents were neutral.

- **Statement 3.2: Developing the skills and attitudes of students:** Collectively, 96,5% of respondents indicated that developing skills and attitudes of students is important (77,0% very important and 19,3% important). In addition, 3,1% of respondents believed this concept to be slightly important and 0.6% were neutral.

  **Statement 3.3: Promoting the development of the students' own conceptual understanding**: Collectively, 97,6% of respondents indicated that promoting the development of the students' own conceptual understanding is important (87,0% very important and 10,6% important). A low percentage of 1,9% remained neutral, while 0,6% of respondents believed that the concept was not important.

The findings reveal that the majority of respondents felt that the transmission of information; developing the skills and attitudes of students; and promoting the development of the students' own conceptual understanding were all important to teaching and learning. The findings resonate the beliefs expressed by Kirkwood and Price (2013: 537) that the transmission of information; the development of students' skills and attitudes; and the development of students' own conceptual understanding are all necessary as they dictate activity in the education ambit for teaching and learning.

### 5.5.2 General teaching challenges

This section focusses on the general teaching challenges in the South African HE context, with emphasis on the historical nature of education from authoritarian systems (Higgs 2006: 841) to a diverse student population, informed by multilingualism, large classes and varied levels of preparedness (Bozalek, Ng'ambi and Gachago 2013: 419). The respondents were asked to indicate their level of agreement in respect of various general teaching challenges.

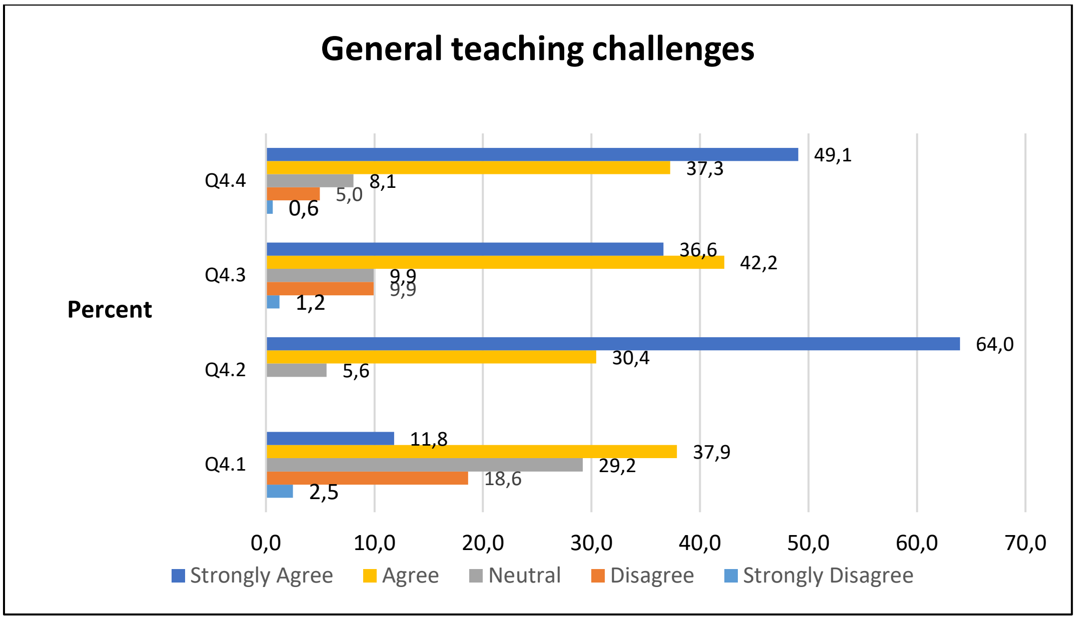


**Figure 5.4: General teaching challenges**

The results shown in Figure 5.4 illustrate the following patterns:

- Statements 4.2, 4.3 and 4.4 show a higher level of agreement; and
- Statement 4.1 indicates a higher level of a neutral response.

Statement 4.2 shows a high level of agreement (64%). This indicates that the respondents viewed increasing throughput with limited resources, while catering for large classes, as a significant challenge in HEIs.

Figure 5.4 shows the results on each of the sub-themes relating to general teaching challenges:

- **Statement 4.1: South African teaching systems are authoritarian and stifle the development of students:** Collectively, almost half of the respondents (49,7%) either strongly agreed (11,8%) or agreed (37,9%) that authoritarian teaching systems stifle student development. A further 29,2% remained neutral, while 18,6% of respondents disagreed and 2,5% strongly disagreed.
- **Statement 4.2: HEIs are expected to increase throughput with limited resources while catering for large classes:** Collectively, a majority of respondents (90,4%) either strongly agreed (64,0%) or agreed (30,4%) that HEIs are expected to increase throughput with

limited resources while catering for large classes, whilst 5,6% of respondents remained neutral.

- **Statement 4.3: Teaching at HEIs is difficult as there is a diverse population informed by multilingualism and varied levels of preparedness:** Collectively, 78,8% of respondents agreed (36,6% strongly agreed and 42,2% agreed) that teaching at an HEI is difficult due to the diverse population informed by multilingualism and varied levels of preparedness. A minor percentage of 11,1% disagreed (1,2% strongly disagreed and 9,9% disagreed) and 9,9% of respondents were neutral.

- **Statement 4.4: Graduates of secondary education lack capabilities as required at university level:** A majority of respondents (86,4%) collectively agreed (49,1% strongly agreed and 37,3% agreed) that graduates of secondary education lack capabilities as required at university level. Collectively, only 5,6% of respondents disagreed (0,6% strongly disagreed and 5,0% disagreed), while 8,1% of respondents remained neutral.

The findings indicate that a majority of the respondents felt that limited resources, the diverse population (with multi-lingualism and varied levels of preparedness) and the lack of university capabilities were significant teaching challenges, while almost half of them agreed that the authoritarian system stifles development. These findings are in agreement with the views expressed by Bozalek, Ng'ambi and Gachago (2013: 419) that large classes and a diverse student population contribute to pressure on HEIs, while Cross and Carpentier (2009: 16) believe that students who are under-prepared school graduates grapple with the level of education offered at HEIs.

#### 5.5.2.1 Other teaching challenges experienced by respondents

In an open-ended question, the respondents were asked to indicate other challenges to teaching in a HEI. The data retrieved from the responses have been analysed and categorised according to the themes below and the frequency of such responses are measured by the number of respondents who commented.

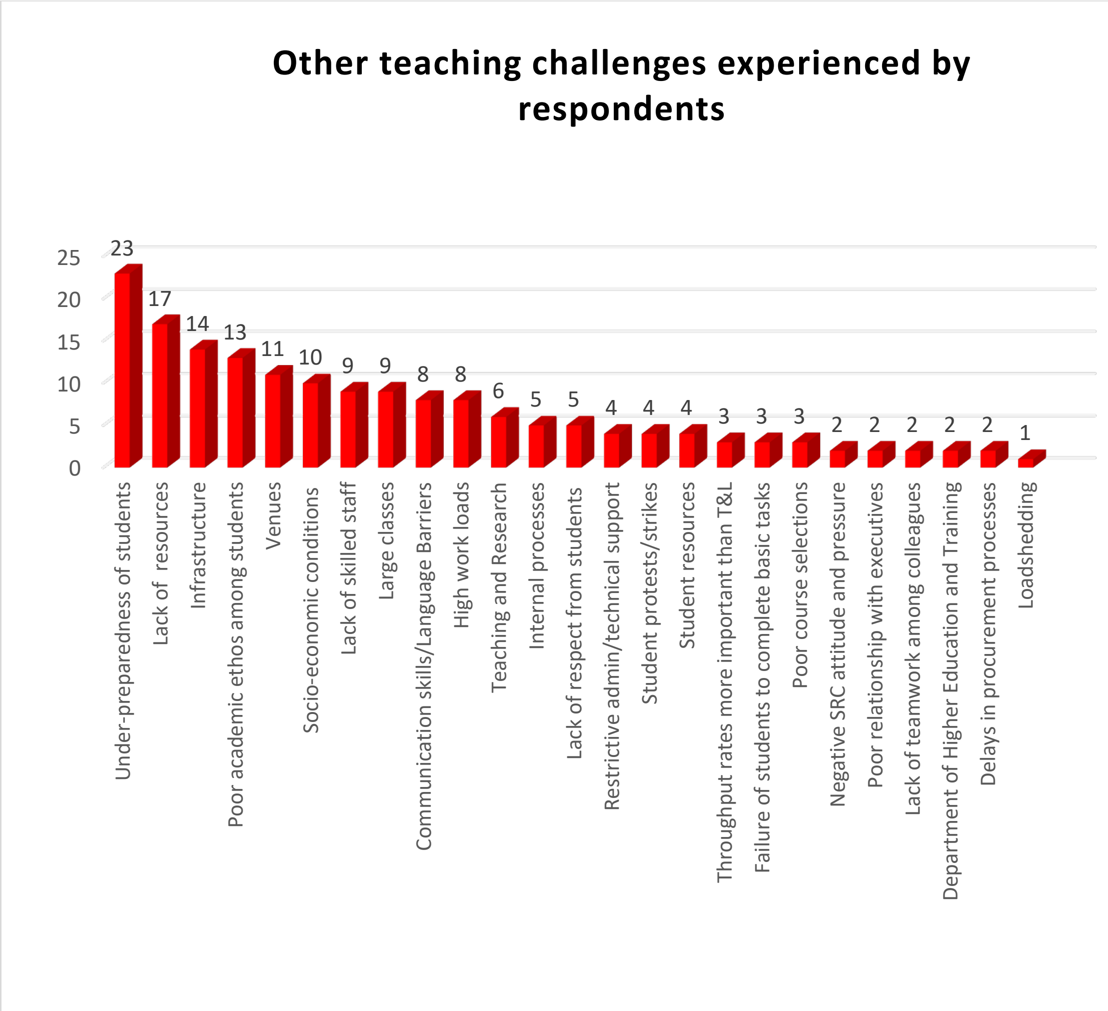


**Figure 5.5: Other teaching challenges**

As shown in Figure 5.5 above, the other general teaching challenges as indicated by the respondents were:

- **Student-related challenges:** Under-preparedness of students (23); poor academic ethos amongst students (13); socio-economic conditions (10); lack of respect from students (5); failure of students to

complete basic tasks (3); and poor course selection (3); student protests and strikes (4); student resources – data and devices (4).
One respondent commented, “It is easy for learners to pass at Basic Education level. This becomes too difficult for them at post-matric level where for instance they are expected to pass with 50% as opposed to 30% at a Basic Education level. The other issue is the mother-tongue and cultural differences. Learners from deep rural areas find it very difficult to acclimatize to the teaching methods used in HEIs”.

- **Resources and infrastructure-related challenges:** lack of resources (17); infrastructural challenges (14); venue challenges (for example, the lack of computer laboratories, damaged lecture venues, venues with no equipment, ageing lecture venues, small venues, venues in need of renovations with respect to seats and air-conditioning (11).

  One of the respondents stated that “Lecture Venues need to be renovated... too many broken chairs resulting in students not having place to sit. Lighting in some venues is very poor or burnt out light bulbs are not replaced efficiently. Basically, the maintenance of lecture venues must improve”.
- **Staff-related challenges:** lack of skilled staff (9); high workloads (8); teaching and research (more emphasis on research, than teaching) (6); throughput rates more important than teaching and learning (3); lack of teamwork amongst colleagues (2); poor relationship with executives (2); and loss of skilled teaching staff (1).
  Another respondent indicated… “there is a severe lack of teamwork amongst colleagues. Senior Faculty staff provide very limited support. Academics worry more about becoming professors and less about teaching students”.
- **Other challenges:** Administrative/technical support (4); internal processes (5); delays in procurement processes (2) and load-shedding (1).

These findings are in agreement with literature that which has revealed that a deficiency exists between the level of education at schools and the level of education offered at HEIs, resulting in ill-prepared students for tertiary education. Moreover, lecturers are expected to increase throughput while working with limited resources (Hall and Symes 2005: 200; Bozalek, Ng'ambi and Gachago 2013: 419 and Cross and Carpentier 2009: 16).

Furthermore, the findings relating to the lack of resources and infrastructure concur with literature which highlights that technology can prove challenging if access to technological tools is hindered; there are insufficient investments in equipment; infrastructure; or when technical support is lacking (Lautenbach 2010: 702; Islam, Beer and Slack 2015: 106; and Asabere *et al.* 2017: 167).

The findings also indicated that staff-related challenges hinder the teaching practices of lecturers in HEIs. These findings attest to the views expressed by Moonsamy and Govender (2018: 3071), McKnight *et al*. (2016: 198) and Mouyabi (2010: 1187) who argue that the lack of skills, the lack of comfort and the lack of knowledge in using technology creates overwhelming stress for lecturers, who still struggle to research and integrate existing technologies into their teaching practices.

### 5.5.3 E-learning practices and trends

This section presents a discussion on the e-learning practices and trends of teaching staff.

#### 5.5.3.1 The number of respondents using an LMS (Learning Management System)

At the end of 2019, Blackboard reached its end-of-life at the institution and was phased out. Moodle became the university's only LMS. This study was carried out at a time where both LMSs co-existed at the university. Figure 5.6

illustrates the number of staff who chose to use an LMS and those who did not engage with an LMS at all.

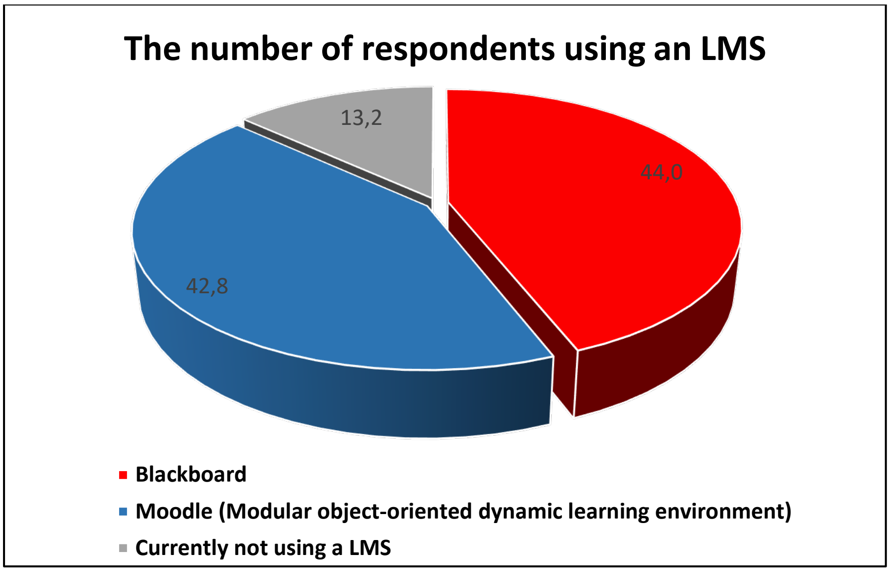


**Figure 5.6: Number of respondents using an LMS**

Figure 5.6 indicates that at the time of conducting the study, 70 respondents had been using the Blackboard LMS, while 68 engaged with Moodle. A further 21 respondents had not used an LMS. The statistics show a total of 2 respondents who did not answer the question.

### 5.5.3.2 Contributions of using an LMS as a teaching tool

Perumal (2010:77-78) states that technology in education promotes "exploratory and inquiry-based modes of learning", thus enabling collaboration and interactive learning.

### 5.5.3.3 Reasons why the selected LMS was best suited to teaching practices

The respondents were asked to indicate which LMS was best suited to their teaching practices:

- Many responded to the choice of LMS by stating that they preferred Blackboard as it was user-friendly, easy to understand and provided a much better interface and usability function than Moodle.

Respondents were also asked to indicate how the attributes of the LMS contributed to teaching and learning. Some of the positive responses were:

- Using an LMS as a teaching tool has assisted some of the respondents with online classes and assessments for larger classes;
- Additional material (demonstration videos, film clips, repeat information, trial tests) allows for understanding and ease of communication;
- Using an LMS allows respondents to create assessments that stimulate critical thinking and also for tracking student progress;
- Online learning also allows for comfort and flexibility with multi-dimensional tools and allows students to interact within a virtual environment;
- Providing for a paper-less environment, the LMS also acts as a repository allowing information-sharing, increasing students' performance and understanding as they are able to access resources; and
- Students can share files and folders and peer review each other's submissions, thereby learning from other students' way of problem solving and deductive reasoning through online engagements.

Other responses received indicated the following:

- Some respondents felt that using an LMS as a teaching tool was not effective, questioning the trustworthiness of assessments, original work and critical thinking of students;
- Practical components of a Health Sciences subject are not afforded enough space or ability to stream live video footage that would complement the practice;
- The LMS is not available offsite at certain of the practical teaching venues;
- Some still feel that the 'manual' methods force students to engage with the material, developing their thinking, writing and listening skills;
- The current LMS does not include a plagiarism checker either; and

- Although engaged in the university's LMS for teaching and learning, many staff still prefer communication to students via email and WhatsApp.

#### 5.5.3.4 Methods used for effective teaching and learning

Online course delivery methods differ. Respondents were asked to indicate their preferred method of delivering an online curriculum. The results are illustrated in Table 5.1.

**Table 5.1: Blended vs Online Methods of teaching**

| | **Frequency** | **Percent** |
|---|---|---|
| Blended/Hybrid: Online and face-to-face delivery | 141 | 87,6 |
| Online: Most/all content is online | 20 | 12,4 |
| **Total** | **161** | **100,0** |

Table 5.1 illustrates that 87,6% of respondents prefer a blended or hybrid method which constitutes a combination of online and face-to-face teaching methods. A further 12,4% of respondents prefer complete online delivery of the curricula where all or most of the content is via online methods. Hence, the results show that the majority of respondents prefer a blended or hybrid method. This finding is further supported by the literature which states that blended or hybrid learning provides for a more "balanced" approach to teaching and learning as it includes face-to-face interaction and online access, creating a harmonious pedagogical environment (Durban University of Technology 2014: 1; Engelbrecht 2003: 27; and Britto, Murugeson and Subramanian 2016: 94).

##### 5.5.3.4.1 Asynchronous vs Synchronous methods

Asynchronous methods consist of learners and/or lecturers interacting online at different times, while synchronous methods consist of learners/lecturers interacting at the same given time. Respondents were asked to indicate the asynchronous and synchronous methods they preferred. The results are illustrated in Table 5.2 and Table 5.3.

**Table 5.2: Asynchronous methods**

| ASYNCHRONOUS METHODS | | Frequency | Percent |
|---|---|---|---|
| **Emails** | Yes | 148 | 91,9 |
| | No | 13 | 8,1 |
| | Total | 161 | 100,0 |
| **Wikis** | Yes | 25 | 15,5 |
| | No | 136 | 84,5 |
| | Total | 161 | 100,0 |
| **Discussion Boards** | Yes | 50 | 31,1 |
| | No | 111 | 68,9 |
| | Total | 161 | 100,0 |
| **Blogs** | Yes | 14 | 8,7 |
| | No | 147 | 91,3 |
| | Total | 161 | 100,0 |

Table 5.2 indicates that 91,9% of respondents conduct their online activities with students via email on an asynchronous level, with a much lower engagement with wikis (15,5%), discussion boards (31,1%) and blogs (8,7%). Hence, the results show that the majority of respondents conduct online activities with students via email on an asynchronous basis. A study by Back *et al.* (2016: 271) concluded that emails are still the "main line of communication" in an online environment at HEIs.

**Table 5.3: Synchronous methods**

| SYNCHRONOUS METHODS | | Frequency | Percent |
|---|---|---|---|
| **Chatrooms** | Yes | 26 | 16,1 |
| | No | 135 | 83,9 |
| | Total | 161 | 100,0 |
| **Video Conferencing** | Yes | 15 | 9,3 |
| | No | 146 | 90,7 |
| | Total | 161 | 100,0 |
| **Skype** | Yes | 8 | 5,0 |
| | No | 153 | 95,0 |
| | Total | 161 | 100,0 |
| **Virtual Classrooms** | Yes | 46 | 28,6 |
| | No | 115 | 71,4 |
| | Total | 161 | 100,0 |
| | | | |
| **Instant Messaging/Chats** | Yes | 118 | 73,3 |
| | No | 43 | 26,7 |
| | Total | 161 | 100,0 |

Table 5.3 above shows the results in respect of synchronous methods used by the respondents. Instant messaging and chats are more favourable (73,3%) as a synchronous method of online interaction, as opposed to virtual classrooms (28,6%), chatrooms (16,1%), video conferencing (9,3%) and Skype (5,0%). Hence, the majority prefer the use of instant messaging and chats. These findings are in agreement with Kay and Lauricella (2014: 3) who posit that instant messaging allows for ease of access to learning resources as well as interactions and collaborations for productivity, research and communication.

### 5.5.4 Challenges in teaching with technology

The literature review identified certain challenges experienced by lecturers in adopting technology for teaching and learning. The following section focuses on the challenges that lecturers encounter in embracing technology for teaching and integrating technology into their curricula to produce a digital curriculum.

### 5.5.4.1 Rigid Teaching Practices

Respondents were asked to indicate their level of agreement on statements relating to the reasons lecturers engage in rigid teaching practices. Figure 5.7 below illustrates the results.

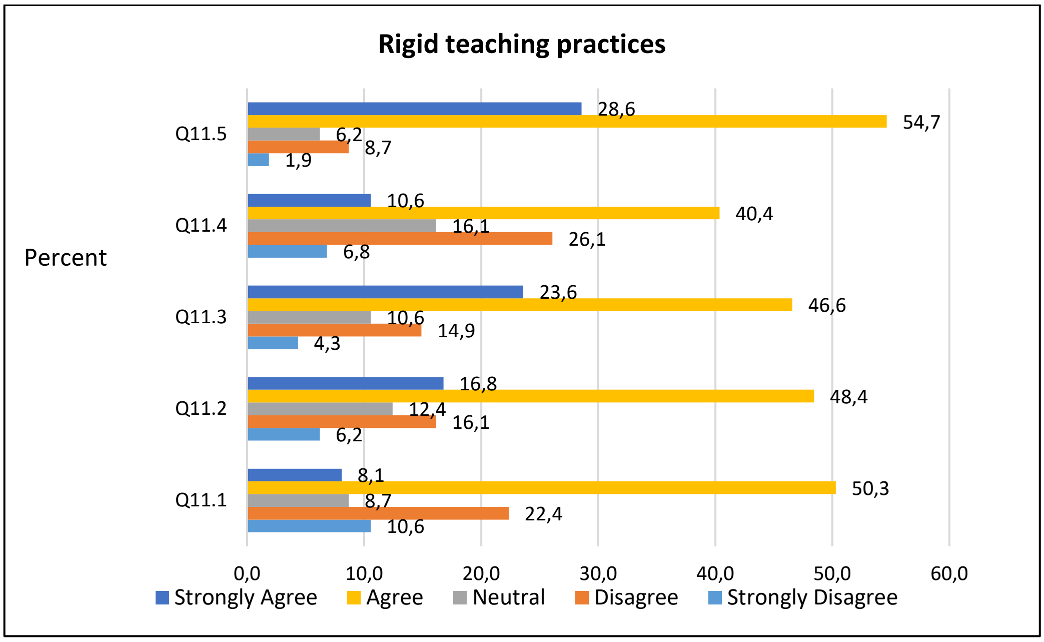


**Figure 5.7: Rigid Teaching Practices**

The following patterns are observable from Figure 5.7.

- Statements 11.3 and 11.5 have relatively high levels of agreement; and
- All 5 statements show similar low levels of disagreement, with statement 11.5 showing the lowest level of disagreement.

Statement 11.5 shows a high level of agreement (28,6%). This indicates that respondents viewed rigid teaching practices which are influenced by pedagogical beliefs as a challenge in teaching with technology.

Figure 5.7 shows the results for each of the sub-themes that relate to rigid teaching practices:

- **Statement 11.1 Academics are less eager to adopt e-learning to support their teaching as they find it difficult to adapt to change:** Collectively, 58,4% of the respondents agreed (8,1% strongly agreed and 50,3% agreed) that difficulty in adapting to change contributes to teaching staff being less optimistic in using technology for teaching. A further 33% disagreed (10,6% respondents strongly disagreed and 22,4% disagreed), while 8,7% of respondents were neutral.

- **Statement 11.2: Academics need to be convinced that the technology enhanced method, which is different from their traditional approach, is more feasible for their students before they actually are willing to adopt any such method:** Collectively, 65,2% of the respondents either strongly agreed (16,8%) or agreed (48,4%) that lecturers will only adopt a technology enhanced method for teaching if it proves more feasible that their traditional method. A lower percentage (22,3%) of respondents disagreed (6,2% strongly disagreed and 16,1% disagreed), while 12,4% of respondents were neutral.
- **Statement 11.3: Although technology is beneficial for communicating with learners, lecturers are concerned about losing face-to-face interaction with students:** Collectively, 70,2% of the respondents either strongly agreed (23,6%) or agreed (46,6%) that lecturing staff are afraid of losing face-to-face interactions with students, even though technology may be beneficial in teaching and learning. A lower percentage of respondents (19,2%) disagreed (4,3% strongly disagreed and 14,9% disagreed), while 10,6% of respondents were neutral.
- **Statement 11.4: Delivering curricula via technology is inhibited due to the reluctance of lecturers to invest the additional effort:** Collectively, 60% of the respondents either strongly agreed (10,6%) or agreed (40,4%) that lecturers do not want to invest the additional effort into a digital curriculum, thus not embracing technology in teaching. A lower percentage of respondents (32,9%) disagreed (6,8% strongly disagreed and 26,1% disagreed) and 16,1% of respondents were neutral.

- **Statement 11.5: Teaching practices are highly influenced by lecturers' pedagogical beliefs and their tried and tested methods of course delivery:** Collectively, 83,3% of the respondents either strongly agreed (54,7%) or agreed (28,6%) that teaching practices are highly influenced by the tried and tested methods of teaching staff. A lower percentage (10,3%) of respondents disagreed (1,9% strongly disagreed and 8,7% disagreed), with a significantly low percentage of respondents (6,2%) being neutral.

The analysis of results indicated above show that the majority of respondents agreed that academics are less eager to adopt e-learning to support their teaching as they find it difficult to adapt to change and believe that their traditional approach is more feasible for their students, before they are actually willing to adopt a different method. These findings are further supported by the views expressed by Lautenbach (2010: 699) that lecturers with preferred traditional teaching methods are often not comfortable with embracing technology for teaching. Therefore, they do not adapt to innovative teaching methods and continue practicing the traditional teaching methods. King and Boyatt (2014: 1275) also believe that that those who are already established in their organisation's teaching environment may find it difficult to adapt to new teaching approaches.

Moreover, the findings reveal that the majority of respondents believed that although technology is beneficial for communicating with learners, lecturers are concerned about losing their face-to-face interaction with students. These findings are in agreement with the views expressed by Britto, Murugeson and Subramanian (2016: 94) that face-to-face instruction is important for communicating with students and fostering a sense of community belonging. Britto and Rush (nd: 30) explain further that online learning cannot replace face-to-face classroom activities.

The results presented above also show that respondents view the delivery of curricula via technology as inhibited due to the reluctance of lecturers to invest additional effort into a digital curriculum. These findings are in agreement with the views expressed in literature that lecturers need to be flexible and adapt to emerging pedagogical technologies for the successful implementation of academic innovations (Allen and Seaman 2015: 6 and Chimbo and Tekere 2014: 68).

The majority of respondents also believed that teaching practices are highly influenced by lecturers' pedagogical beliefs and their tried and tested methods of course delivery, thus creating challenges of rigid teaching practices. These findings are in agreement with the views expressed by Buchanan *et al.* (2013: 8), who argue that lecturers believe that new methods of teaching are risky, and doubt whether technology would enhance their subjects.

#### 5.5.4.2 Other reasons why lecturers are not willing to modify their teaching practices

In an open-ended question, the respondents were asked to indicate the reasons they believed that teaching staff were not willing to modify their teaching practices. Five respondents did not provide a response to this question.

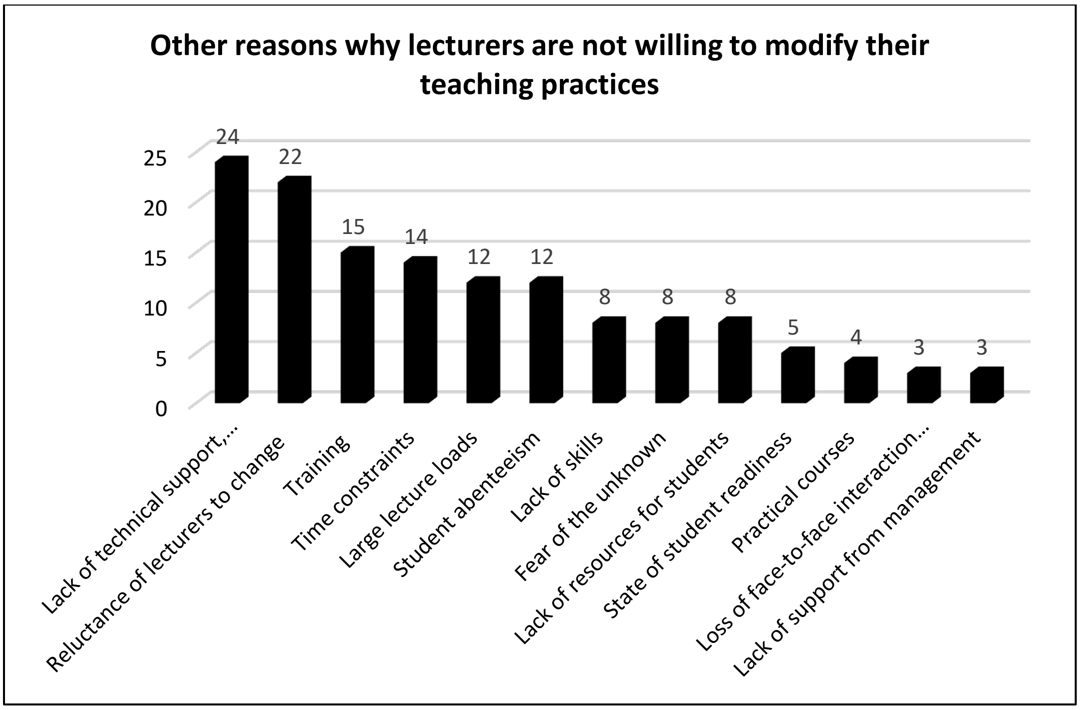


**Figure 5.8: Other reasons why lecturers are not willing to modify their teaching practices**

As illustrated in Figure 5.8 above, the other reasons why lecturers are not willing to modify their teaching practices as indicated by the respondents were as follows:

- **<u>Staff concerns</u>**
    - Reluctance of lecturers to change (22);
    - Fear of the unknown (8); and
    - Lack of skills (8).
- **<u>Institutional Support</u>**
    - Lack of support from management (3); and
    - Lack of technical support, infrastructure, training, resources (24).
- **<u>Impact on time</u>**
    - Time constraints (14).
- **<u>Student concerns</u>**
    - Student absenteeism (12);

  - Lack of resources (8); and
  - State of student readiness (5).
- **Other reasons**
  - Loss of face-to-face interaction with students (3); and
  - Practical courses (4).

The findings revealed that many respondents believed that teaching staff are not willing to change their teaching methods if their teaching methods have proven successful in classrooms. These findings are supported by King and Boyatt (2014: 1275), who argue that lecturers who have established their teaching practices in an organisation will find it challenging to adapt to new teaching approaches. Furthermore, one of the respondents stated, “It is a challenge to orientate educators that have been accustomed to doing the same things for many years.” "You can’t teach old dogs new tricks". “Teaching staff become resistant to change”.

As revealed by the responses, lecturers do not have adequate skills or have limited computer literacy to transform their classes into online classes. One respondent indicated that, “Lecturers are often employed based on their expertise in their area of specialization, which is not education. They also do not necessarily have the skills and knowledge of curriculum design and pedagogy, especially with technology”. This finding is further supported by Asbere *et al.* (2017: 168) who argue that lecturers do not have the necessary skills to cope with the constant advancements in technology.

The responses also revealed that many respondents believed that teaching staff were forced to convert courses to include at least 50% of online material. However, there is little or no support provided by the institution in terms of technical support, infrastructure, devices, data and time. The respondents further indicated that, often, proper training and support was not provided to teaching staff who are transitioning course content from face-to-face to online settings. These findings are in agreement with the views of Buchanan, Sainter and Saunders (2013: 1) that staff training and digital literacy initiatives are crucial in ensuring success for teaching with technology. However, it is also imperative to emphasize the provision of proper resources and technical support.

Respondents indicated that time constraints are one the main concerns in converting learning material into a digital format. Large lecture loads impact on the time available to re-design learning material. This finding is further supported by Wagner, Hassanein and Head (2008: 29) who state that it takes almost twice as long to provide online learning materials as compared to traditional learning materials.

The responses to the open-ended question further revealed that some respondents believed that online technologies increase student absenteeism, while others believed that a lack of resources for students (data and devices) and the state of readiness on the part of the student to adapt to modified teaching practices impact negatively on the transition to a digital curriculum. One respondent stated that, "Our department started mainly using the LMS as a repository. As a first-year lecturer dealing with very new students, I found many unable to even access these materials for download/watching. Many did not have Wi-Fi at home and I ended up not wanting to disadvantage students in mastering content and thinking associated with my modules simply because they were not adequately experienced or resourced digitally. I would return to hardcopies of critical materials so that nobody would be compromised in their learning".

The responses also indicated that there is a concern by some respondents that lecturers may not want to modify their teaching practices as they will lose the face-to-face interaction and this depletes the way students engage with a lecturer and the learning materials. These findings concur with the views expressed by Britto, Murugeson and Subramanian (2016: 94), who posit that face-to-face interactions provide for “community belonging”, which cannot be replicated in an online environment.

The findings indicated that respondents believed that there is difficulty in converting clinically heavy and practically orientated classes into online classes. One respondent stated that, “Some courses require more practical skills, hence online teaching does not always work for everything and by pushing it a lot, some students will leave with inadequate practical skills”. These findings are in agreement with Sahu (2020: 3), who believes that practically inclined courses become difficult to assess in an online environment.

### 5.5.4.3 Lack of skills/knowledge/engagement in the use of technology

Respondents were asked to indicate their level of agreement on statements relating to the lack of skills/knowledge/engagement in the use of technology. The results are illustrated in Figure 5.9 below.

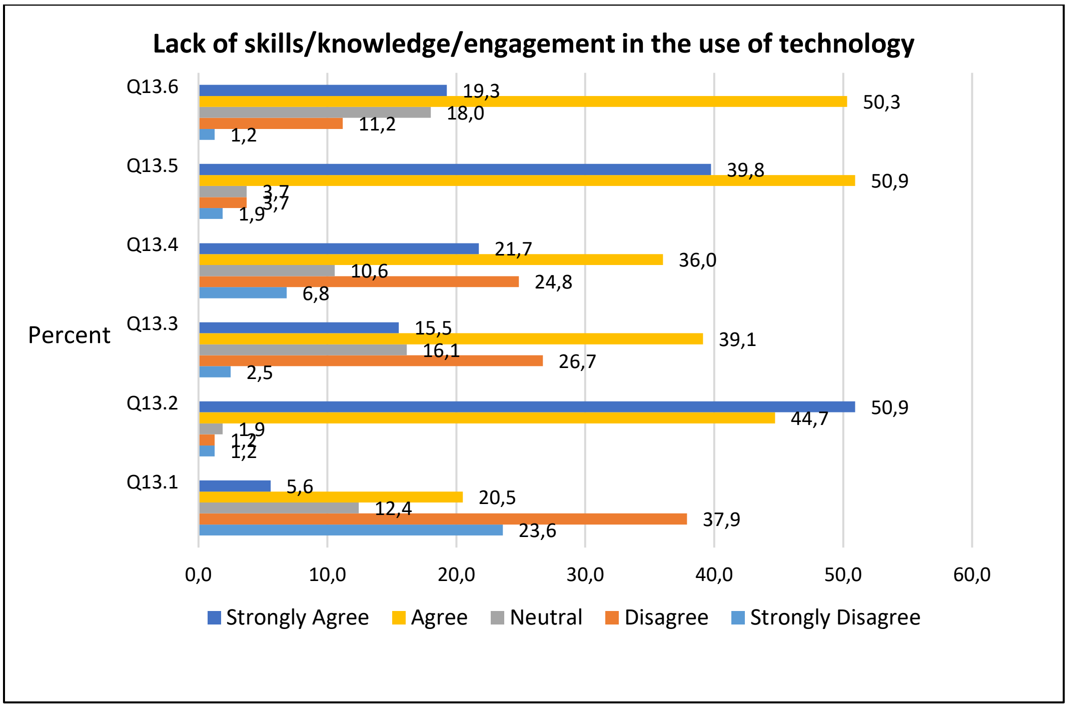


**Figure 5.9: Lack of skills/knowledge/engagement in the use of technology**

From the results illustrated in Figure 5.9, the following patterns are discernible:-

- Statements 13.2, 13.5 and 13.6 show higher levels of agreement;
- Statement 13.1 shows a high level of disagreement; and
- Statements 13.2 and 13.5 show relatively low levels of neutral responses.

The results show a high level of agreement for statement 13.2 (50,9%). This indicates that improving technological skills and knowledge is a crucial priority for engaging with technology for teaching. The results also show a high level of disagreement for statement 13.1 (37,9%), which indicates that the lack of necessary skills is not believed to be a challenge to teaching with technology.

Figure 5.9 indicates the results for each of the statements that relate to the lack of skills/knowledge/engagement in the use of technology:

- **Statement 13.1: Navigation into educational programmes using technology is difficult because I do not have the necessary skills:** Collectively, 26,1% of respondents either strongly agreed (5,6%) or agreed (20,5%) that navigation into educational programmes using technology is difficult because they do not have the necessary skills. A further 61% either strongly disagreed (23,6%) or disagreed (37,9%), while 12,4% of respondents were neutral.
- **Statement 13.2: Improving technological skills and knowledge is a crucial priority to ensure success in teaching with technology:** Collectively, 95,3% of respondents either strongly agreed (50,9%) or agreed (44,7%) that improving technological skills and knowledge was regarded as a crucial priority to ensure success in teaching with technology. Collectively, a lower percentage (2,4%) of respondents either strongly disagreed (1,2%) or disagreed (1,2%). A further 1,9% of respondents remained neutral.

- **Statement 13.3: Lecturers who lack technological skills cannot provide appropriate feedback to students**: Collectively, 54,6% of respondents either strongly agreed (15,5%) or agreed (39,1%) that lecturers who lack technological skills cannot provide appropriate feedback to students. A further 29,2% disagreed (2,5% strongly disagreed and 26,7% disagreed). Respondents who remained neutral comprised 16,1%.
- **Statement 13.4: Lecturers who lack technological skills grapple with the preparation of course content:** Collectively, 57,7% of respondents either strongly agreed (21,7%) or agreed (36,0%) that lecturers who lack technological skills grapple with the preparation of course content. A further 29,2% of respondents disagreed (2,5% strongly disagreed and 26,7% disagreed). Respondents who chose to remain neutral totalled 10,6%.
- **Statement 13.5: Lecturers need to have the appropriate facilitation skills and develop technological skills for effective e-learning delivery:** Collectively, 90,7% of respondents either strongly agreed (39,8%) or agreed (50,9%) that lecturers need to have the appropriate facilitation skills and develop technological skills for effective e-learning delivery. A minor percentage of respondents disagreed (1,9% strongly disagreed and 3,7% disagreed), while 3,7% of respondents were neutral.
- **Statement 13.6: Lecturers may not be resistant to technological application, but are simply confused as to how to implement technology their formal teaching methods:** Collectively, 69,6% of respondents either strongly agreed (19,3%) or agreed (50,3%) that lecturers may not be resistant to technological application, but are simply confused as to how to implement technology into their formal teaching methods. A relatively lower percentage (12,4%) of respondents disagreed (1,2% strongly disagreed and 11,2% disagreed) and a further 18,0% of respondents were neutral.

Based on the results presented in Figure 5.9 above, the findings indicate that the majority of respondents believed that the lack of skills necessary to integrate technology into the curricula and provide appropriate feedback to students was not a challenge to teaching with technology. The findings also revealed that a majority of respondents believed that improving technological skills and knowledge, as well as having the appropriate facilitation skills, are crucial priorities to ensure success in teaching with technology. These findings are in agreement with the view expressed by Mouyabi (2010: 1187) that improving technological skills and alleviating confusion on how to infuse teaching with technology is a crucial priority to ensure success in teaching with technology.

### 5.5.4.4 Lack of access to technology

The respondents were asked to indicate their level of agreement on statements which relate to the lack of access to technology. Figure 5.10 shows below illustrate the results.

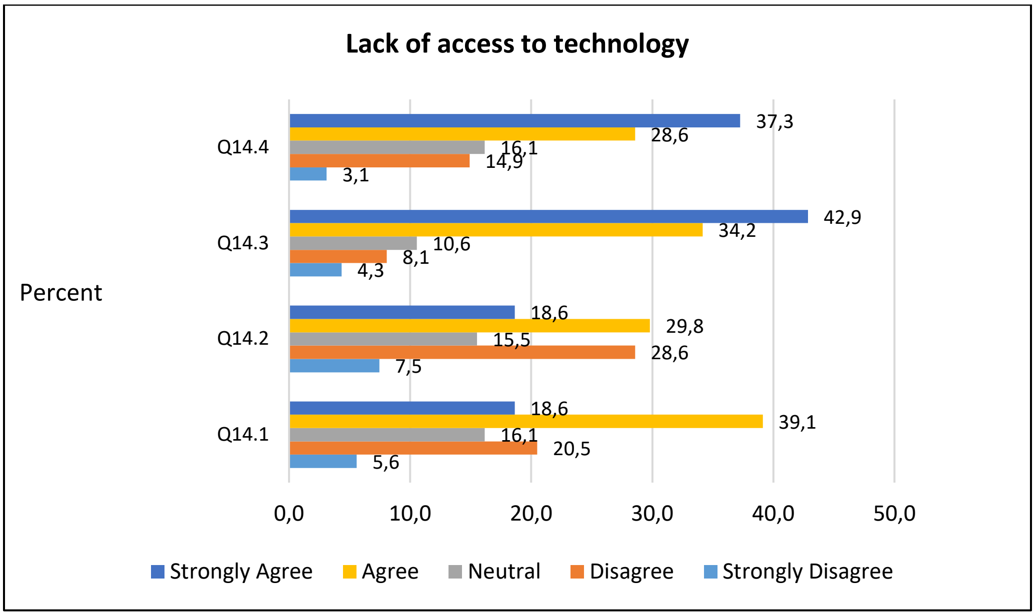


**Figure 5.10: Lack of access to technology**

From the results presented in Figure 5.10, the following patterns are observable:

- Statements 14.1, 14.3 and 14.4 have relatively higher levels of agreement; and
- Statements 14.1, 14.2 and 14.4 show similar levels of neutral responses.

Moreover, the results indicate a high level of agreement for statement 14.3 (42,9%). This shows that respondents view insufficient investments in equipment, infrastructure and resources as a great challenge to teaching with technology.

Figure 5.10 indicates the results for each of the sub-themes that relate to the lack of access to technology:

- **Statement 14.1: There is a lack of technical support in HEIs**: Collectively, 57,7% of respondents either strongly agreed or agreed that there is a lack of technical support in HEIs. A lower percentage (26,1%) of respondents disagreed (5,6% strongly disagreed and 20,5% of respondents disagreed), whilst a further 16,1% remained neutral.
- **Statement 14.2: There is a lack of technical support in my institution:** Collectively, 48,1% of respondents either strongly agreed (18,6%) or agreed (29,8%) that there is a lack of technical support in DUT. A further 36,1% disagreed (7,5% strongly disagreed and 28,6% disagreed), while 15,5% of respondents remained neutral.
- **Statement 14.3: There is insufficient investment in equipment, infrastructure and resources:** Collectively, 77,1% of respondents either strongly agreed (42,9%) or agreed (34,2%) that there is insufficient investment in equipment, infrastructure and resources. A minor percentage of respondents (12,4%) disagreed (4,3% strongly disagreed and 8,1% disagreed) and 10,6% were neutral.

- **Statement 14.4: Lecturers have outdated desktop computers and laptops which proves challenging when engaging in innovative methods of teaching:** More than half the respondents (65,9%) collectively agreed (37,3% strongly agreed and 28,6% agreed) that lecturers have outdated desktop computers and laptops, which proves challenging when engaging in innovative methods of teaching. Collectively, 18% of respondents either strongly disagreed (3,1%) or disagreed (14,9% disagreed). A further 16,1% remained neutral.

The results as presented in Figure 5.10 above reveal that the majority of respondents agreed that there is a lack of technical support in HEIs; there is insufficient investment in equipment, infrastructure and resources; and that lecturers have outdated desktop computers and laptops which proves challenging when engaging in innovative methods of teaching. These findings concur with literature that points out that outdated equipment and structural factors (infrastructure), coupled with the lack of technical support, prove challenging to academic staff when trying to engage in innovative methods of teaching and has a negative impact on e-learning teaching outcomes (Lautenbach 2010: 72, Islam, Beer and Slack 2015: 106 and Buchanan, Sainter and Saunders 2013: 1). It is also evident that HEIs in developing countries are saddled with inadequate technological resources and limited investments in equipment for e-learning (Asbere *et al.* 2017:167).

#### 5.5.4.5 Challenges relating to poor infrastructure

The respondents were asked to indicate their level of agreement with statements relating to poor infrastructure.

Figure 5.11 illustrates the challenges that are prevalent in teaching with technology due to poor infrastructure.

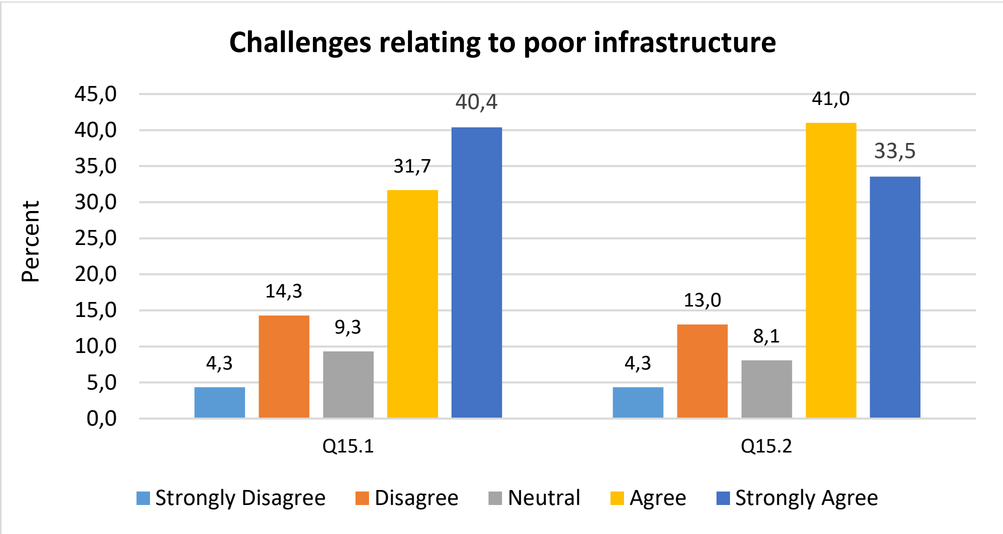


**Figure 5.11: Challenges relating to poor infrastructure**

Figure 5.11 shows the results for each of the sub-themes related to challenges relating to poor infrastructure:

- **Statement 15.1 - There is insufficient access to Wi-Fi and bandwidth to access resources for teaching with technology**: A significantly high percentage of respondents (71,8%) collectively agreed (40,4% strongly agreed and 31,7% agreed) that there is insufficient access to Wi-Fi and bandwidth to access resources for teaching with technology. Collectively, 18,6% of respondents disagreed (4,3% strongly disagreed and 14,3%) disagreed) and 9,3% remained neutral.
- **Statement 15.2 - Technical errors, slowness in systems and bugs hinder my e-learning processes:** The majority of respondents (74,5%) collectively agreed (33,5% strongly agreed and 41,0% agreed)

that technical errors, slowness in systems and bugs hinder e-learning processes. Collectively, a lower percentage (17,3%) of respondents disagreed (4,3% strongly disagreed and 13,0% disagreed), while a further 8,1% of respondents were neutral.

The findings indicate that the majority of respondents agreed that insufficient access to Wi-Fi and bandwidth and technical impediments are challenges to teaching with technology. Literature reveals that e-teaching is dependent on proper network infrastructure and proper working systems and devices. The findings are therefore in agreement with literature whereby reliable technological access leads to successful e-learning implementation (Asabere *et al.* 2017: 167 and Islam, Beer and Slack 2015: 106).

### 5.5.4.6 Challenges with integrating technology into teaching practices

The respondents were asked to indicate their level of agreement with statements relating to the challenges with integrating technology into their teaching practices. The results are illustrated with Figure 5.12.

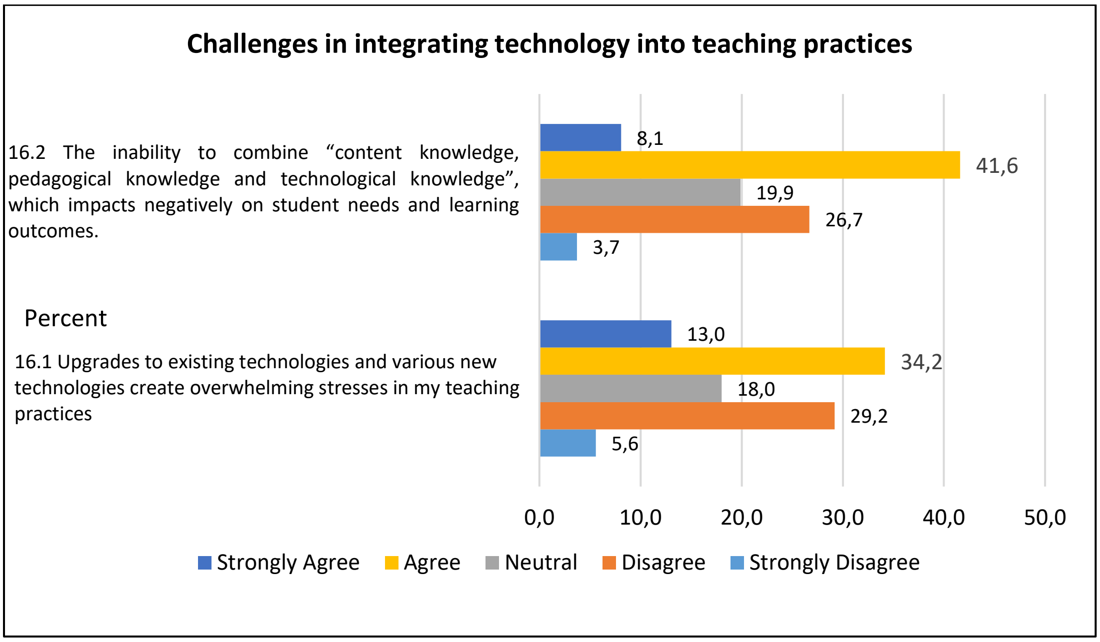


**Figure 5.12: Challenges with integrating technology into teaching practices**

Figure 5.12 illustrates the results for each of the sub-themes that relate to challenges with integrating technology into teaching practices

- **Statement 16.1 - Upgrades to existing technologies and various new technologies create overwhelming stresses in my teaching practices:** Collectively, 47,2% of respondents either strongly agreed (13,0%) or agreed (34,2%) that upgrades to existing technologies and various new technologies create overwhelming stresses in teaching practices. A further 34,8% of respondents collectively disagreed (5,6% strongly disagreed and 29,2% disagree, while 18,0% remained neutral.

- **Statement 16.2: The inability to combine "content knowledge, pedagogical knowledge and technological knowledge", which impacts negatively on student needs and learning outcomes:** Collectively, 49,7% of respondents either strongly agreed (8,1%) or agreed (41,6%) that the inability to combine "content knowledge, pedagogical knowledge and technological knowledge", which impacts negatively on student needs and learning outcomes, is a challenge in integrating technology into their teaching practices. A lower percentage (30,4%) of respondents disagreed (3,7% strongly disagreed and 26,7% disagreed), while 19,9% remained neutral.

Based on the results presented in Figure 5.12, the findings indicate that almost half the respondents believed that upgrades or various new technologies and the inability to combine "content knowledge, pedagogical knowledge and technological knowledge" are challenges in integrating technology into their teaching practices. Literature highlights that it may prove overwhelming for some teaching staff to manage the various new technologies and upgrades to existing technologies for integration into existing teaching practises, especially if teaching staff are attempting to replicate their physical classrooms online (Grajek 2015: 13, Mouyabi 2010: 1187).

#### 5.5.4.7 Use of technology entails more work

The respondents were asked to indicate their level of agreement on statements relating to the use of technology entailing more work. The results are depicted in Figure 5.13 below.

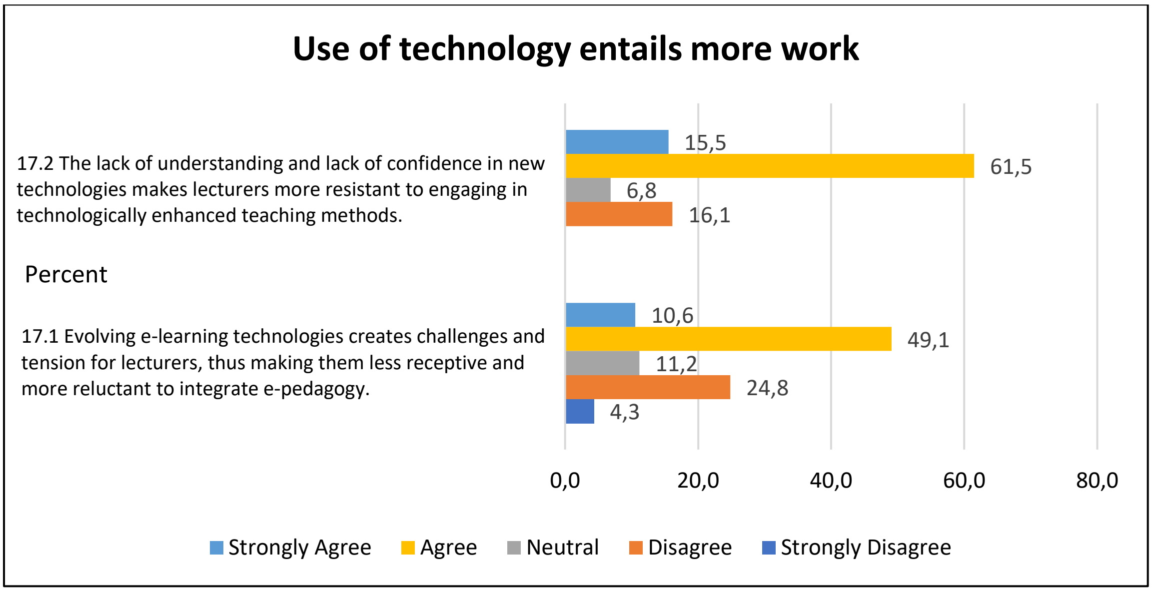


**Figure 5.13: Use of technology entails more work**

Figure 5.13 illustrates the results for each of the sub-themes that relate to the use of technology entailing more work:

- **Statement 17.1 - Evolving e-learning technologies create challenges and tension for lecturers, thus making them less receptive and more reluctant to integrate e-pedagogy:** Collectively, 59,7% of respondents either strongly agreed (10,6%) or agreed (49,1%) that evolving e-learning technologies create challenges and tension for lecturers, thus making them less receptive and more reluctant to integrate e-pedagogy. A further 29,1% of respondents disagreed (4,3% strongly disagreed and 24,8% disagreed), while 11,2% remained neutral.

- **Statement 17.2 - The lack of understanding and lack of confidence in new technologies makes lecturers more resistant to engaging**

**in technologically-enhanced teaching methods:** Collectively, 77% of respondents either strongly agreed (15,5%) or agreed (61,5%) that the lack of understanding and lack of confidence in new technologies makes lecturers more resistant to engaging in technologically-enhanced teaching methods. A lower percentage disagreed (16,1% disagreed) and 6,8% of respondents remained neutral.

The findings revealed that the majority of respondents indicated that the lack of understanding and lack of confidence in new technologies is a challenge which makes lecturers more resistant to engage in technologically-enhanced teaching methods. The majority also believed that evolving e-learning technologies are a challenge for lecturers, thus making them less receptive and more reluctant to integrate e-pedagogy. These findings concur with the views expressed by Wagner, Hassanein and Head (2008: 29) that teaching with technology is fundamentally different from traditional teaching methods, thus requiring a commitment of time and training. The authors therefore maintain that providing online versions of course content takes almost twice as long compared to traditional delivery, creating resistance by lecturers to the additional workload.

#### 5.5.4.8 How teaching with technology impacted on lecturers' understanding of learner differences

In an open-ended question, the respondents were asked to indicate how their teaching practice (with technology) impacted on their understanding of learner differences (i.e. backgrounds and personalities). Eight respondents did not provide any responses. The responses received indicated the following:

- **Understanding learner challenges with respect to access to devices and data**

  A significant number of staff (20) indicated that:

  - only when engaging their students with technology, did they come to the realisation that most students have difficulty connecting as they do not have devices, nor do they have data;

- some students may have devices, but connectivity is a problem as they reside in rural areas; and
- some students lacked access to computers even before being students at a HEI.

These findings are in agreement with Rachfall, Foerster-Trallo and Zimbelmann (2019: 5336), who state that the lack of technical prerequisites (hardware and network connectivity issues) has an impact on the acceptance of e-learning by students. However, the authors state further that it is co-operation between student and lecturer and promoting a "trusting atmosphere" which will enable learning success (2019: 5332).

- **Understanding that learners from a lower SET background have lesser interest in and response to computer courses**

A significant number of respondents (18) further indicated that:

- The digital divide certainly does exist as students from lower socio-economic background generally show lesser interest in and response to the technological mode of delivery.

This finding is in agreement with the view expressed by Czerniewicz and Brown (2013: 46) that some students are "digital strangers", students who have had limited exposure to computers before enrolling at an HEI. The authors state further that (the lack of) information and communication technology experience and opportunities also shapes how students engage with their studies.

- **Understanding that some departments lack a computer course to orientate students**

  Some respondents (4) indicated that:

  - some departments do not have a computer course to orientate the students, so the lecturers need to orientate their students before even using the e-learning mode.

Departments that lack computer courses, i.e. those departments that teach practical courses (health, culinary, language), combine theory and practice, thus consolidating students' academic and practical skills (Elhaty *et al.* 2020: 2866). This finding is in agreement with the authors' views that transforming these types of classes to an e-learning environment is difficult as both students and staff would not have experienced teaching and learning in an online environment.

- **Lecturers find it difficult to assess learner differences without face-to-face interactions**

A significant number of respondents (16) indicated that:

  - learners were regarded as just a number on the system, thus proving difficult for lecturers to assess learner differences without face-to-face interactions;
  - e-learning favours a student who is technological savvy and not one who battles with technology; and
  - a student who is not confident in their technological abilities is going to be timid in class and may need more assistance than others.

  Understanding learner differences (i.e. how students learn and perceive) is important when conveying and sharing information with students. However, Brozik and Zapalska (2006), as cited by Islam, Beer and Slack (2015: 104), state that online classes do not help in such a scenario as there is no face-to-face interaction.

- **Inadequate facilities and large classes make it difficult to assess learner differences**

  Some respondents (13) indicated that:

  - Inadequate facilities within the institution are a major obstacle in assessing learner differences;
  - large classes also make it difficult to assess learner differences;
  - technology alone does not allow the lecturer to really understand the diverse backgrounds and personalities of the student population; and
  - in order to grasp the understanding of learner differences in terms of background and personality, a blended teaching approach is needed.

These views are in agreement with Hedtrich and Graulich (2018: 2263) who maintain that student competencies and formative feedback is difficult in e-learning, especially in large classes. The authors argue further that although lecturers have insight into the students' learning via the LMS, it is difficult to assess individual differences and provide formative feedback.

- **Understanding how students' diverse personalities affect their response to technology**

  Some of the respondents (15) further indicated that:

  a major factor also remains that students have diverse personalities and come from diverse backgrounds, so technology is welcomed by some, whilst not by others; and teaching practices are adapted to fit the student cohort, as different responses to technology illustrate learner experiences and personalities. Zapalska and Brozik (2006) as cited in Islam, Beer and Slack (2015: 104) claim that it is the understanding by academics of learner differences and learning styles that will allow for the understanding of how students' diverse personalities affect their response to technology. The authors further state that if students are comfortable with a particular learning style, then no matter what materials or resources are provided to them, they will not cope with the introduction of a new method of teaching. This concurs with the responses that learning with technology is welcomed by some, whilst not by others.

- **Understanding that the virtual space is more open and comfortable for students**

  A significant number of respondents (18) indicated that:

  - some lecturers identified that a virtual space allows for students to be more open and comfortable;
  - it allows learners with a variety of different skills and abilities to learn in a safe environment that is non-threatening, and those who want to learn will find a way that shows their academic personality; and

- some lecturers believe that a digital curriculum enables them to understand learners' needs and how to prepare in addressing these needs.

These views are in agreement with Radha *et al.* (2020: 1090) who maintain that e-learning provides for a higher degree of reliable communication between students and lecturers. The authors further maintain that e-learning provides for a more inclusion-based environment (i.e. it reaches all heterogeneity of groups with freedom of knowledge-sharing) (2020: 1093).

#### 5.5.4.9 Other challenges to teaching with technology

The respondents were asked to indicate what other challenges (apart from the ones listed) they experienced in their teaching practices with e-learning. Figure 5.14 provides a graphical representation of the responses to other challenges that lecturers have with teaching with technology, apart from those listed in the survey. The graphical representation is based on the frequency of responses listed below within the particular themes listed.

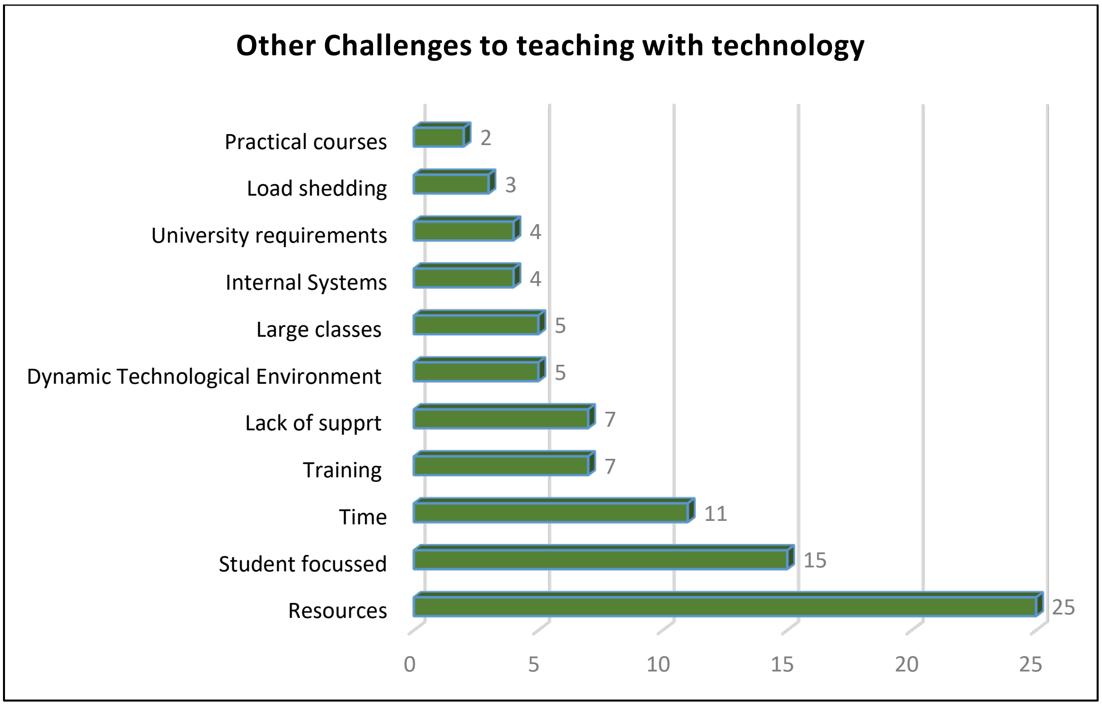


**Figure 5.14: Other challenges to teaching with technology**

As shown in Figure 5.14 above, the other challenges experienced by respondents in teaching with technology include:

- **Challenges with respect to students were as follows:**
    - Student focussed (15) – lack of resources for students to engage in online learning; restrictions in data and network for students; no effort from students to engage in online learning; and the inability of students to work independently;
    - Internal systems (4) - un-timeous registration of students; email systems unused by students; copyright stifles students' work; and
    - Large classes (5) – online assessments for large classes is a challenge.
- **Challenges with university systems were as follows:**
    - lack of support (7) – limited technical support; and
    - university requirements (4) – more emphasis on staff qualification rather than promoting staff to learn the necessary skills to teach updated industrial knowledge.
- **Challenges with resources and time were as follows:**
    - Resources (25) – lack of updated equipment, venues, data, infrastructure
    - Time (11) – limited time to work with e-learning with heavy work loads
- **Other challenges were as follows:**
    - Dynamic technological environment (5) – technology is moving too fast to keep up with changes;

- Load shedding (3) – load shedding and power outages are disruptive for online teaching and learning; and
- Practical courses (2) – some practical courses cannot be held online.

The findings above have indicated that the more dominant trends in the challenges relating to teaching with technology stem from the lack of adequate resources for teaching staff and the lack of time. The lack of data, devices and network connectivity for the students, as well as the lack of effort from students and their inability to work independently also contributes to the teaching challenges in e-learning. Kebritchi, Lipschuetz and Santiague (2017: 19) state that it takes more time to prepare, plan and teach via e-learning than it does in a face-to-face environment. The authors state further that learners in an online environment may add to the challenges of teaching staff as they (learners), do not take responsibility for their learning and do not establish their learning goals (2017: 9). The lack of resources for both staff and students to engage in successful e-learning is further indicated by Al-araibi, Naz'ri bin Mahrin, and Yusoff (2019: 567-590) who claim that the benefits of e-learning are fully attained when there is easier access to the internet, technological infrastructure, technical support, as well as access to hardware and software.

### 5.5.5 BEST-PRACTICES

This section focusses on best-practices for integrating technology with pedagogy to produce a successful digital curriculum. Respondents were given "best-practice" scenarios as depicted in literature. Respondents had to rate these practices as what they believed are best practices, using a Likert Scale analysis.

#### 5.5.5.1 Best-practices in staff development

Mishra and Koehler's TPACK (Technological Pedagogical Content Knowledge) model was the basis of best-practice scenarios. The TPACK model demonstrates the combination of the technical competencies, content knowledge and pedagogical knowledge of lecturing staff. This combination, coupled with lecturers' technological pedagogical knowledge, technological content knowledge and pedagogical content knowledge, results in technological pedagogical content knowledge a framework for successful teaching practices in an online environment.

The respondents were asked to rate their level of agreement on statements relating to best-practices in staff development. The results are illustrated in Figure 5.15.

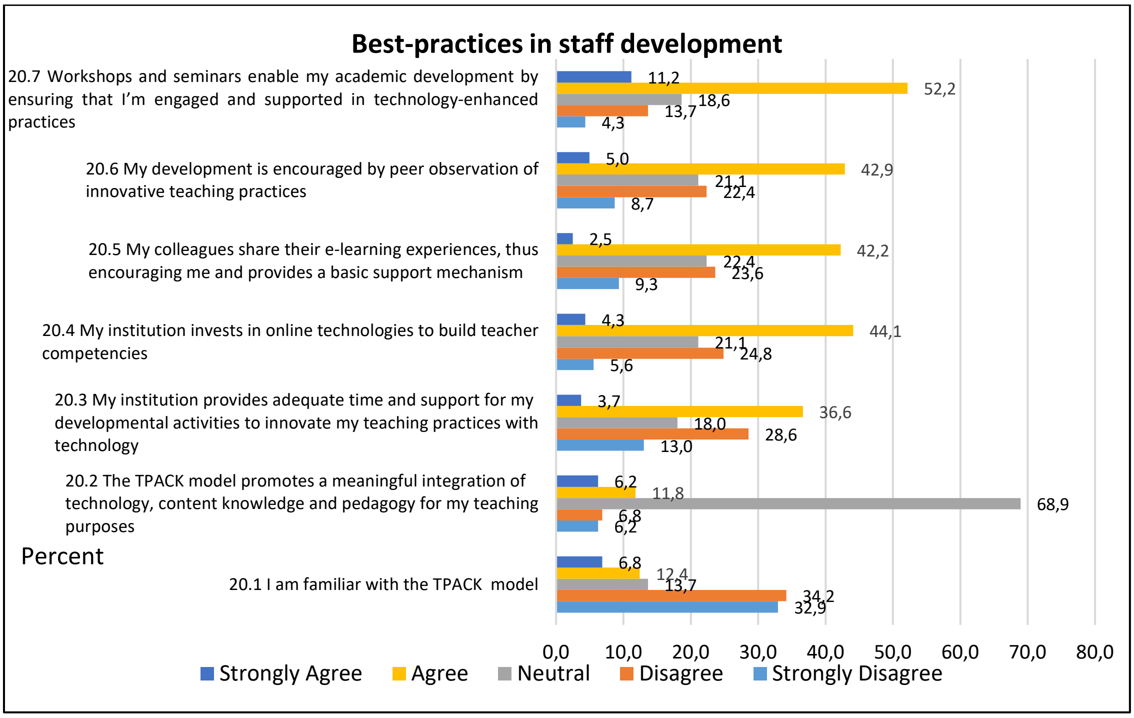


**Figure 5.15: Best-practices in staff development**

From the results illustrated in Figure 5.15, the following patterns are observable:

- Statements 20.1 and 20.2 indicate low levels of agreement;
- Statement 20.2 shows a relatively high level of neutral responses; and
- Statements 20.3, 20.4, 20.5 and 20.6 show similar levels of disagreement.

The results indicate a high level of disagreement for Statement 20.1 (34,2%). This shows that majority of the respondents are not familiar with the TPACK model that is prevalent in teaching with technology.

Figure 6.14 above indicates the results of each of the sub-themes that relate to best practices in staff development:

- **Statement 20.1 - I am familiar with Mishra and Koehler's TPACK (Technological Pedagogical Content Knowledge) model**: Collectively, 19,2% of respondents either strongly agreed (6,8) or agreed (12,4%) that they are familiar with Mishra and Koehler's TPACK (Technological Pedagogical Content Knowledge) model. The majority (67,1%) of respondents disagreed (34,2% disagreed and 32,9% strongly disagreed) and 13,7% of respondents remained neutral.

- **Statement 20.2 - The TPACK model promotes a meaningful integration of technology, content knowledge and pedagogy for my teaching purposes:** Eighteen percent of respondents collectively agreed (6,2% strongly agreed and 11,8% agreed) that the TPACK model promotes a meaningful integration of technology, content knowledge and pedagogy for teaching purposes. Collectively, 13,05% of respondents either strongly disagreed (6,25%) or disagreed (6,8%) while 68,9% of respondents were neutral.

- **Statement 20.3 - My institution provides adequate time and support for my developmental activities to innovate my teaching practices with technology:** Collectively, 40,3% of respondents either strongly agreed (3,7%) or agreed (36,6%) that the institution provides adequate time and support for developmental activities to innovate teaching practices with technology. A further 41,6% of respondents disagreed (13,0% strongly disagreed and 28,6% disagreed) with18,0% of respondents remaining neutral.

- **Statement 20.4 - My institution invests in online technologies to build teacher competencies**: Collectively, 48,3% of respondents either strongly agreed (4,2%) or agreed (44,1%) that the institution invests in online technologies to build teacher competencies. A further 30,4% of respondents collectively disagreed (5,6% strongly disagreed and 24,8% disagreed), while 21,1% of respondents remained neutral.

- **Statement 20.5 - My colleagues share their e-learning experiences, thus encouraging me and providing a basic support mechanism:** Collectively, 44,7% of respondents either strongly agreed (2,5%) or agreed (42,2%) that their colleagues share their e-learning experiences, thus encouraging each other and providing a basic support mechanism. A further 32,9% of respondents disagreed (9,3% strongly disagreed and 23,6% disagreed), with 22,4% remaining neutral.

- **Statement 20.6 - My development is encouraged by peer observation of innovative teaching practices:** Collectively, 47,9% of respondents either strongly agreed (5,0%) or agreed (42,9%) that their development is encouraged by peer observation of innovative teaching practices. A lower percentage (31,1%) of respondents disagreed (8,7% strongly disagreed and 22,4% disagreed), with a further 21,1% being neutral.

- **Statement 20.7 - Workshops and seminars enable my academic development by ensuring that I am engaged and supported in technology-enhanced practices:** Collectively, 63,4% of respondents either strongly agreed (11,2%) or agreed (52,2%) that workshops and seminars enable academic development by ensuring that staff are engaged and supported in technology-enhanced practices. A further 18% of respondents disagreed (4,3% strongly disagreed and 13,7% disagreed), while 18,6% remained neutral.

The findings indicate that the majority of respondents are not familiar with the TPACK model. However, Roddy *et al*. (2017: 4) believe that teaching staff can develop a range of skills by conforming to the TPACK (Technological Pedagogical Content Knowledge) model as proposed by Mishra and Koehler (2006). The findings also indicate that almost half the respondents believe that the institution invests in online technologies and provides for adequate time and support for the respondents' developmental activities for innovative teaching practices with technology. These findings are important as expressed by the views of King and Boyatt (2014: 1272-1280) that institutions need to develop a supportive institutional culture which would take into account integration between available technologies with existing pedagogic systems and practices. Almost half the respondents also agreed that their development is encouraged by peer observation of innovative teaching practices. Furthermore, the majority of respondents also believed that workshops and seminars enable academic development. Martin (2018: 1) that academic staff can develop themselves by regularly engaging with or observing their colleagues' professional and pedagogic skills. Keppel, Suddaby and Hard, (2015: 5) assert that academic development is further enhanced when teaching staff engage in workshops and seminars which contribute to methods necessary for improving their existing practices.

#### 5.5.5.2 Resources and technical support for online teaching

The respondents were asked to indicate their level of agreement on statements relating to resources and technical support for online teaching. The results are shown in Figure 5.16 below.

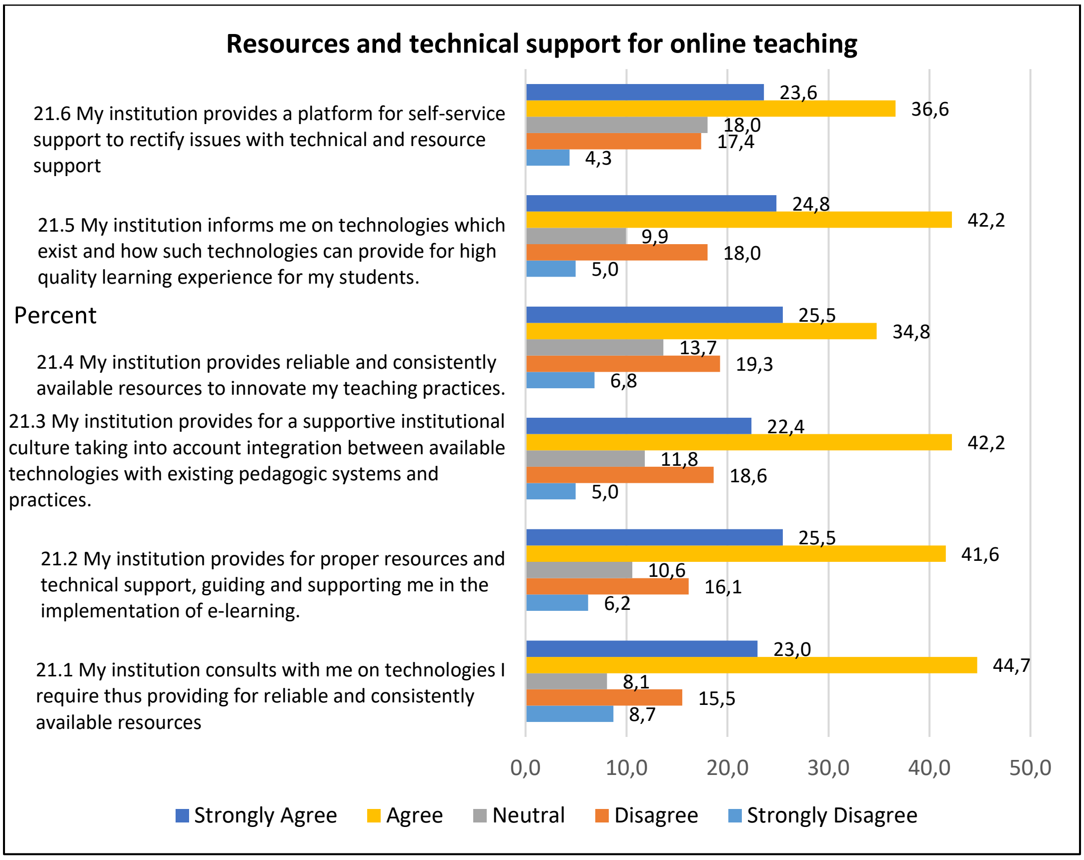


**Figure 5.16: Resources and technical support for online teaching**

From the results indicated in Figure 5.16, the following patterns are discernible:

- Statements 21.1, 21.2, 21.3 and 21.5 show higher levels of agreement; and
- All statements indicate similar levels of disagreement.

The results show a higher level of agreement for Statement 21.2 (25,5%) and Statement 21.4 (25,5%). This indicates that respondents view proper resources, technical support and reliable and consistently available resources as important for the implementation of e-learning and innovation of teaching practices.

Figure 5.16 above illustrates the results for each of the sub-themes that relate to resources and technical support:

- **Statement 21.1 - My institution consults with me on the technologies I require thus providing for reliable and consistently available resources:** Collectively, 67,7% of respondents either strongly agreed (23,0%) or agreed (44,7%) that the institution consults with teaching staff on the technologies required, thus providing for reliable and consistently available resources. A further 24,2% of respondents collectively disagreed (8,7% strongly disagreed and 15,5% disagreed) and 8.1% remained neutral.

- **Statement 21.2 - My institution provides proper resources and technical support, guiding and supporting me in the implementation of e-learning:** Collectively, 67,1% of respondents either strongly agreed (25,5%) or agreed (41,6%) that learning can be adopted on a positive level if the institution provides proper resources and technical support, guiding and supporting respondents in the implementation of e-learning. A further 22,3% of respondents collectively disagreed (6,2% strongly disagreed and 16,1% disagreed), while 10,6% were neutral.

- **Statement 21.3 - My institution provides for a supportive institutional culture, taking into account the integration between available technologies with existing pedagogic systems and practices:** Collectively, 64,6% of respondents either strongly agreed (22,4%) or agreed (42,2%) that the institution provides for a supportive institutional culture, taking into account the integration between available technologies with existing pedagogic systems and practices. A lower percentage (26,1%) of respondents disagreed (6,8% strongly disagreed and 19,3% disagreed), while 11,8% remained neutral.

- **Statement 21.4 - My institution provides reliable and consistently available resources to innovate my teaching practices:** Over half the respondents (60,3%) collectively agreed (25,5% strongly agreed and 34,8% agreed) that the institution provides reliable and consistently available resources to innovate teaching practices as a best-practice. A further 26,1% of respondents disagreed (16,8% strongly disagreed and 19,3% disagreed), with 13,7% who remained neutral.

- **Statement 21.5 - My institution informs me of technologies which exist and how such technologies can provide for a high quality learning experience for my students:** Collectively, 67% of respondents either strongly agreed (24,8%) or agreed (42,2%) that the institution informs staff of technologies which exist and how such technologies can provide for a high-quality learning experience for students. A further 23% disagreed (5,0% strongly disagreed and 18,% disagreed), while a further 9,9% remained neutral.

- **Statement 21.6 - My institution provides a platform for self-service support to rectify issues with technical and resource support**: Over half the respondents (60,2%) collectively agreed (23,6% strongly agreed and 36,6% agreed) that e-learning can be adopted on a positive level if the institution provides a platform for self-service support to rectify issues with technical and resource support. Collectively, 21,7% of respondents either strongly disagreed (4,3%) or disagreed (17,4%) and 18,0% were neutral.

Based on the results presented above, the findings reveal that the majority of respondents agreed that the institution consults with them on the technologies they require, thus providing for reliable and consistently available resources; that the institution provides proper resources and technical support, guiding and supporting them in the implementation of e-learning; and that the institution also provides for a supportive institutional culture, taking into account the integration between available technologies with existing pedagogic systems and practices. The findings showed that the majority also agreed that the institution provides reliable and consistently available resources to innovate their teaching practices; that it informs them of technologies which exist and how such technologies can provide for high a quality learning experience for students; and that it provides a platform for self-service support to rectify issues with technical and resource support. These findings concur with the views expressed by King and Boyatt (2014: 1272-1280) that a supportive institutional culture and the positive integration between available technologies with existing pedagogic systems and practices are ideal for successful e-learning adoption.

### 5.5.5.3 Use of instructional technology

The respondents were asked to indicate their level of agreement with statements relating to the use of instructional technology. The results are illustrated by Figure 5.17.

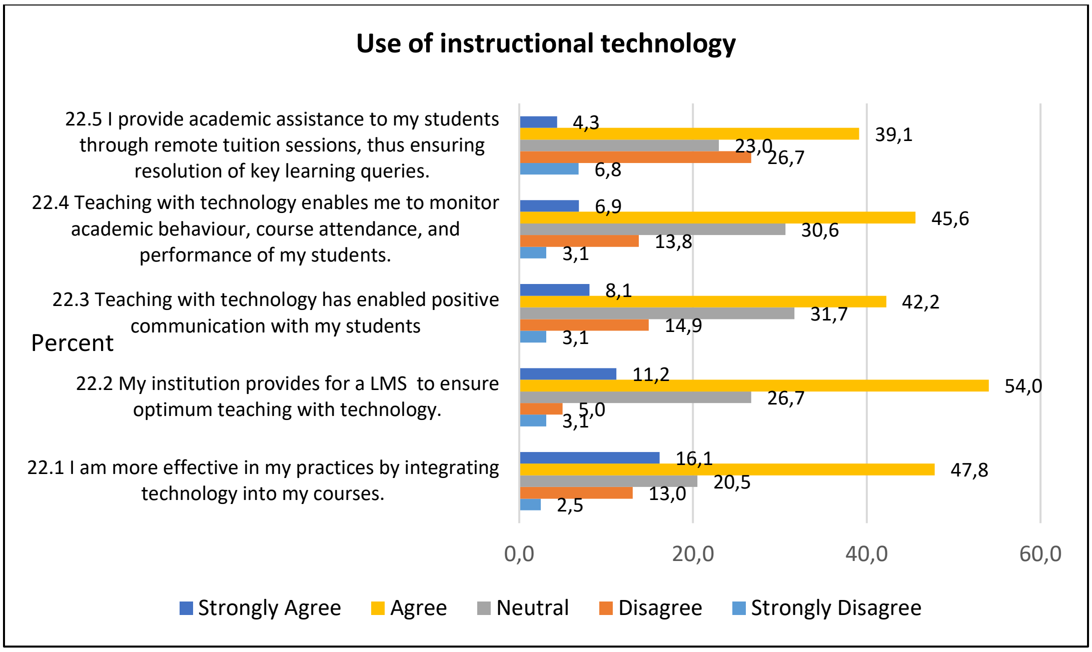


**Figure 5.17: Use of instructional technology**

From the results illustrated in Figure 5.17, the following patterns are observable:

- Statements 22.1 and 22.2 show higher levels of agreement;
- Statement 22.5 shows the highest level of disagreement; and
- Statements 22.2, 22.3 and 22.4 show similar levels of neutral responses.

The results show a high level of disagreement for Statement 22.5 (26,7%). This indicates that respondents do not view assistance to students through remote tuition sessions as important in e-learning technologies.

Figure 6.16 above illustrates the results for each of the sub-themes that relate to the use of instructional technology:

- **Statement 22.1 - I am more effective in my practices by integrating web-based content, e-books, lecture recordings, social media, simulations and online collaboration tools into my courses**: Collectively, 63,9% of respondents either strongly agreed (16,1%) or agreed (47,8%) that they are more effective in their practices by integrating web-based content, e-books, lecture recordings, social media, simulations and online collaboration tools into their courses. A lower percentage (15,5%) of respondents disagreed (2,5% strongly disagreed and 13,0% disagreed). A further 20,5% were neutral.
- **Statement 22.2 - My institution provides an LMS (Learning Management System) to ensure the organisation, course structure and delivery of course material for optimum teaching with technology:** Over half the respondents (65,2%) collectively agreed (11,2% strongly agreed and 54,0% agreed) that the institution provides an LMS to ensure the organisation, course structure and delivery of course material for optimum teaching with technology. In addition, 8,1% disagreed (3,1% strongly disagreed and 5,0% disagreed), while a further 31,7% of respondents remained neutral.

- **Statement 22.3 - Teaching with technology has enabled communication with my students via live chats, video/webcam interactions and virtual classrooms, thus having a positive influence on student engagement and course completion:** Collectively, 50,3% of respondents either strongly agreed (8,1%) or agreed (42,2%) that teaching with technology has enabled communication with students via live chats, video/webcam interactions and virtual classrooms, thus having a positive influence on student engagement and course completion. A minor percentage (18%) of respondents disagreed (3,1% strongly disagreed and 14,9% disagreed). A further 31,7% were neutral.

- **Statement 22.4 - Teaching with technology enables me to monitor academic behaviour, course attendance, and performance of my students:** More than half the respondents (52,5%) collectively agreed (6,9% strongly agreed and 45,6% agreed) that teaching with technology enables the respondents to monitor academic behaviour, course attendance, and the performance of their students. Collectively, 16,9% of respondents either strongly disagreed (3,1%) or disagreed (13,8%), while 30,6% remained neutral.

- **Statement 22.5 - I provide academic assistance to my students through remote tuition sessions, thus ensuring the resolution of key learning queries:** Collectively, 43,2% of respondents either strongly agreed (4,1%) or agreed (39,1%) that they provide academic assistance to students through remote tuition sessions, thus ensuring the resolution of key learning queries. A further 33,5% of respondents disagreed (6,8% strongly disagreed and 26,7% disagreed), while 23,0% remained neutral.

The findings indicate that the majority of respondents believe that they are effective in their practices by integrating technology into their courses, which has a positive influence on student engagement and course completion. The majority also agreed that the LMS ensures the organisation, course structure and delivery of course material for optimum teaching with technology, and that teaching with technology has enabled communication with students via live chats, video/webcam interactions and virtual classrooms. There was also agreement among the majority that teaching with technology enables the monitoring of academic behaviour, course attendance and the performance of students. These findings are in agreement with the views expressed by Roddy *et al.* (2017:3-5) that teaching with technology provides for the effective monitoring of student progress, thus assisting lecturers to detect those who are struggling with academic activities.

### 5.5.5.4 Significance of community chat groups

The respondents were asked to indicate their level of agreement with statements relating to the significance of community chat groups as a best-practice. The results are indicted in Figure 5.18 below.

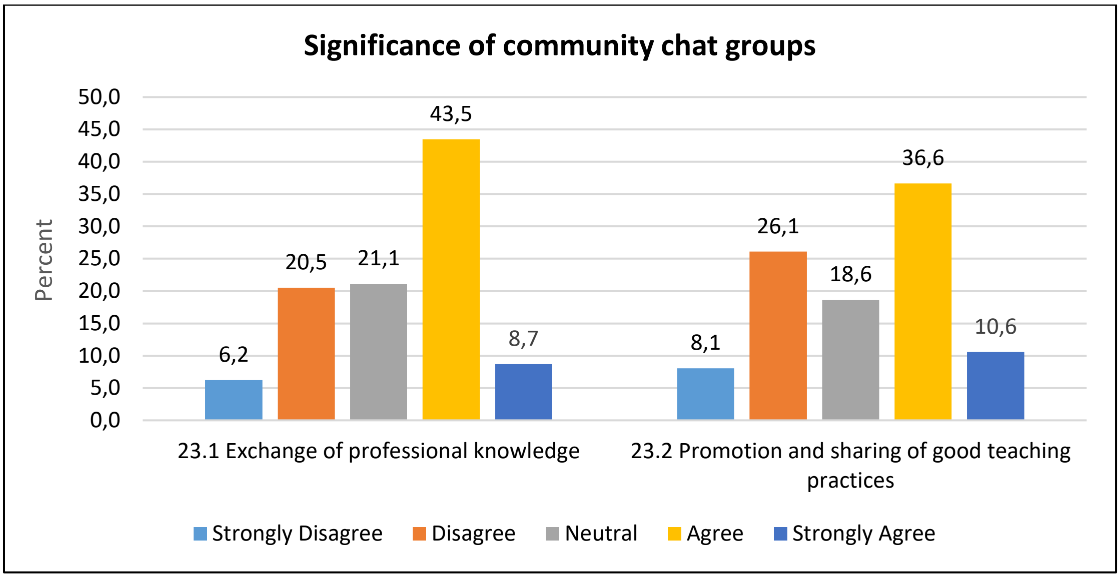


**Figure 5.18: Significance of community chat groups**

Figure 5.18 illustrates the results for the two sub-themes that relate to the significance of community chat groups:

- **Statement 23.1 - I use my online space for professional learning by engaging with colleagues and exchanging professional knowledge:** Over half the respondents (52,2%) agreed (8,7% strongly agreed and 43,5% agreed) that using their online space for professional learning by engaging with colleagues and exchanging professional knowledge was seen as a best-practice. Collectively, 26,7% either strongly disagreed (6,2%) or disagreed (20,5%), while a further 21,15% of respondents remained neutral.

- **Statement 23.2 - My colleagues and I assist each other in recognising changing fields and organising the mix of learning technologies in support of learning, thus ensuring the promotion and sharing of good teaching practices**: Collectively, 47,2% either strongly agreed (10,6%) or agreed (36,6%) that colleagues assisted each other in recognising changing fields and organising the mix of learning technologies in support of learning, thus ensuring the promotion and sharing of good teaching practices. A further 34,2% of respondents disagreed (8,1% strongly disagreed and 26.1% disagreed) and 18,6% were neutral.

The findings indicate that the majority of respondents believed that using online spaces for engaging and exchanging knowledge is regarded as a best-practice. Some respondents also believed that promoting and sharing good teaching practices (through assisting each other by engaging in and sharing learning technologies) is deemed a best-practice. Keppell, Suddaby and Hard (2015: 2) state that shared practices and the exchange of stories and experiences can assist in recognising the changing field and organising the mix of learning technologies in support of teaching and learning with technology. The authors state further that this is a way to reach out to colleagues by way of social learning and understanding different environments, with an exchange of professional knowledge.

#### 5.5.5.5 Other best-practices that would be beneficial to teaching and learning with technology

In an open-ended question, the respondents were asked to indicate the best-practices (other than those that were listed) they believed would be beneficial to teaching and learning with technology at DUT. The responses received were categorised as per the most common themes and are listed below. Thirteen respondents chose not to respond.

- **Student development:**
  - Build student capacity with data and devices;
  - Build communities of practice for students;
  - Communicate with small groups of students for problem-solving;
  - Address challenges of language and comprehension; and
  - Offer basic computer courses to first-year students

- **Staff development:**
    - Workshops to equip staff with new methods of teaching in the information age;
    - Afford staff the time to attend development workshops and training;
    - CELT to be decentralized to faculties and increase the staff complement of CELT;
    - Forums on Friday Afternoon amongst faculty/department staff should be encouraged to share best-practices that are successful; and
    - More teamwork and collaboration.
- **Resource requirements:**
    - Data and connectivity with back-up and technical support; and
    - Teacher aides.
- **Lessons and assessments:**
    - Referring students to online databases, You Tube videos, other institutions' free resources;
    - Open book, open web is an assessment form to be considered at DUT;
    - Use of games, quizzes etc. by some lecturers;
    - Use of platforms that students use, i.e. students' favourite forms of social media; and
    - Engage students in discussions on online learning on these social media platforms.

From the results reflected above, the findings indicate that student and staff development, proper and essential resources and lessons and assessments are all important components of best practices for e-learning. These findings concur with the views expressed by Roddy *et al.* (2017: 6) that targeted training programmes, as well as easy access to comprehensive resources, are vital to improving student success in intensive online learning environments.

These findings are further supported by Tarus and Gichoya (2015: 7) and King and Boyatt (2014: 1272-1280), who attribute the success of e-learning initiatives to the access to computers and other e-learning technological access devices, as well as network connectivity and bandwidth. Literature further supports the findings on lessons and assessments by attributing the use of technology for online peer tutoring, discussion boards and group video-conferences (e.g., Google hangouts) to facilitate synchronous and asynchronous interactions with others and to promote collaborative learning, thus reducing the feeling of isolation experienced by online learners (Grajek 2015: 14-15).

The findings on staff development are supported by the views expressed by King and Boyatt (2014: 1272-1280), who argue that the exchange of e-learning experiences as a support mechanism encourages knowledge-sharing. Workshops and seminars encourage academic development (Keppell, Suddaby and Hard 2015: 5). Technology requirements, levels of expertise, communication styles and service expectations of staff differ, therefore requiring different levels of IT support (Grajek 2015: 22).

## 5.6 Inferential Statistics

Inferential statistics entails the inferences which were drawn about the population from the sample obtained. The two most important aspects of precision are reliability and validity. This section presents the Cronbach's alpha (α) coefficients that were obtained to test the reliability of the survey instrument of this study. Maree (2016: 41) explains that the Cronbach's coefficient alpha is calculated to determine the reliabilities of a test and is further based on the inter-item correlations. Furthermore, the validity of the survey instrument is indicated by the Pearson coefficient results that were obtained. In view of the definition of inferential statistics, it can be concluded that it is therefore a means of ensuring the reliability and validity of the instruments assessed.

### 5.6.1. Reliability Statistics

Maree (2016:164) posits that reliability indicates the "consistency or repeatability of a measure or an instrument". The author further states that high reliability is a result of the measure or instrument producing the same results each time the research is conducted on the same sample. Using the Cronbach's alpha co-efficient technique, the reliability of the instrument was tested. There are different reports about the acceptable values of alpha (Tavakol and Dennick 2011: 54). However, a reliability coefficient of 0.60 or higher is considered as "acceptable" for a newly developed construct.

### 5.6.1.1 Cronbach's Alpha

Table 5.4 reflects the Cronbach's alpha score for the items that constituted the questionnaire.

**Table 5.4: Cronbach's Alpha Score**

| | Section | Number of Items | Cronbach's Alpha |
|---|---|---|---|
| Q2 | Methods Relating to Teaching Practices | 5 | 0.659 |
| Q3 | Importance for Teaching and Learning | 2 | 0.657 |
| Q4 | Teaching Challenges in Higher Education Institutions (HEIS) | 4 | 0.601 |
| Q11 | Rigid Teaching Practices | 5 | 0.770 |
| Q13 | Lack of Skills/Knowledge/Engagement in The Use of Technology | 6 | 0.670 |
| Q14 | Lack of Access to Technology | 4 | 0.781 |
| Q15 | Challenges Relating to Poor Infrastructure | 2 | 0.712 |
| Q16 | Challenges in Integrating Technology into Teaching Practices | 2 | 0.720 |
| Q17 | Use of Technology Entails More Work | 2 | 0.632 |
| Q20 | Best Practices in Staff Development | 7 | 0.729 |
| Q21 | Resources and Technical Support | 6 | 0.942 |
| Q22 | Use of Instructional Technology | 5 | 0.726 |
| Q23 | Significance of Community Chat Groups | 2 | 0.836 |

The reliability scores for all sections exceeded the recommended Cronbach's alpha value. All scores are higher than 0.60, which indicates a degree of acceptable, consistent scoring for these sections of the study.

### 5.6.1.2 Factor Analysis

Factor analysis is a statistical technique whose main goal is data reduction. A typical use of factor analysis is in survey research, where a researcher wishes to represent a number of questions with a small number of hypothetical factors. Factor analysis ensures that an instrument in a research study actually measures the construct that it was designed to measure (Welman, Kruger and Mitchell 2005: 142). The analysis from the KMO and Bartlett's test are set out below.

#### 5.6.1.2.1 Kaiser-Meyer-Olkin (KMO) and Bartlett's test

The matrix table is preceded by the summarised Table 5.5 below that reflects the results of KMO and Bartlett's Test. The requirement is that Kaiser-Meyer-Olkin Measure of Sampling Adequacy should be greater than 0.50 and Bartlett's Test of Sphericity less than 0.05. In all instances, the conditions are satisfied which allows for the factor analysis procedure.

**Table 5.5: KMO and Bartlett's Test**

| | | |
|---|---|---|
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy. | | 0.674 |
| Bartlett's Test of Sphericity | Approx. Chi-Square | 4244.289 |
| | df | 1378 |
| | Sig. | 0.000 |

All of the conditions are satisfied for factor analysis i.e. the Kaiser-Meyer-Olkin Measure of Sampling Adequacy value should be greater than 0.500 and the Bartlett's Test of Sphericity sig. value should be less than 0.05.

Factor analysis was conducted only for the Likert scale items. Certain components divided into finer components. This is explained below in the rotated component matrix.

## 5.6.1.2.1.1 Rotated Component Matrices

| **Table 5.6: Rotated Component Matrices** | Component | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | |
| Develop critical thinking skills. | -0.049 | 0.038 | -0.006 | -0.024 | 0.091 | -0.017 | 0.436 | -0.057 | 0.446 | -0.006 | -0.006 | -0.043 | -0.300 | Q2.1 |
| Stimulate valuable classroom interaction. | -0.014 | -0.031 | 0.087 | 0.057 | 0.051 | -0.127 | 0.295 | -0.067 | 0.632 | 0.152 | 0.015 | -0.037 | 0.082 | Q2.2 |
| Encouraging learning through students' own efforts. | 0.036 | -0.032 | -0.027 | -0.015 | -0.036 | -0.042 | 0.844 | 0.046 | 0.110 | 0.062 | 0.059 | 0.086 | -0.004 | Q2.3 |
| Use of tutor manuals. | 0.112 | 0.093 | 0.023 | -0.016 | -0.066 | 0.108 | 0.168 | 0.355 | 0.596 | 0.008 | 0.065 | 0.011 | 0.157 | Q2.4 |
| Use of resource books. | 0.080 | 0.093 | -0.065 | 0.031 | -0.276 | 0.182 | 0.104 | 0.207 | 0.669 | 0.087 | 0.035 | 0.152 | 0.147 | Q2.5 |
| Transmission of information. | 0.100 | -0.079 | 0.093 | 0.092 | 0.121 | 0.032 | -0.011 | -0.061 | 0.641 | -0.090 | -0.093 | 0.135 | -0.134 | Q3.1 |
| Developing skills and attitudes of students. | 0.183 | 0.031 | -0.161 | -0.156 | 0.026 | 0.172 | 0.600 | -0.105 | 0.311 | -0.036 | 0.069 | 0.076 | 0.161 | Q3.2 |
| Promoting the development of the students' own conceptual understanding. | 0.077 | 0.109 | 0.001 | 0.113 | 0.028 | 0.000 | 0.806 | -0.044 | 0.101 | -0.020 | 0.045 | -0.030 | 0.118 | Q3.3 |
| South African teaching systems are authoritarian and stifles the development of students. | 0.048 | 0.139 | -0.025 | -0.084 | 0.083 | 0.013 | 0.181 | -0.070 | -0.072 | -0.054 | 0.606 | -0.220 | -0.016 | Q4.1 |
| HEIs are expected to increase throughput with limited resources while catering for large classes. | -0.076 | -0.076 | 0.158 | -0.110 | -0.172 | 0.112 | 0.004 | 0.107 | 0.082 | 0.219 | 0.562 | 0.264 | -0.125 | Q4.2 |
| Teaching at HEIs is difficult as there is a diverse population informed by multilingualism and varied levels of preparedness. | 0.155 | -0.129 | 0.087 | 0.015 | 0.122 | 0.006 | 0.047 | -0.026 | -0.110 | -0.175 | 0.655 | 0.300 | 0.024 | Q4.3 |
| Graduates of secondary education lack capabilities as required at university level. | 0.074 | -0.065 | 0.007 | -0.047 | 0.110 | -0.009 | -0.043 | 0.183 | 0.088 | 0.140 | 0.686 | -0.023 | 0.029 | Q4.4 |
| Academics are less eager to adopt e-learning to support their teaching as they find it difficult to adapt to change. | 0.077 | -0.030 | 0.065 | 0.013 | 0.825 | 0.061 | 0.097 | 0.068 | -0.065 | -0.020 | 0.007 | -0.035 | 0.038 | Q11.1 |
| Academics need to be convinced that the technology enhanced method, which is different from their traditional approach, is more feasible for their students, before they actually are willing to adopt any such method. | 0.132 | -0.139 | 0.114 | 0.184 | 0.687 | 0.215 | -0.060 | 0.167 | 0.053 | -0.073 | 0.010 | 0.116 | 0.077 | Q11.2 |
| Although technology is beneficial for communicating to learners, lecturers are concerned about losing the face-to-face interaction with students. | 0.125 | -0.014 | 0.023 | 0.174 | 0.264 | 0.179 | 0.007 | 0.002 | 0.155 | -0.041 | 0.015 | 0.160 | 0.444 | Q11.3 |
| Delivering curricula via technology is inhibited due to the reluctance of lecturers to invest the additional effort. | 0.068 | 0.088 | -0.013 | -0.004 | 0.787 | 0.169 | -0.039 | 0.120 | 0.024 | 0.018 | 0.136 | 0.067 | 0.014 | Q11.4 |
| Teaching practices are highly influenced by lecturers' pedagogical beliefs and their tried and tested methods of course delivery. | 0.017 | 0.091 | -0.055 | -0.095 | 0.599 | 0.292 | 0.068 | -0.094 | 0.005 | 0.180 | 0.061 | 0.154 | 0.289 | Q11.5 |
| Navigation into educational programmes using technology is difficult because I do not have the necessary skills. | -0.044 | -0.204 | 0.054 | -0.020 | 0.143 | 0.111 | 0.155 | 0.158 | -0.016 | 0.002 | -0.067 | -0.051 | 0.696 | Q13.1 |
| Improving technological skills and knowledge is a crucial priority to ensure success in teaching with technology. | 0.073 | 0.038 | -0.019 | -0.077 | 0.091 | -0.054 | -0.058 | 0.072 | 0.234 | 0.007 | 0.110 | 0.659 | 0.109 | Q13.2 |
| Lecturers who lack technological skills cannot provide appropriate feedback to students. | 0.019 | 0.166 | -0.142 | 0.044 | 0.153 | 0.170 | -0.071 | 0.694 | 0.124 | -0.068 | 0.105 | 0.263 | 0.107 | Q13.3 |
| Lecturers who lack technological skills grapple with preparation of course content. | 0.063 | 0.332 | -0.031 | 0.038 | 0.144 | 0.131 | -0.049 | 0.639 | 0.004 | -0.087 | 0.125 | 0.211 | 0.188 | Q13.4 |
| Lecturers need to have the appropriate facilitation skills and develop technological skills for effective e-learning delivery. | 0.026 | -0.056 | 0.057 | 0.013 | 0.147 | 0.172 | 0.254 | 0.313 | -0.029 | -0.062 | -0.019 | 0.677 | -0.109 | Q13.5 |
| Lecturers may not be resistant to technological application, but are simply confused as to how to implement technology into their formal teaching methods. | 0.055 | -0.103 | -0.103 | -0.061 | 0.178 | 0.477 | 0.324 | 0.277 | -0.043 | -0.030 | -0.056 | 0.272 | 0.050 | Q13.6 |
| There is a lack of technical support in HEIs. | -0.085 | 0.012 | 0.677 | -0.107 | 0.101 | 0.291 | 0.065 | 0.334 | -0.030 | 0.094 | 0.031 | 0.019 | -0.160 | Q14.1 |
| There is a lack of technical support in my institution. | -0.151 | -0.080 | 0.645 | -0.202 | 0.024 | 0.311 | -0.018 | 0.354 | 0.052 | 0.102 | -0.008 | -0.031 | -0.199 | Q14.2 |
| There is insufficient investments in equipment, infrastructure and resources. | -0.129 | -0.056 | 0.726 | -0.206 | -0.049 | 0.077 | 0.002 | -0.108 | -0.091 | 0.099 | 0.046 | 0.156 | 0.003 | Q14.3 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lecturers have outdated desktop computers and laptops which prove challenging when engaging in innovative methods of teaching. | -0.129 | 0.059 | 0.657 | -0.066 | 0.019 | -0.018 | 0.039 | -0.252 | 0.021 | 0.037 | -0.050 | 0.115 | 0.074 | Q14.4 |
| There is insufficient access to WiFi and bandwidth to access resources for teaching with technology. | -0.021 | -0.026 | 0.716 | 0.071 | 0.084 | -0.104 | -0.130 | -0.041 | 0.058 | -0.127 | 0.062 | -0.060 | 0.055 | Q15.1 |
| Technical errors, slowness in systems and bugs hinder my e-learning processes. | 0.068 | 0.021 | 0.632 | -0.043 | -0.004 | 0.090 | -0.101 | 0.083 | 0.201 | -0.151 | 0.088 | -0.247 | 0.205 | Q15.2 |
| Upgrades to existing technologies and various new technologies create overwhelming stresses in my teaching practices | 0.130 | -0.155 | 0.102 | 0.073 | 0.018 | 0.597 | 0.089 | 0.271 | 0.051 | 0.140 | 0.053 | -0.178 | 0.368 | Q16.1 |
| The inability to combine “content knowledge, pedagogical knowledge and technological knowledge”, which impacts negatively on student needs and learning outcomes. | 0.019 | 0.045 | 0.197 | -0.024 | 0.121 | 0.712 | -0.157 | 0.122 | 0.147 | 0.015 | -0.108 | -0.060 | 0.195 | Q16.2 |
| Evolving e-learning technologies creates challenges and tension for lecturers, thus making them less receptive and more reluctant to integrate e-pedagogy. | 0.139 | -0.172 | 0.084 | -0.054 | 0.218 | 0.659 | 0.052 | -0.124 | -0.053 | -0.016 | 0.004 | 0.023 | 0.045 | Q17.1 |
| The lack of understanding and lack of confidence in new technologies makes lecturers more resistant to engaging in technologically enhanced teaching methods. | -0.011 | 0.027 | 0.036 | -0.061 | 0.289 | 0.646 | -0.002 | 0.001 | 0.054 | -0.096 | 0.220 | 0.140 | -0.124 | Q17.2 |
| I am familiar with Mishra and Koehler’s TPACK (Technological Pedagogical Content Knowledge) model. | 0.011 | 0.063 | 0.036 | 0.128 | 0.030 | -0.085 | -0.009 | 0.007 | 0.057 | 0.866 | 0.021 | -0.037 | -0.008 | Q20.1 |
| The TPACK model promotes a meaningful integration of technology, content knowledge and pedagogy for my teaching purposes. | -0.056 | 0.025 | -0.054 | -0.046 | -0.005 | 0.073 | 0.025 | -0.091 | 0.019 | 0.878 | 0.052 | -0.001 | 0.005 | Q20.2 |
| My institution provides adequate time and support for my developmental activities to innovate my teaching practices with technology. | 0.105 | 0.076 | -0.269 | 0.701 | 0.003 | -0.097 | -0.120 | -0.041 | 0.065 | 0.073 | -0.134 | -0.056 | 0.067 | Q20.3 |
| My institution invests in online technologies to build teacher competencies. | -0.029 | -0.071 | -0.304 | 0.681 | 0.169 | -0.092 | -0.067 | -0.105 | 0.056 | -0.010 | -0.150 | 0.107 | -0.017 | Q20.4 |
| My colleagues share their e-learning experiences, thus encouraging me and provides a basic support mechanism. | 0.238 | 0.187 | 0.142 | 0.717 | -0.073 | -0.076 | 0.100 | 0.206 | -0.038 | 0.080 | -0.036 | -0.021 | 0.120 | Q20.5 |
| My development is encouraged by peer observation of innovative teaching practices. | 0.214 | 0.162 | 0.019 | 0.782 | -0.003 | 0.083 | 0.071 | 0.144 | 0.074 | -0.009 | 0.036 | -0.120 | -0.138 | Q20.6 |
| Workshops and seminars enable my academic development by ensuring that I’m engaged and supported in technology-enhanced practices. | 0.129 | 0.134 | -0.131 | 0.696 | 0.051 | 0.046 | -0.002 | -0.259 | 0.035 | -0.050 | 0.022 | -0.007 | 0.038 | Q20.7 |
| My institution consults with me on technologies I require thus providing for reliable and consistently available resources. | 0.818 | 0.127 | -0.102 | 0.059 | 0.066 | 0.020 | 0.085 | -0.003 | -0.005 | -0.021 | -0.052 | -0.004 | -0.107 | Q21.1 |
| My institution provides for proper resources and technical support, guiding and supporting me in the implementation of e-learning. | 0.865 | 0.071 | -0.172 | 0.119 | 0.060 | 0.068 | 0.071 | -0.018 | 0.021 | 0.031 | 0.023 | 0.048 | -0.022 | Q21.2 |
| My institution provides for a supportive institutional culture taking into account integration between available technologies with existing pedagogic systems and practices. | 0.923 | 0.058 | -0.089 | 0.094 | -0.007 | 0.041 | 0.026 | -0.044 | 0.018 | 0.003 | 0.057 | 0.074 | -0.010 | Q21.3 |
| My institution provides reliable and consistently available resources to innovate my teaching practices. | 0.913 | -0.002 | 0.004 | 0.104 | -0.010 | 0.055 | -0.012 | 0.051 | 0.053 | 0.026 | 0.070 | 0.014 | 0.060 | Q21.4 |
| My institution informs me on technologies which exist and how such technologies can provide for high quality learning experience for my students. | 0.849 | -0.011 | -0.018 | 0.129 | 0.052 | -0.061 | 0.069 | 0.090 | 0.113 | -0.046 | 0.068 | 0.018 | 0.119 | Q21.5 |
| My institution provides a platform for self-service support to rectify issues with technical and resource support | 0.832 | -0.080 | 0.021 | 0.069 | 0.136 | 0.099 | -0.007 | -0.026 | 0.033 | -0.054 | 0.044 | -0.035 | 0.047 | Q21.6 |
| I am more effective in my practices by integrating web based content, e-books, lecture recordings, social media, simulations and online collaboration tools into my courses. | 0.083 | 0.698 | 0.041 | -0.061 | -0.054 | -0.123 | -0.084 | -0.052 | 0.005 | -0.022 | 0.133 | 0.063 | -0.125 | Q22.1 |
| My institution provides for an LMS (Learning management system) to ensure organisation, course structure and delivery of course material for optimum teaching with technology. | 0.067 | 0.526 | -0.191 | 0.146 | -0.117 | 0.246 | 0.053 | -0.390 | -0.101 | 0.014 | -0.020 | 0.042 | 0.029 | Q22.2 |
| Teaching with technology has enabled communication with my students via live chat, video/webcam interactions and virtual classrooms, thus having a positive influence on student engagement and course completion. | 0.040 | 0.716 | -0.134 | 0.030 | -0.042 | -0.099 | 0.217 | 0.058 | 0.105 | -0.066 | -0.011 | -0.186 | -0.170 | Q22.3 |
| Teaching with technology enables me to monitor academic behaviour, course attendance, and performance of my students. | -0.022 | 0.697 | -0.139 | 0.103 | 0.112 | 0.063 | -0.095 | 0.140 | -0.068 | 0.029 | 0.047 | -0.165 | -0.272 | Q22.4 |
| I provide academic assistance to my students through remote tuition sessions, thus ensuring resolution of key learning queries. | -0.033 | 0.717 | 0.009 | 0.160 | 0.057 | 0.007 | 0.019 | -0.025 | 0.159 | -0.002 | -0.237 | 0.057 | 0.103 | Q22.5 |
| I use my online space for professional learning by engaging with colleagues and exchanging professional knowledge. | 0.038 | 0.636 | 0.157 | 0.300 | -0.022 | -0.079 | 0.078 | 0.079 | -0.123 | 0.220 | -0.110 | 0.159 | 0.151 | Q23.1 |
| My colleagues and I assist each other in recognising changing fields and organising the mix of learning technologies in support of learning thus ensuring the promotion and sharing of good teaching practices. | 0.111 | 0.585 | 0.176 | 0.480 | -0.067 | -0.087 | 0.101 | 0.148 | -0.152 | 0.161 | 0.002 | 0.043 | 0.137 | Q23.2 |
| Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. | | | | | | | | | | | | | | |
| a. Rotation converged in 12 iterations. | | | | | | | | | | | | | | |

With reference to Table 5.6 above:

The principle component analysis was used as the extraction method and the rotation method was Varimax with Kaiser Normalization. This is an orthogonal rotation method that minimizes the number of variables that have high loadings on each factor. It simplifies the interpretation of the factors.

Factor analysis/loading shows inter-correlations between variables. Items of questions that loaded similarly imply measurement along a similar factor. An examination of the content of items loading at or above 0.5 (and using the higher or highest loading in instances where items cross-loaded at greater than this value) effectively measured along the various components. Within the section, the splits are colour coded.

The statements that constituted Questions 4 (general teaching challenges), 14 (lack of access to technology), 15 (challenges relating to poor infrastructure), 16 (challenges integrating technology into teaching practices), 17(use of technology entails more work), 21 (resources and technical support for e-learning), 22 (effective teaching practices with instructional technology) and 23 (professional development through community chat groups) loaded perfectly along a single component. This implies that the statements that constituted these sections perfectly measured what they set out to measure.

It is noted that the variables that constituted Questions 2 (importance of specific teaching practices), 3 (specific concepts for teaching and learning), 11 (rigid teaching practices) and 20 (best practices in staff development) loaded along 2 components (sub-themes) and Question 13 (lack of skills/knowledge/engagement in the use of technology) loaded along 4 components. This means that respondents identified different trends within the section.

However, it is also noted that there is an overlapping amongst the statements, which means that statements from different questions loaded along the same themes. This is mainly due to the interpretation of the statements by the respondents.

### 5.6.2 Cross-tabulations

In reporting a result, the traditional approach requires a statement of significance. A Chi square test was performed to determine whether there was a statistically significant relationship between the variables (rows versus columns). The null hypothesis states that there is no association between the two. The alternate hypothesis indicates that there is an association. All p-values more than 0.05 indicate that there is no significant relationship.

#### 5.6.2.1 HEIs are expected to increase throughput with limited resources while catering for large classes and *Faculty

This section focusses on the cross-tabulation between “HEIs are expected to increase throughput with limited resources while catering for large classes” and the “Faculty” of the respondent**.** Table 5.7 below summarises the results of the Chi square test.

**Table 5.7: HEIs are expected to increase throughput with limited resources while catering for large classes and *Faculty**

| | | | FACULTY | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Management Sciences | Art and Design | Engineering and the Built Environment | Health Sciences | Accounting and Informatics | Applied Sciences | Total |
| HEIs are expected to increase throughput with limited resources while catering for large classes. | Neutral | Count | 1 | 1 | 5 | 1 | 1 | 0 | 9 |
| | | %age within faculty | 2.9% | 4.8% | 15.2% | 6.7% | 5.3% | 0.0% | 5.6% |
| | Agree | Count | 4 | 4 | 15 | 7 | 5 | 14 | 49 |
| | | %age within faculty | 11.4% | 19.0% | 45.5% | 46.7% | 26.3% | 36.8% | 30.4% |
| | Strongly Agree | Count | 30 | 16 | 13 | 7 | 13 | 24 | 103 |
| | | %age within faculty | 85.7% | 76.2% | 39.4% | 46.7% | 68.4% | 63.2% | 64.0% |
| | | TOTAL | 35 | 21 | 33 | 15 | 19 | 38 | 161 |
| | | | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% |
| | | Value | | df | Significance (2-sided) | | | | |
| Pearson Chi-square | | 24.418 | | 10 | 0.007 | | | | |

The results show that all other faculties scored a higher level of agreement, compared to the faculties of Engineering and the Built Environment and Health

Sciences. The p-value between **HEIs are expected to increase throughput with limited resources while catering for large classes** and **Faculty** is 0.007. This means that there is a significant relationship between the variables, i.e. the faculty of the respondent did play a significant role in terms of how respondents viewed how HEIs are expected to increase throughput with limited resources while catering for large classes.

#### 5.6.2.2 Technical errors, slowness in systems and bugs hinder my e-learning processes and *Faculty

The results of the cross-tabulation between "Technical errors, slowness in systems and bugs hinder my e-learning processes" and "Faculty" indicated in Table 5.8 below show that the faculties of Engineering and the Built Environment and Accounting and Informatics scored much higher levels of agreement as compared to the other faculties.

**Table 5.8: Technical errors, slowness in systems and bugs hinder my e-learning processes and *Faculty**

| | | | FACULTY | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Man-agement Sciences | Art and Design | Engineering and the Built Environment | Health Sciences | Accounting and Informatics | Applied Sciences | Total |
| Technical errors, slowness in systems and bugs hinder my e-learning processes. | Strongly Disagree | Count | 1 | 2 | 1 | 0 | 0 | 3 | 7 |
| | | % within faculty | 2,9% | 9,5% | 3,0% | 0,0% | 0,0% | 7,9% | 4,3% |
| | Disagree | Count | 5 | 1 | 1 | 6 | 1 | 7 | 21 |
| | | % within faculty | 14,3% | 4,8% | 3,0% | 40,0% | 5,3% | 18,4% | 13,0% |
| | Neutral | Count | 4 | 3 | 0 | 3 | 0 | 3 | 13 |
| | | % within faculty | 11,4% | 14,3% | 0,0% | 20,0% | 0,0% | 7,9% | 8,1% |
| | Agree | Count | 11 | 11 | 15 | 5 | 10 | 14 | 66 |
| | | %age within faculty | 31,4% | 52,4% | 45,5% | 33,3% | 52,6% | 36,8% | 41,0% |
| | Strongly Agree | Count | 14 | 4 | 16 | 1 | 8 | 11 | 54 |
| | | %age within faculty | 40,0% | 19,0% | 48,5% | 6,7% | 42,1% | 28,9% | 33,5% |
| | | TOTAL | 35 | 21 | 33 | 15 | 19 | 38 | 161 |
| | | | 100,0% | 100,0% | 100,0% | 100,0% | 100,0% | 100,0% | 100,0% |
| | | Value | | df | Significance (2 sided) | | | | |
| Pearson chi-square | | 36.719 | | 20 | 0.013 | | | | |

The p-value is 0.013. This indicates a significant relationship between the variables i.e. the faculty of the respondent influenced how technical errors, slowness in systems and bugs hinder e-learning processes.

### 5.6.2.3 Workshops and seminars enable my academic development by ensuring that I am engaged and supported in technology-enhanced practices and *Faculty

The section below indicates the cross-tabulation between “Workshops and seminars enable my academic development by ensuring that I am engaged and supported in technology-enhanced practices” and “Faculty”. The results indicate that the Faculty of Accounting and Informatics scored much higher levels of agreement as compared to the other faculties.

**Table 5.9: Workshops and seminars enable my academic development by ensuring that I am engaged and supported in technology-enhanced practices and *Faculty**

| | | | FACULTY | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Man-agement Sciences | Art and Design | Engineering and the Built Environment | Health Sciences | Accounting and Informatics | Applied Sciences | Total |
| Workshops and seminars enable my academic development by ensuring that I'm engaged and supported in technology-enhanced practices | Strongly Disagree | Count | 3 | 1 | 0 | 0 | 0 | 3 | 7 |
| | | % within Faculty | 8,6% | 4,8% | 0,0% | 0,0% | 0,0% | 7,9% | 4,3% |
| | Disagree | Count | 5 | 3 | 8 | 0 | 3 | 3 | 22 |
| | | % within Faculty | 14,3% | 14,3% | 24,2% | 0,0% | 15,8% | 7,9% | 13,7% |
| | Neutral | Count | 4 | 7 | 1 | 5 | 5 | 8 | 30 |
| | | % within Faculty | 11,4% | 33,3% | 3,0% | 33,3% | 26,3% | 21,1% | 18,6% |
| | Agree | Count | 18 | 9 | 23 | 8 | 6 | 20 | 84 |
| | | % within Faculty | 51,4% | 42,9% | 69,7% | 53,3% | 31,6% | 52,6% | 52,2% |
| | Strongly Agree | Count | 5 | 1 | 1 | 2 | 5 | 4 | 18 |
| | | % within Faculty | 14,3% | 4,8% | 3,0% | 13,3% | 26,3% | 10,5% | 11,2% |
| | | TOTAL | 35 | 21 | 33 | 15 | 19 | 38 | 161 |
| | | | 100,0% | 100,0% | 100,0% | 100,0% | 100,0% | 100,0% | 100,0% |
| | | Value | | df | Significance (2 sided) | | | | |
| Pearson chi-square | | 32.247 | | 20 | 0.041 | | | | |

The p-value is 0.041, which indicates that a significant relationship exists between “workshops and seminars enable my academic development by ensuring that I am engaged and supported in technology-enhanced practices” and “Faculty”. This means that the faculty of the respondent played a significant role in how they viewed workshops and seminars as enabling academic development by ensuring that they are engaged and supported in technology-enhanced practices.

#### 5.6.2.4 My institution provides reliable and consistently available resources to innovate my teaching practices and *Faculty

The results of the cross-tabulation between “My institution provides reliable and consistently available resources to innovate my teaching practices” and “Faculty” are indicated in Table 5.10 below. The faculties of Management Sciences and Accounting and Informatics scored much higher levels of agreement as compared to the other faculties.

**Table 5.10: My institution provides reliable and consistently available resources to innovate my teaching practices and *Faculty**

| | | | **FACULTY** | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Man-agement Sciences | Art and Design | Engineering and the Built Environment | Health Sciences | Accounting and Informatics | Applied Sciences | Total |
| My institution provides reliable and consistently available resources to innovate my teaching practices | Strongly Disagree | Count | 3 | 0 | 4 | 1 | 0 | 3 | 11 |
| | | % within Faculty | 8,6% | 0,0% | 12,1% | 6,7% | 0,0% | 7,9% | 6,8% |
| | Disagree | Count | 5 | 7 | 7 | 0 | 2 | 10 | 31 |
| | | % within Faculty | 14,3% | 33,3% | 21,2% | 0,0% | 10,5% | 26,3% | 19,3% |
| | Neutral | Count | 5 | 3 | 1 | 7 | 2 | 4 | 22 |
| | | % within Faculty | 14,3% | 14,3% | 3,0% | 46,7% | 10,5% | 10,5% | 13,7% |
| | Agree | Count | 9 | 6 | 12 | 7 | 9 | 13 | 56 |
| | | % within Faculty | 25,7% | 28,6% | 36,4% | 46,7% | 47,4% | 34,2% | 34,8% |
| | Strongly Agree | Count | 13 | 5 | 9 | 0 | 6 | 8 | 41 |
| | | % within Faculty | 37,1% | 23,8% | 27,3% | 0,0% | 31,6% | 21,1% | 25,5% |
| | | TOTAL | 35 | 21 | 33 | 15 | 19 | 38 | 161 |
| | | | 100,0% | 100,0% | 100,0% | 100,0% | 100,0% | 100,0% | 100,0% |
| | | value | | df | Significance (2 sided) | | | | |
| Pearson chi-square | | 35.606 | | 20 | 0.017 | | | | |

The p-value between “my institution provides reliable and consistently available resources to innovate my teaching practices and Faculty” is 0.017. This indicates a significant relationship between the variables. Moreover, it indicates further that the faculty of the respondent played a significant role in how respondents viewed the institution’s provision of reliable and consistently available resources to innovate teaching practices.

#### 5.6.2.5 My institution provides a platform for self-service support to rectify issues with technical and resource support and *Faculty

Table 5.11 below indicates the results of the cross-tabulation between “My institution provides a platform for self-service support to rectify issues with technical and resource support” and “Faculty”. The results indicated that the Faculty of Management Sciences scored much higher levels of agreement as compared to the other faculties.

**Table 5.11: My institution provides a platform for self-service support to rectify issues with technical and resource support and *Faculty**

| | | | FACULTY | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| My institution provides a platform for self-service support to rectify issues with technical and resource support | | | Man-agement Sciences | Art and Design | Engineering and the Built Environment | Health Sciences | Accounting and Informatics | Applied Sciences | Total |
| | Strongly Disagree | Count | 3 | 0 | 3 | 0 | 0 | 1 | 7 |
| | | % within Faculty | 8,6% | 0,0% | 9,1% | 0,0% | 0,0% | 2,6% | 4,3% |
| | Disagree | Count | 8 | 4 | 5 | 2 | 2 | 7 | 28 |
| | | % within Faculty | 22,9% | 19,0% | 15,2% | 13,3% | 10,5% | 18,4% | 17,4% |
| | Neutral | Count | 3 | 7 | 1 | 5 | 2 | 11 | 29 |
| | | % within Faculty | 8,6% | 33,3% | 3,0% | 33,3% | 10,5% | 28,9% | 18,0% |
| | Agree | Count | 8 | 6 | 16 | 7 | 11 | 11 | 59 |
| | | % within Faculty | 22,9% | 28,6% | 48,5% | 46,7% | 57,9% | 28,9% | 36,6% |
| | Strongly Agree | Count | 13 | 4 | 8 | 1 | 4 | 8 | 38 |
| | | % within Faculty | 37,1% | 19,0% | 24,2% | 6,7% | 21,1% | 21,1% | 23,6% |
| | | TOTAL | 35 | 21 | 33 | 15 | 19 | 38 | 161 |
| | | | 100,0% | 100,0% | 100,0% | 100,0% | 100,0% | 100,0% | 100,0% |
| | | Value | | df | Significance (2 sided) | | | | |
| Pearson chi-square | | 32.558 | | 20 | 0.038 | | | | |

The p-value is 0.038, which indicates a significant relationship between “My institution provides a platform for self-service support to rectify issues with technical and resource support” and “Faculty”. This reflects that the faculty of the respondent played a significant role in how the respondent viewed the institution’s provision of a platform for self-service support to rectify issues with technical and resource support.

Hence, from the analysis of results, the following statistically significant relationships (p-value < 0.05) were found:

- HEIs are expected to increase throughput with limited resources while catering for large classes and *Faculty (p-value = 0.007);
- Technical errors, slowness in systems and bugs hinder e-learning processes and *Faculty (p-value = 0.013);
- Workshops and seminars enable my academic development by ensuring that I’m engaged and supported in technology-enhanced practices and *Faculty (p-value = 0.041);
- My institution provides reliable and consistently available resources to innovate my teaching practices and *Faculty (p-value = 0.017);
- My institution provides a platform for self-service support to rectify issues with technical and resource support and *Faculty (p-value = 0.038).

**5.6.3 Correlation Analysis**

A Bivariate correlation was also performed on the (ordinal) data. The results are found in Appendix A. Positive values indicated a directly proportional relationship between the variables and a negative value indicated an inverse relationship. All significant relationships were indicated by a * or **.

**5.6.3.1 Significant correlations**

The selected significant correlations are set out below.
The directly proportional relationships between statements that were considered significant for the study are analysed and is indicated below

according to the sub-themes indicated:

- The correlation value between “Delivering curricula via technology is inhibited due to the reluctance of lecturers to invest the additional effort” and “Academics are less eager to adopt e-learning to support their teaching as they find it difficult to adapt to change” is 0.547. This is a directly proportional relationship. The respondents indicate that the more academics find it difficult to adapt to change and accept e-learning, the more reluctant they will be to invest additional effort into e-learning.
- The correlation value between “My institution provides for a supportive institutional culture taking into account the integration between available technologies with existing pedagogic systems and practices” and “My institution provides for proper resources and technical support, guiding and supporting me in the implementation of e-learning” is 0.835. This is a directly related proportionality. Respondents indicate that the more the institution provides for proper resources and technical support in e-learning, the higher the level of a supportive institutional culture for integrating technologies and pedagogy.
- The correlation value between “My colleagues and I assist each other in recognising changing fields and organising the mix of learning technologies in support of learning, thus ensuring the promotion and sharing of good teaching practices” and “I use my online space for professional learning by engaging with colleagues and exchanging professional knowledge” is 0.723. This is a directly proportional relationship. The respondents indicate that the more they engage with their colleagues and exchange professional knowledge, the more they promote and share good teaching practices.
- The correlation value between “My institution provides a platform for self-service support to rectify issues with technical and resource support” and “My institution provides reliable and consistently available resources to innovate my teaching practices” is 0.765. This is a directly

proportional relationship. The respondents indicate that the higher the provision of reliable and consistently available resources by the institution, the greater the ability of staff to rectify technical and resource issues on their own.

- The correlation value between “My institution informs me on technologies which exist and how such technologies can provide for a high-quality learning experience for my students” and “My institution provides for a supportive institutional culture taking into account the integration between available technologies with existing pedagogic systems and practices” is 0.782. This is a directly related proportionality. The respondents indicate that the higher the level of institutional support on integrating technologies with existing pedagogical systems, the more the support for academics to provide a high-quality learning experience.
- The correlation value between “My institution provides reliable and consistently available resources to innovate my teaching practices” and “My institution provides proper resources and technical support, guiding and supporting me in the implementation of e-learning” is 0.771. This is a directly proportional relationship. The respondents indicate that the more the institution provides proper resources and technical support, the more innovative their teaching practices will be.
- The correlation value between “My institution provides reliable and consistently available resources to innovate my teaching practices” and “My institution provides a supportive institutional culture taking into account the integration between available technologies with existing pedagogic systems and practices” is 0.874. This is a directly related proportionality. The respondents indicated that the more the institution supports the integration of available technologies with existing pedagogic systems and practices, the more innovative their teaching practices will be.

- The correlation value between “My institution informs me of technologies which exist and how such technologies can provide for a high-quality learning experience for my students” and “My institution provides proper resources and technical support, guiding and supporting me in the implementation of e-learning” is 0.738. This is a directly proportional relationship. The respondents indicate that the more the institution provides resources and technical support for the implementation of e-learning, the greater the ability for academics to provide a high-quality learning experience for their students.

- The correlation value between “My development is encouraged by peer observation of innovative teaching practices” and “My colleagues share their e-learning experiences, thus encouraging me and providing a basic support mechanism” is 0.680. This is a directly related proportionality. The respondents indicate that the more colleagues share their e-learning experiences and provide a basic support mechanism, the more the development of innovative teaching practices through peer observation.

**5.6.3.2 Negative correlations**

Negative values imply an inverse relationship, i.e. the variables have an opposite effect on each other. As the value of one variable increases, the value of the other decreases. The analysis of statements significant to the study revealed the following inverse relationships:

- The correlation value between “HEIs are expected to increase throughput with limited resources while catering for large classes” and “My institution provides adequate time and support for my developmental activities to innovate my teaching practices with technology” is -0.216. That is, the more finances are allocated to developmental efforts, the less the need to focus on increasing throughput (The assumption is that successful development would automatically increase throughput).

- The correlation value between “My institution provides adequate time and support for my developmental activities to innovate my teaching practices with technology” and “There is a lack of technical support in my institution” is -0.361. This illustrates that the higher the level of support for lecturers’ developmental activities to innovate teaching practice with technology, the less likely it is to find a lack of technical support.
- The correlation value between “My institution provides adequate time and support for my developmental activities to innovate my teaching practices with technology” and “There is insufficient investments in equipment, infrastructure and resources” is -0.371. This shows that the higher the level of support for lecturers’ developmental activities to innovate teaching practice with technology, the less likely it is to find insufficient investments in equipment, infrastructure and resources.
- The correlation value between “My institution consults with me on the technologies I require, thus providing reliable and consistently available resources” and “Lecturers have outdated desktop computers and laptops which prove challenging when engaging in innovative methods of teaching” is -0.215. This shows that the higher the level of consultation with staff on the technologies required, the less likely it is for them to have outdated computers and laptops which prove challenging when engaging in innovative teaching methods.
- The correlation value between “My institution provides for an LMS (Learning management system) to ensure the organisation, course structure and delivery of course material for optimum teaching with technology” and “There is a lack of technical support in my institution” is -0.261. This indicates that with better provision in terms of an LMS, the less likely it is to have a lack of technical support by the institution.

### 5.6.4 Chi-square tests

Chi-square tests are conducted to "examine the association between two categorical variables", i.e. to show the relationships, differences and associations in the scoring patterns of responses (Waller 2012: 2). The chi-square test therefore determined whether the scoring patterns per statement were significantly different per option. While, the null hypothesis claims that similar numbers of respondents scored across each option for each statement (one statement at a time), the alternate hypothesis states that there is a significant difference between how they responded. The sig. values or p-values (as reflected in the tables below) indicate the level of significance. P-values less than 0.05 indicate distributions that are not similar, therefore illustrating that the way respondents scored is significant.

Specific sections are analysed within the themes of teaching practices, general teaching challenges, challenges of teaching with technology and best-practices.

#### 5.6.4.1 The level of importance of specific teaching practices

This section is analysed based on how respondents viewed the importance of specific teaching practices in their classrooms. The scoring patterns are shown in Table 5.12 below. The p-values for all statements are less than 0.05 (the level of significance), thus implying distributions that were not similar. This indicates that the differences between the way respondents scored (Not important, Slightly important, Moderately important, Important and Very important) were significant.

### Table 5.12: The level of importance of specific teaching practices

| | | Not Important | | Slightly Important | | Moderately Important | | Important | | Very important | | Chi Square |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Count | Row N % | Count | Row N % | Count | Row N % | Count | Row N % | Count | Row N % | p-value |
| 2.1 | Teaching practices that develop critical thinking skills. | 0 | 0.0% | 0 | 0.0% | 2 | 1.2% | 27 | 16.8 % | 132 | 82.0 % | < 0.001 |
| 2.2 | Stimulate valuable classroom interaction. | 0 | 0.0% | 3 | 1.9% | 6 | 3.7% | 54 | 33.5 % | 98 | 60.9 % | < 0.001 |
| 2.3 | Encouraging learning through students' own efforts. | 1 | 0.6% | 0 | 0.0% | 1 | 0.6% | 44 | 27.3 % | 115 | 71.4 % | < 0.001 |
| 2.4 | Use of tutor manuals. | 3 | 1.9% | 14 | 8.7% | 31 | 19.3 % | 63 | 39.1 % | 50 | 31.1 % | < 0.001 |
| 2.5 | Use of resource books. | 1 | 0.6% | 6 | 3.7% | 18 | 11.2 % | 70 | 43.5 % | 66 | 41.0 % | < 0.001 |

### 5.6.4.2 The level of Importance of specific concepts for teaching and learning

This section is analysed based on how respondents viewed the importance of specific concepts for teaching and learning. The scoring patterns shown in Table 5.13 below indicate p-values less than 0.05, thus indicating that distributions were not similar. The differences between the way respondents scored (Not important, Slightly important, Moderately important, Important and Very important) were thus significant.

### Table 5.13: Level of Importance of specific concepts for teaching and learning

| | | Not Important | | Slightly Important | | Moderately Important | | Important | | Very important | | Chi Square |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Count | Row N % | Count | Row N % | Count | Row N % | Count | Row N % | Count | Row N % | p-value |
| 3.1 | Transmission of information. | 0 | 0,0% | 6 | 3,7% | 13 | 8,1% | 56 | 34,8% | 86 | 53,4% | < 0.001 |
| 3.2 | Developing skills and attitudes of students. | 0 | 0,0% | 1 | 0,6% | 5 | 3,1% | 31 | 19,3% | 124 | 77,0% | < 0.001 |
| 3.3 | Promoting the development of the students' own conceptual understanding. | 1 | 0,6% | 0 | 0,0% | 3 | 1,9% | 17 | 10,6% | 140 | 87,0% | < 0.001 |

### 5.6.4.3 General teaching challenges

This section analyses how the respondents rated general teaching challenges. The scoring patterns in Table 5.14 below indicate p-values of less than 0.05 for all statements, thus implying distributions that were not similar. Hence the ways in which respondents scored (Not important, Slightly important, Moderately important, Important and Very important) were significant.

**Table 5.14: General teaching challenges**

| | | Strongly Disagree | | Disagree | | Neutral | | Agree | | Strongly Agree | | Chi Square |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Count | Row N % | Count | Row N % | Count | Row N % | Count | Row N % | Count | Row N % | p-value |
| 4.1 | South African teaching systems are authoritarian and stifles the development of students. | 4 | 2,5 % | 30 | 18,6% | 47 | 29,2% | 61 | 37,9% | 19 | 11,8 % | < 0.001 |
| 4.2 | HEIs are expected to increase throughput with limited resources while catering for large classes. | 0 | 0,0 % | 0 | 0,0 % | 9 | 5,6 % | 49 | 30,4% | 103 | 64,0 % | < 0.001 |
| 4.3 | Teaching at HEIs is difficult as there is a diverse population informed by multilingualism and varied levels of preparedness. | 2 | 1,2 % | 16 | 9,9 % | 16 | 9,9 % | 68 | 42,2% | 59 | 36,6 % | < 0.001 |
| 4.4 | Graduates of secondary education lack capabilities as required at university level. | 1 | 0,6 % | 8 | 5,0 % | 13 | 8,1 % | 60 | 37,3% | 79 | 49,1 % | < 0.001 |

### 5.6.4.4 Rigid teaching practices

This section analyses how respondents scored rigid practices. Each statement indicates a p-value of 0.001. As the significant p-values are less than 0.05 for all statements, indications are that the differences between the way respondents scored (Strongly disagree, Disagree, Neutral, Agree, Strongly agree) were significant.

**Table 5.15: Rigid teaching practices**

| | | Strongly Disagree | | Disagree | | Neutral | | Agree | | Strongly Agree | | Chi Square |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Count | Row N % | Count | Row N % | Count | Row N % | Count | Row N % | Count | Row N % | p-value |
| 11.1 | Academics are less eager to adopt e-learning to support their teaching as they find it difficult to adapt to change. | 17 | 10,6% | 36 | 22,4% | 14 | 8,7% | 81 | 50,3% | 13 | 8,1% | < 0.001 |
| 11.2 | Academics need to be convinced that the technology enhanced method, which is different from their traditional approach, is more feasible for their students, before they actually are willing to adopt any such method. | 10 | 6,2% | 26 | 16,1% | 20 | 12,4% | 78 | 48,4% | 27 | 16,8% | < 0.001 |
| 11.3 | Although technology is beneficial for communicating to learners, lecturers are concerned about losing the face-to-face interaction with students. | 7 | 4,3% | 24 | 14,9% | 17 | 10,6% | 75 | 46,6% | 38 | 23,6% | < 0.001 |
| 11.4 | Delivering curricula via technology is inhibited due to the reluctance of lecturers to invest the additional effort. | 11 | 6,8% | 42 | 26,1% | 26 | 16,1% | 65 | 40,4% | 17 | 10,6% | < 0.001 |
| 11.5 | Teaching practices are highly influenced by lecturers' pedagogical beliefs and their tried and tested methods of course delivery. | 3 | 1,9% | 14 | 8,7% | 10 | 6,2% | 88 | 54,7% | 46 | 28,6% | < 0.001 |

### 5.6.4.5 Lack of skills/knowledge/engagement in the use of technology

This section analyses how the respondents rated the lack of skills/knowledge/engagement in the use of technology. The scoring patterns indicated in Table 5.16 below reveals p-values of less than 0.05 for all statements thus implying distributions that were not similar, and the ways in which respondents scored (Strongly disagree, Disagree, Neutral, Agree, Strongly agree) were significant.

**Table 5.16: Lack of skills/knowledge/engagement in the use of technology**

| | | Strongly Disagree | | Disagree | | Neutral | | Agree | | Strongly Agree | | Chi Square |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Count | Row N % | Count | Row N % | Count | Row N % | Count | Row N % | Count | Row N % | p-value |
| 13.1 | Navigation into educational programmes using technology is difficult because I do not have the necessary skills. | 38 | 23,6% | 61 | 37,9% | 20 | 12,4% | 33 | 20,5% | 9 | 5,6% | < 0.001 |
| 13.2 | Improving technological skills and knowledge is a crucial priority to ensure success in teaching with technology. | 2 | 1,2% | 2 | 1,2% | 3 | 1,9% | 72 | 44,7% | 82 | 50,9% | < 0.001 |
| 13.3 | Lecturers who lack technological skills cannot provide appropriate feedback to students. | 4 | 2,5% | 43 | 26,7% | 26 | 16,1% | 63 | 39,1% | 25 | 15,5% | < 0.001 |
| 13.4 | Lecturers who lack technological skills grapple with preparation of course content. | 11 | 6,8% | 40 | 24,8% | 17 | 10,6% | 58 | 36,0% | 35 | 21,7% | < 0.001 |
| 13.5 | Lecturers need to have the appropriate facilitation skills and develop technological skills for effective e-learning delivery. | 3 | 1,9% | 6 | 3,7% | 6 | 3,7% | 82 | 50,9% | 64 | 39,8% | < 0.001 |
| 13.6 | Lecturers may not be resistant to technological application, but are simply confused as to how to implement technology into their formal teaching methods. | 2 | 1,2% | 18 | 11,2% | 29 | 18,0% | 81 | 50,3% | 31 | 19,3% | < 0.001 |

### 5.6.4.6 Lack of access to technology

This section analyses how respondents scored the lack of access to technology. Each statement indicates a p-value of 0.001. As the significant p-values are less than 0.05 for all statements, this indicates that the differences between the ways in which respondents scored (Strongly disagree, Disagree, Neutral, Agree, Strongly agree) were significant.

**Table 5.17: Lack of access to technology**

| | | Strongly Disagree | | Disagree | | Neutral | | Agree | | Strongly Agree | | Chi square |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Count | Row N % | Count | Row N % | Count | Row N % | Count | Row N % | Count | Row N % | p-value |
| 14.1 | There is a lack of technical support in HEIs. | 9 | 5,6% | 33 | 20,5% | 26 | 16,1% | 63 | 39,1% | 30 | 18,6% | < 0.001 |
| 14.2 | There is a lack of technical support in my institution. | 12 | 7,5% | 46 | 28,6% | 25 | 15,5% | 48 | 29,8% | 30 | 18,6% | < 0.001 |
| 14.3 | There is insufficient investments in equipment, infrastructure and resources | 7 | 4,3% | 13 | 8,1% | 17 | 10,6% | 55 | 34,2% | 69 | 42,9% | < 0.001 |
| 14.4 | Lecturers have outdated desktop computers and laptops which prove challenging when engaging in innovative methods of teaching. | 5 | 3,1% | 24 | | 26 | 16,1% | 46 | 28,6% | 60 | 37,3% | < 0.001 |

### 5.6.4.7 Challenges relating to poor infrastructure

This section analyses how the respondents rated challenges relating to poor infrastructure. The scoring patterns indicated in Table 5.18 below indicate p-values of less than 0.05 for both statements, thus implying distributions that were not similar. Moreover, the ways in which respondents scored (Strongly disagree, Disagree, Neutral, Agree, Strongly agree) were significant.

**Table 5.18: Challenges relating to poor infrastructure**

| | | Strongly Disagree | | Disagree | | Neutral | | Agree | | Strongly Agree | | Chi Square |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Count | Row N % | Count | Row N % | Count | Row N % | Count | Row N % | Count | Row N % | p-value |
| 15.1 | There is insufficient access to Wi-Fi and bandwidth to access resources for teaching with technology. | 7 | 4,3% | 23 | 14,3% | 15 | 9,3% | 51 | 31,7% | 65 | 40,4% | < 0.001 |
| 15.2 | Technical errors, slowness in systems and bugs hinder my e-learning processes. | 7 | 4,3% | 21 | 13,0% | 13 | 8,1% | 66 | 41,0% | 54 | 33,5% | < 0.001 |

### 5.6.4.8 Challenges in integrating technology into teaching practices

This section analyses how respondents scored challenges in integrating technology into teaching practices. Both statements indicate a p-value of 0.001. As the significant p-values are less than 0.05 for both statements, indications are that the differences in the ways in which respondents scored (Strongly disagree, Disagree, Neutral, Agree, Strongly agree) were significant.

## Table 5.19: Challenges in integrating technology into teaching practices

| | | Strongly Disagree | | Disagree | | Neutral | | Agree | | Strongly Agree | | Chi Square |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Count | Row N % | Count | Row N % | Count | Row N % | Count | Row N % | Count | Row N % | p-value |
| 16.1 | Upgrades to existing technologies and various new technologies create overwhelming stresses in my teaching practices | 9 | 5,6% | 47 | 29,2% | 29 | 18,0% | 55 | 34,2% | 21 | 13,0% | < 0.001 |
| 16.2 | The inability to combine “content knowledge, pedagogical knowledge and technological knowledge”, which impacts negatively on student needs and learning outcomes | 6 | 3,7% | 43 | 26,7% | 32 | 19,9% | 67 | 41,6% | 13 | 8,1% | < 0.001 |

### 5.6.4.9 Use of technology entails more work

This section analysis is based on how the respondents rated the concept of technology entailing more work. The scoring patterns in Table 5.20 below indicate p-values of less than 0.05 for both statements, thus implying distributions that were not similar. The ways in which respondents scored (Strongly disagree, Disagree, Neutral, Agree, Strongly agree) were significant.

### Table 5.20: Use of technology entails more work

| | | Strongly Disagree | | Disagree | | Neutral | | Agree | | Strongly Agree | | Chi Square |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Count | Row N % | Count | Row N % | Count | Row N % | Count | Row N % | Count | Row N % | p-value |
| 17.1 | Evolving e-learning technologies creates challenges and tension for lecturers, thus making them less receptive and more reluctant to integrate e-pedagogy. | 7 | 4,3% | 40 | 24,8% | 18 | 11,2% | 79 | 49,1% | 17 | 10,6% | < 0.001 |
| 17.2 | The lack of understanding and lack of confidence in new technologies makes lecturers more resistant to engaging in technologically enhanced teaching methods. | 0 | 0,0% | 26 | 16,1% | 11 | 6,8% | 99 | 61,5% | 25 | 15,5% | < 0.001 |

### 5.6.4.10 Best-practices in staff development

This section analyses how respondents scored best-practices in staff development. Each statement indicates a p-value of 0.001. As the significant p-values are less than 0.05 for all statements, this indicates that the differences between the ways respondents scored (Strongly disagree, Disagree, Neutral, Agree, Strongly agree) were significant.

## Table 5.21 Best-practices in staff development

| | | Strongly Disagree | | Disagree | | Neutral | | Agree | | Strongly Agree | | Chi Square |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Count | Row N % | Count | Row N % | Count | Row N % | Count | Row N % | Count | Row N % | p-value |
| 20.1 | I am familiar with Mishra and Koehler's TPACK (Technological Pedagogical Content Knowledge) model. | 53 | 32,9% | 55 | 34,2% | 22 | 13,7% | 20 | 12,4% | 11 | 6,8% | < 0.001 |
| 20.2 | The TPACK model promotes a meaningful integration of technology, content knowledge and pedagogy for my teaching purposes. | 10 | 6,2% | 11 | 6,8% | 111 | 68,9% | 19 | 11,8% | 10 | 6,2% | < 0.001 |
| 20.3 | My institution provides adequate time and support for my developmental activities to innovate my teaching practices with technology. | 21 | 13,0% | 46 | 28,6% | 29 | 18,0% | 59 | 36,6% | 6 | 3,7% | < 0.001 |
| 20.4 | My institution invests in online technologies to build teacher competencies. | 9 | 5,6% | 40 | 24,8% | 34 | 21,1% | 71 | 44,1% | 7 | 4,3% | < 0.001 |
| 20.5 | My colleagues share their e-learning experiences, thus encouraging me and provides a basic support mechanism. | 15 | 9,3% | 38 | 23,6% | 36 | 22,4% | 68 | 42,2% | 4 | 2,5% | < 0.001 |
| 20.6 | My development is encouraged by peer observation of innovative teaching practices. | 14 | 8,7% | 36 | 22,4% | 34 | 21,1% | 69 | 42,9% | 8 | 5,0% | < 0.001 |
| 20.7 | Workshops and seminars enable my academic development by ensuring that I'm engaged and supported in technology-enhanced practices. | 7 | 4,3% | 22 | 13,7% | 30 | 18,6% | 84 | 52,2% | 18 | 11,2% | < 0.001 |

### 5.6.4.11 Resources and technical support

This section analyses how the respondents rated the provision of resources and technical support as a best-practice. The scoring patterns in Table 5.22 below indicate p-values of less than 0.05 for all statements thus implying distributions that were not similar. The ways in which respondents scored (Strongly disagree, Disagree, Neutral, Agree, Strongly agree) were significant.

## Table 5.22 Resources and technical support

| | | Strongly Disagree | | Disagree | | Neutral | | Agree | | Strongly Agree | | Chi Square |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Count | Row N % | Count | Row N % | Count | Row N % | Count | Row N % | Count | Row N % | p-v alue |
| 21.1 | My institution consults with me on technologies I require thus providing for reliable and consistently available resources. | 14 | 8,7 % | 25 | 15,5% | 13 | 8,1% | 72 | 44,7% | 37 | 23,0 % | < 0.001 |
| 21.2 | My institution provides for proper resources and technical support, guiding and supporting me in the implementation of e-learning. | 10 | 6,2 % | 26 | 16,1% | 17 | 10,6% | 67 | 41,6% | 41 | 25,5 % | < 0.001 |
| 21.3 | My institution provides for a supportive institutional culture taking into account integration between available technologies with existing pedagogic systems and practices. | 8 | 5,0 % | 30 | 18,6% | 19 | 11,8% | 68 | 42,2% | 36 | 22,4 % | < 0.001 |
| 21.4 | My institution provides reliable and consistently available resources to innovate my teaching practices. | 11 | 6,8 % | 31 | 19,3% | 22 | 13,7% | 56 | 34,8% | 41 | 25,5 % | < 0.001 |
| 21.5 | My institution informs me on technologies which exist and how such technologies can provide for high quality learning experience for my students. | 8 | 5,0 % | 29 | 18,0% | 16 | 9,9% | 68 | 42,2% | 40 | 24,8 % | < 0.001 |
| 21.6 | My institution provides a platform for self-service support to rectify issues with technical and resource support | 7 | 4,3 % | 28 | 17,4% | 29 | 18,0% | 59 | 36,6% | 38 | 23,6 % | < 0.001 |

### 5.6.4.12 Use of instructional technology

This section analyses how respondents scored the use of instructional technology as a best-practice. Each statement indicates a p-value of 0.001. As the significant p-values are less than 0.05 for all five statements, this indicates that the differences between the ways in which respondents scored (Strongly disagree, Disagree, Neutral, Agree, Strongly agree) were significant.

## Table 5.23 Use of instructional technology

| | | Strongly Disagree | | Disagree | | Neutral | | Agree | | Strongly Agree | | Chi Square |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Count | Row N % | Count | Row N % | Count | Row N % | Count | Row N % | Count | Row N % | p-value |
| 22.1 | I am more effective in my practices by integrating web based content, e-books, lecture recordings, social media, simulations and online collaboration tools into my courses. | 4 | 2,5% | 21 | 13,0% | 33 | 20,5% | 77 | 47,8% | 26 | 16,1% | < 0.001 |
| 22.2 | My institution provides for an LMS (Learning management system) to ensure organisation, course structure and delivery of course material for optimum teaching with technology. | 5 | 3,1% | 8 | 5,0% | 43 | 26,7% | 87 | 54,0% | 18 | 11,2% | < 0.001 |
| 22.3 | Teaching with technology has enabled communication with my students via live chat, video/webcam interactions and virtual classrooms, thus having a positive influence on student engagement and course completion. | 5 | 3,1% | 24 | 14,9% | 51 | 31,7% | 68 | 42,2% | 13 | 8,1% | < 0.001 |
| 22.4 | Teaching with technology enables me to monitor academic behaviour, course attendance, and performance of my students. | 5 | 3,1% | 22 | 13,8% | 49 | 30,6% | 73 | 45,6% | 11 | 6,9% | < 0.001 |
| 22.5 | I provide academic assistance to my students through remote tuition sessions, thus ensuring resolution of key learning queries. | 11 | 6,8% | 43 | 26,7% | 37 | 23,0% | 63 | 39,1% | 7 | 4,3% | < 0.001 |

### 5.6.4.13 Significance of community chat groups

This section analyses how respondents rated the significance of community chat groups as a best-practice. Both statements indicate a p-value of 0.001. As the significant p-values are less than 0.05 for both statements, this indicates that the differences in the ways in which respondents scored (Strongly disagree, Disagree, Neutral, Agree, Strongly agree) were significant.

### Table 5.24 Significance of community chat groups

| | | Strongly Disagree | | Disagree | | Neutral | | Agree | | Strongly Agree | | Chi Square |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Count | Row N % | Count | Row N % | Count | Row N % | Count | Row N % | Count | Row N % | p-value |
| 23.1 | I use my online space for professional learning by engaging with colleagues and exchanging professional knowledge. | 10 | 6,2% | 33 | 20,5 % | 34 | 21,1 % | 70 | 43,5 % | 14 | 8,7% | < 0.001 |
| 23.2 | My colleagues and I assist each other in recognising changing fields and organising the mix of learning technologies in support of learning thus ensuring the promotion and sharing of good teaching practices. | 13 | 8,1% | 42 | 26,1 % | 30 | 18,6 % | 59 | 36,6 % | 17 | 10,6 % | < 0.001 |

## SECTION B – ANALYSIS OF STUDENT DATA

### 5.6.5 The sample and response rate

The sample was inclusive of 330 full-time students from all 6 faculties. There was no distinction between gender and race. The total number of students who responded to the survey was 256. This yielded a 78% response rate. Hardcopy questionnaires were initially randomly handed out to students by the researcher. However, due to the lockdown of the institution resulting from the Covid-19 pandemic, it was impossible to administer hardcopy questionnaires. The researcher resorted to contacting students via WhatsApp and email to administer the questionnaires. However, students found it difficult to access and complete the PDF formatted questionnaire. The researcher had to then administer an online questionnaire and ensure that those who had completed the hardcopy questionnaire were not included in the sample that was chosen to complete the online questionnaire. The results of the online questionnaires, together with the results obtained from the hard-copy questionnaires, were captured onto one comprehensive Excel spreadsheet.

### 5.6.6 The Research Instrument

Twenty questions were designed for the survey instrument. The instrument consisted of 75 items, with a level of measurement at a nominal or an ordinal level. The questionnaire was divided into 20 questions, which measured various themes as illustrated below:

| | |
|---|---|
| 1 | Biographical data<br>➢ Faculty<br>➢ Level |
| 2 | Background information to technology in education<br>➢ Technology in Secondary School<br>➢ Access to electronic devices |
| 3 | E-learning<br>➢ E-learning practices/trends |
| 4 | Challenges experienced with E-learning<br>➢ Distraction to weaker students<br>➢ Difficulty in concentrating on online learning<br>➢ Use of Technology requires more time |

| | |
|---|---|
| | ➢ Interactions between peers, lecturers and learning material<br>➢ Lack of Human contact<br>➢ Lack of access to technology<br>➢ Technological skills challenges<br>➢ Working online<br>➢ Poor quality of e-learning systems<br>➢ Poor effort from lecturers<br>➢ Training/workshops/orientation<br>➢ Technical support |
| 6 | Best practices |

### 5.7 Sectional Analysis

This section analyses the scoring patterns of the respondents per variable per section. The results are first presented using summarised percentages for the variables that constitute each section. Results are then further analysed according to the importance of the statements.

#### 5.7.1 Biographical Data

This section summarises the biographical characteristics of the respondents, i.e. the number of respondents within each faculty who responded to the survey and the level of study.

##### 5.7.1.1 The number of respondents per faculty

Figure 5.19 below illustrates the different faculties and the number of respondents form each faculty.

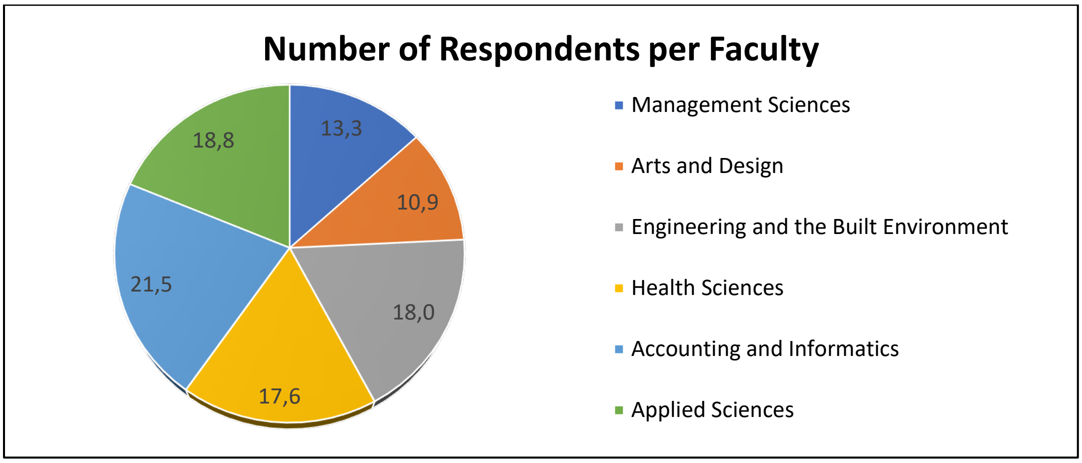


**Figure 5.19: Number of respondents per faculty**

Figure 5.19 indicates that the Faculty of Accounting and Informatics yielded the highest response rate (21,5%), with similar number of responses from the Faculties of Engineering and the Built Environment (18,0%), Health Sciences (17,6%) and Applied Sciences (18,8%). The Faculty of Management Sciences yielded a lower response rate (13,3%), but was higher than that of the Faculty of Arts and Design (10,9%).

#### 5.7.1.2 Level of Study

For the purposes of this research study, only full-time students from study levels 1, 2 and 3 were targeted. Figure 5.20 below indicates the number of respondents from each level of study.

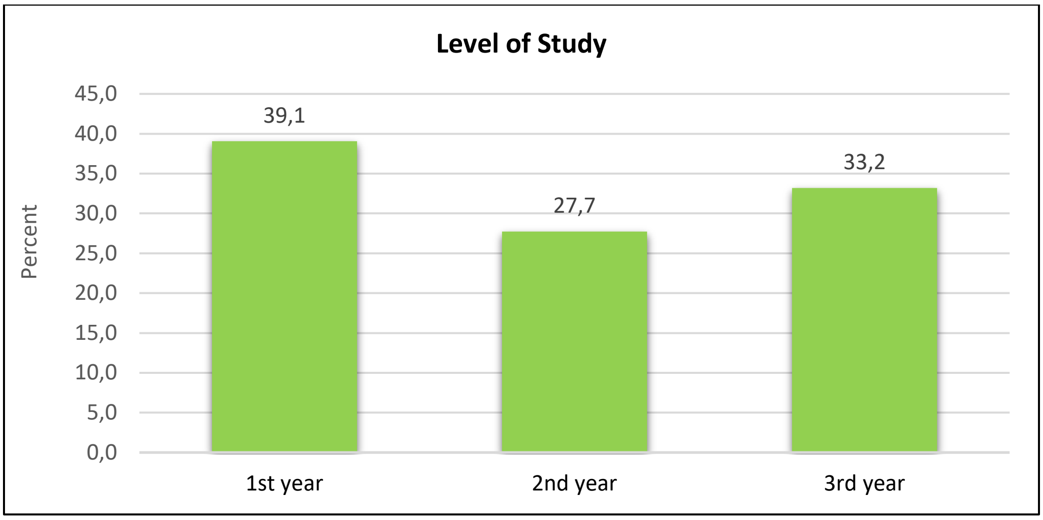


**Figure 5.20: Level of Study**

The number of 1st year students yielded the highest response rate at 39,1%, with 33,2% of respondents from the 3rd level of study. The lowest response rate was from the 2nd level of study at 27,7%.

### 5.7.2. Background information to technology in education

This section focused on the experience students had with technology in education at a secondary school level.

#### 5.7.2.1 Technology in Secondary School

Figure 5.21 indicates the exposure that students had to technology and devices at a secondary school level.

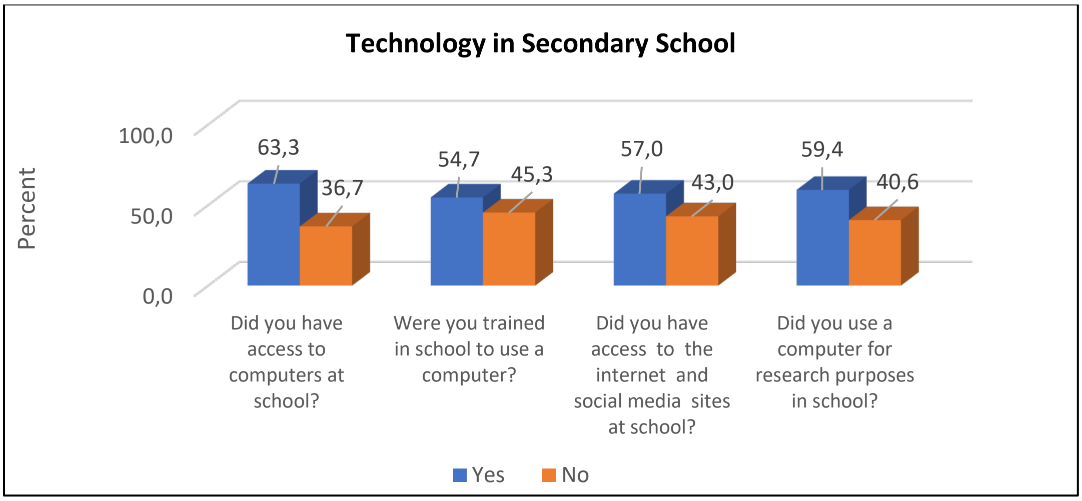


**Figure 5.21: Use of and access to technology in Secondary School**

**Statement 1.1: Whether respondents had access to computers at school**

Figure 6.20 illustrates that 63,3% of respondents had access to computers at secondary school, with a lower percentage of respondents (36,7%) who did not.

**Statement 1.2: Whether respondents were trained to use a computer in school?**

Figure 6.20 indicates that 54,7% of respondents were trained to use a computer at school, with 45,3% who were not.

**Statement 1.3: Whether respondents had access to the internet and social media sites at school**

Figure 6.20 shows that 57,0% of respondents had access to social media and the internet, while 43,0% did not.

**Statement 1.4: Whether respondents used a computer for research purposes in school**

Figure 5.21 illustrates that 59,4% of respondents used a computer in school for research purposes, while 40,6% did not.

Hence, the findings from these results affirm that the majority of respondents had access to computers at school; were trained to use a computer in school; had access to the internet and social media sites at school and had used a computer for research purposes in school.

**Statement 1.5: Additional comments to use of and access to technology in secondary education**

Further to the background information on technology in secondary education, respondents were given the option of providing additional comments on the use of and access to technology in secondary education. The responses were analyzed by the researcher and categorized as per the themes listed below, as graphically represented in Figure 5.22.

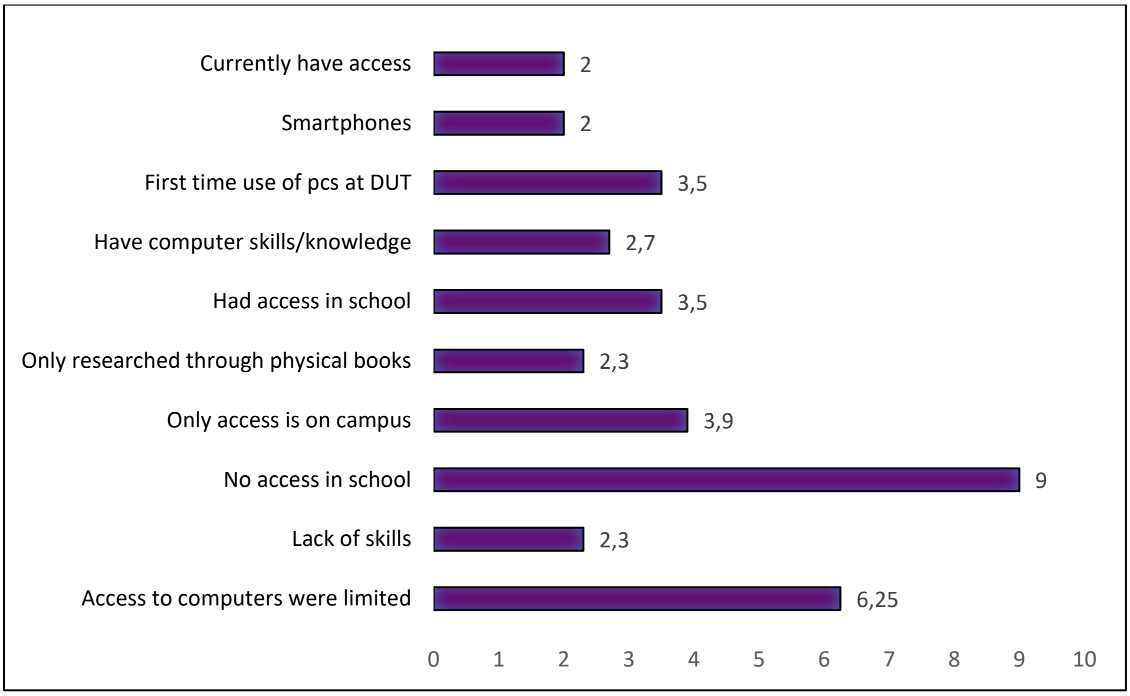


**Figure 5.22: Additional comments on the use of and access to technology in secondary education**

- **Access to computers:** Figure 6.21 illustrates that 9% of respondents indicated that they have had no access to computers in secondary school, with 6,25% experiencing limited access. Only 3,5% of respondents had access to computers at school.
- **Research:** Figure 6.21 shows that 2,3% of respondents engaged in research using physical books only.
- **Technological/Computer Skills:** Figure 6.21 shows that 3,5% of the respondents indicated that their first experience with computers was on campus; 2,7% have computer skills, while 2,3% lack computer skills. A further 2% indicated that they currently only use their smartphones.

### 5.7.2.2 Ownership of Technological Devices

This section focuses on the ownership of electronic/technological devices by the respondents, who were asked to indicate the types of technological devices they owned. The results are shown in Figure 5.23 below.

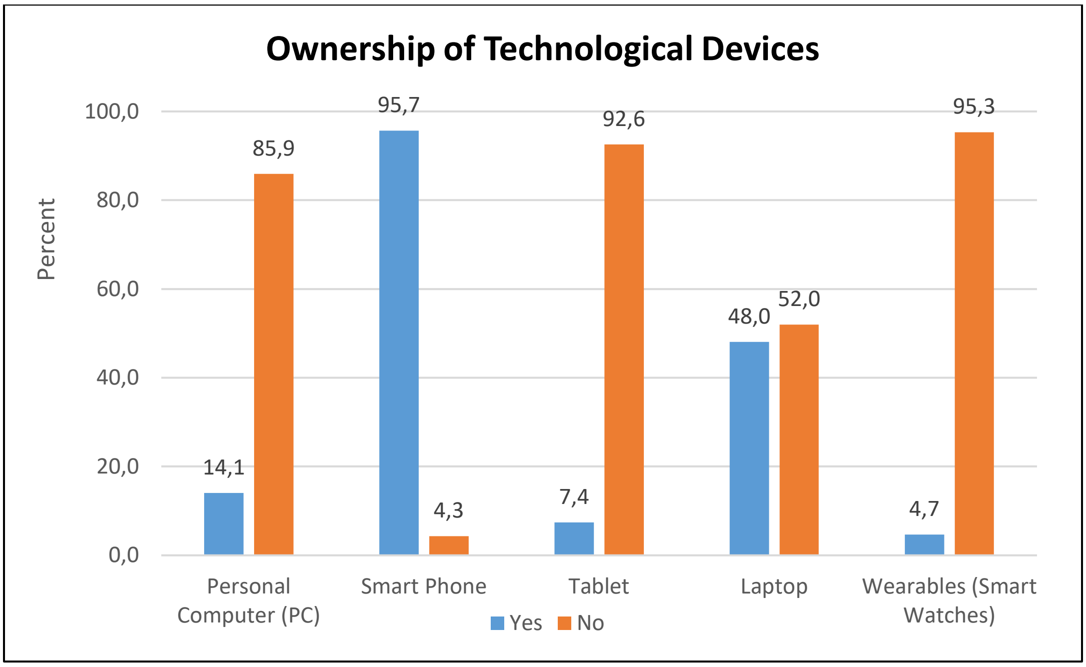


**Figure 5.23: Ownership of Technological Devices**

Figure 5.23 above illustrates that while a majority (95,7%) owned smart phones, only 48% of them owned laptops and a small percentage of respondents (14,1%) owned personal computers. A very low percentage of respondents owned tablets (7,4%) and wearables (4,7%). Hence, the findings show that most of the students have smartphones and about half of them have laptops. Anshari *et al*. (2017: 3073) argue that smartphones enhance education by providing digital materials instead of text books, as well as access to the world-wide-web. Kay and Lauricella (2014: 2) further indicate that over the years, laptops have become more affordable to the point that university students can purchase them.

### 5.7.2.3 Experience with technological devices

This section highlights the experience that the respondents have with technological devices. The respondents were asked to indicate how frequently they were exposed to various types of devices. Figure 6.23 below shows the results.

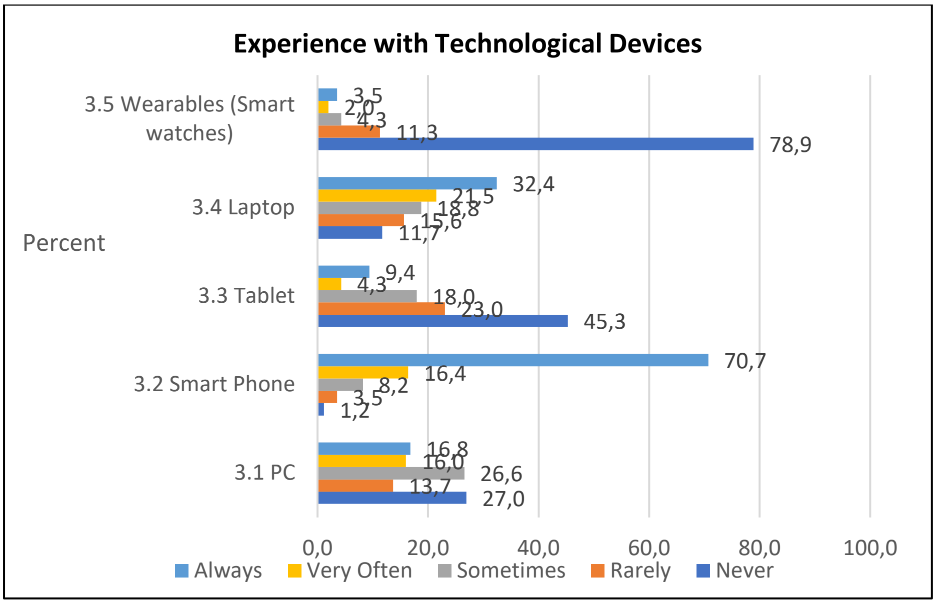


**Figure 5.24: Respondents' experience with technological devices**

From the results presented in Figure 5.24 above, the following patterns are observable:

- Option 3.2 shows a high level for “always”; and
- Options 3.3 and 3.5 show a high level for “never”.

The results indicate that 70,7% indicated “always” for exposure to smartphones and 32,4% had exposure to laptops “always”. In addition, 45,3% have not had exposure to a Tablet (as a device) and 78,9% have never had any exposure to Wearables (such as Smart Watches).

The results presented in Figure 5.24 show the following for the individual sub-themes for the respondents’ experience with technological devices:

- **Q3.1 Personal Computer (PC):** Figure 5.24 illustrates that a small percentage (16,8%) of respondents have always had experience with personal computers; 16,0% very often, 26,6% sometimes, 13,7% rarely and 27,0% never.
- **Q3.2 Smartphone:** Figure 5.24 further indicates that 70,7% of respondents always have exposure to smartphones: 16,4% very often, 8,2% sometimes, 3,5% rarely and 1,2% never.
- **Q3.3 Tablet:** As indicated above in Figure 5.24, only 9,4% of respondents always have access to a tablet, while 4,3% have access very often. Moreover, 18,0% sometimes, 23,0% rarely and 45,3% never.
- **Q3.4 Laptop:** Figure 5.24 shows that 32,4% of respondents always have access to a laptop, with 21,5% having access very often. 18,8% have access sometimes, with 15,6% rarely and 11,7% who have never had access.
- **Q3.5 Wearables (Smart Watches):** Only 3,5% of respondents always have access to wearables as indicated in Figure 5.24. A further 2,0% have access very often with 4,3% having access sometimes;11,3% rarely have access and a majority of 78,9% of respondents never have access.

Based on the results indicated in Figure 5.24, the findings show that the majority of students only have access to smartphones which can be used for e-learning.  Only a limited percentage of students have access to personal computers and laptops. Long (2017: 5) believes that for technology integration in curricula to be deemed rational, access to devices is one the core elements that is required. Computers are a fundamental requirement for effective e-learning courses (Mapuva 2009: 102).

### 5.7.3 E-Learning

This section focuses on e-learning at DUT. E-learning, as defined in the South African Government Gazette (2017: 362), is 'technology-enhanced learning'. It is that which uses information communication technology to access programmes or courses with the use of electronic devices (computers, laptops and other mobile devices). E-learning can take place online, offline, or a combination thereof. E-learning occurs via an LMS (Learning Management System). This section indicates the learning management system and the methods of delivery for e-learning programmes. Before assessing the e-learning challenges experienced by respondents, it is necessary to understand their exposure to the LMS and the different modes of e-learning delivery.

#### 5.7.3.1 Learning Management System (LMS)

The respondents were asked to indicate the type of LMS that they were exposed to. The results are indicated in Figure 5.25.

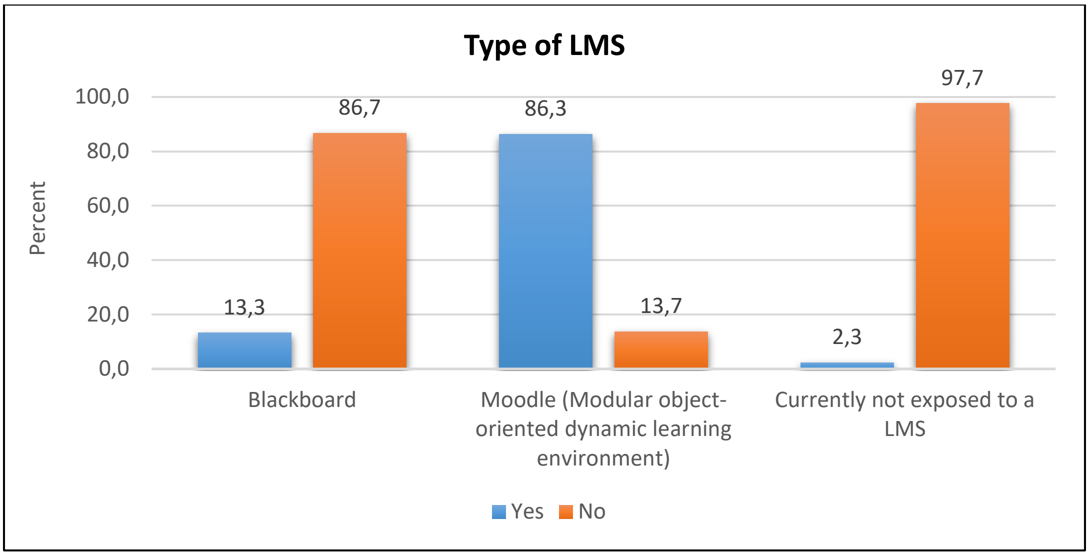


**Figure 5.25: Type of Learning Management System (LMS) that respondents are exposed to**

Figure 5.25 illustrates that 86.3% of the respondents are exposed to and are currently using Moodle, while 13,3% have used Blackboard. Only a minor percentage of respondents (2,3%) have not been exposed to an LMS. Hence, the majority of the respondents are exposed to Moodle.

### 5.7.3.2 Online course delivery Methods

This section focuses on the various online course delivery methods that respondents are exposed to. Online course delivery methods can be asynchronous (interacting with peers/lecturers at different times) or synchronous (interacting with peers/lecturers at the same time).

#### 5.7.3.2.1 Asynchronous methods that respondents are exposed to

The respondents were asked to indicate which of the asynchronous methods they used. Figure 5.26 indicates the results.

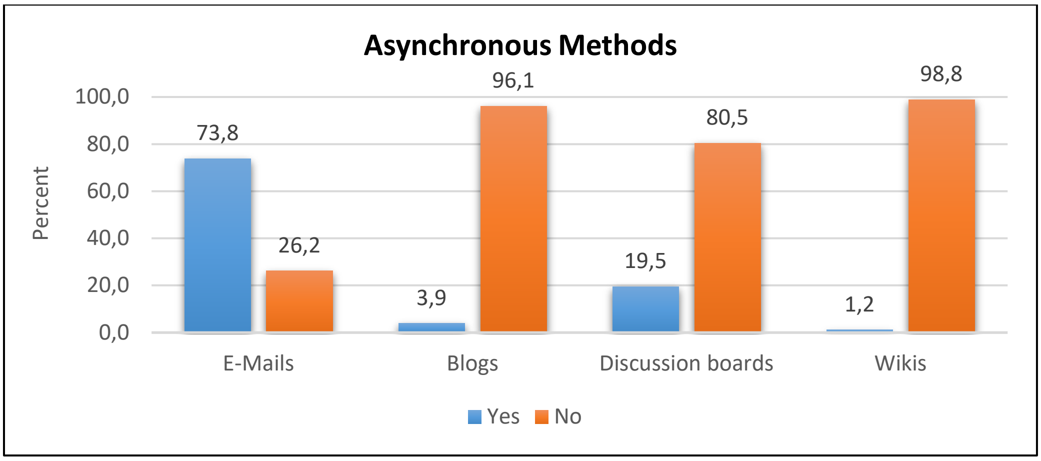


**Figure 5.26: Asynchronous Methods that respondents are exposed to**

Figure 5.26 illustrates that the majority of asynchronous activity occurs in the form of emails (as chosen by 73,8% respondents). A further 19,5% of the respondents use discussion boards, while a few (3,9%) use blogs and 1,2% use wikis. Back *et al.* (2016: 269) argue that emails are the online method most preferred by students for online exchange and teamwork with peers.

### 5.7.3.2.2 Synchronous methods that respondents are exposed to

The respondents were asked to indicate which of the synchronous methods they used. Figure 5.27 below indicates the results.

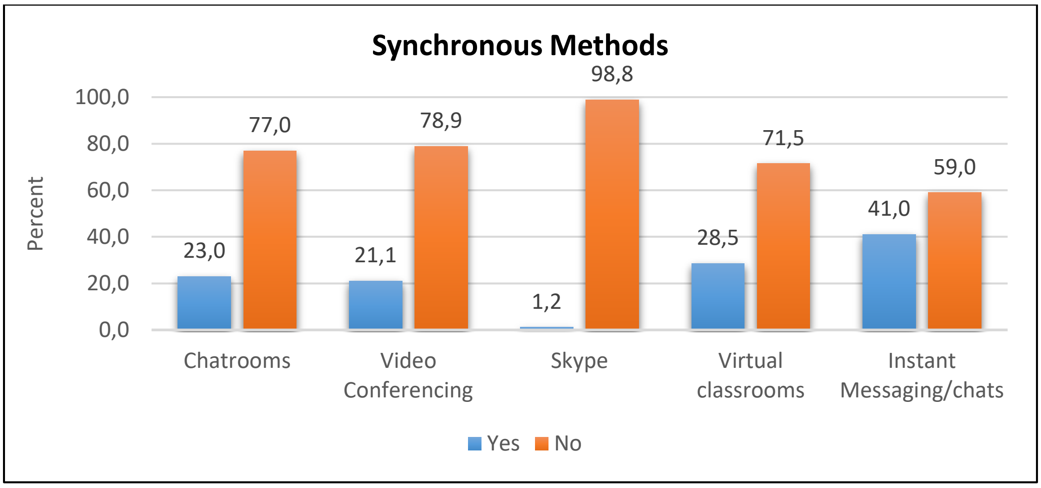


**Figure 5.27: Synchronous Methods**

Figure 5.27 shows that just 23% of respondents were exposed to chatrooms and 21,1% were exposed to video-conferencing. Another 28,5% of respondents were exposed to virtual classrooms and 41,0% engaged in instant messaging and chats. A very small percentage of respondents (1,2%) used Skype. The findings show that only some of the respondents used synchronous methods. Synchronous learning occurs in real-time, with learners interacting with other learners or with lecturers at the same time, exchanging ideas or receiving lecturer feedback or instruction (Wagner, Hassanein and Head 2008: 26; Arkoful and Abaidoo 2015: 31; Mandala, Abdullah and Ismail, 2013).

### 5.7.4 Challenges experienced with e-learning

This section focuses on the various challenges that respondents experienced with e-learning. They were asked to indicate their level of agreement with various statements relating to each of the following challenges that they experienced with e-learning: technology is a distraction to weaker students; lack of concentration in online learning; the use of technology requires more time; the impact of e-learning on interactions between peers, lecturers and learning material; the lack of human contact; the lack of access to technology; the lack of technological skills; the risks associated with online studies; the poor quality of e-learning systems; poor effort from lecturers; the lack of training, workshops and/or orientation; and the lack of technical support.

#### 5.7.4.1 Technology in learning is a distraction to weaker students

On the challenge relating to technology being a distraction to weaker students, the respondents were asked to indicate their level of agreement with two statements: Firstly, that they were distracted by social media and other entertaining content; and secondly, that lessons with technology lacked innovation.

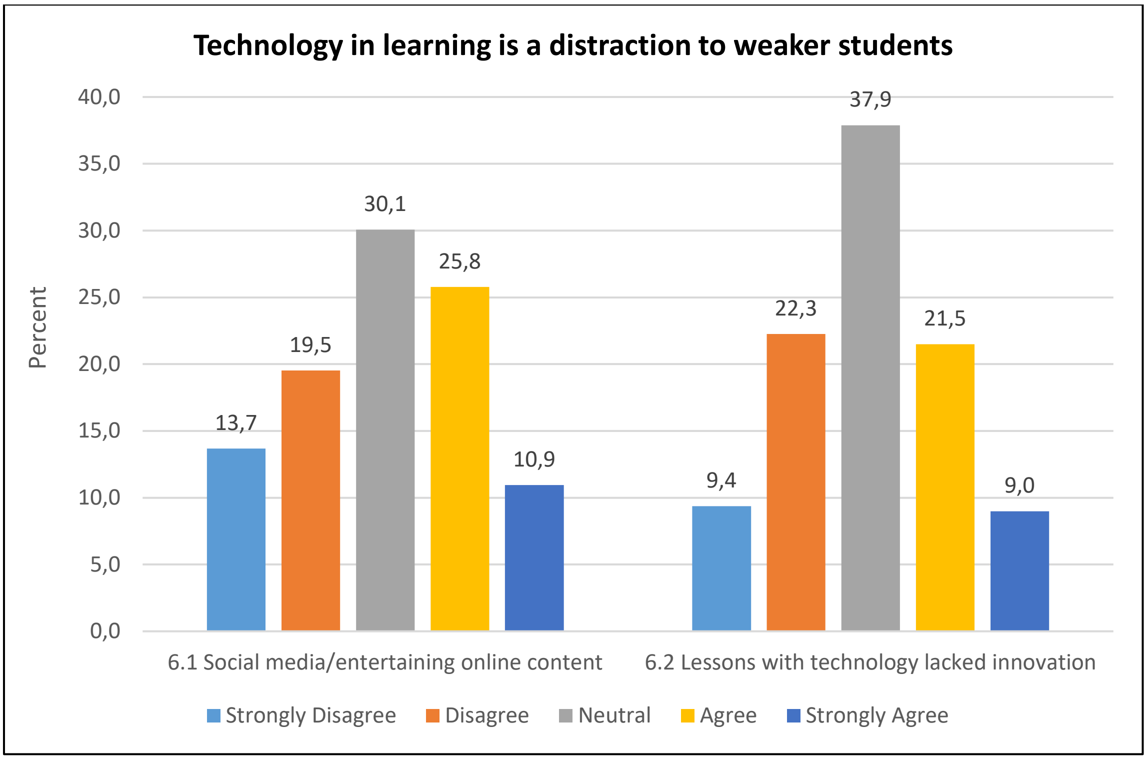


**Figure 5.28: Technology in learning is a distraction to weaker students**

Figure 5.28 above illustrates the results on each of the sub-themes relating to whether technology in learning is a distraction to weaker students: -

- **Statement 6.1 - Social media/entertaining online content:** Collectively 36,7% of respondents either strongly agreed (10,9%) or agreed (25,8%) that they are distracted by social media and other entertaining content when using technology for learning. A lower collective percentage of 33,2% of respondents either strongly disagreed (13,7%) or disagreed (19,5%), with 30,1% of respondents being neutral.
- **Statement 6.2 - Lessons with technology lacked innovation:** Collectively 30,5% of respondents agreed (9% strongly agreed and 21,5% agreed) that learners are often distracted when using technology for learning, as lessons with technology lack innovation. Collectively, 31,7% disagreed (9,4% strongly disagreed and 22,3% disagreed), while 37,9% of respondents remained neutral.

The findings revealed that only some of the respondents believed that social media and other entertaining online content distracts them from their work and that those lessons with technology which lacked innovation, were not a distraction to weaker students. Literature has also revealed that students' attention is diverted away from study material by social media and other interesting sites on the web (Selwyn 2016: 1011; Raghunath, Anker and Nortcliffe 2018: 184).

### 5.7.4.2 Lack of concentration with online learning

The respondents were asked to indicate their level of agreement with each of three statements as reasons for their lack of concentration in online learning. Figure 5.29 below shows the results.

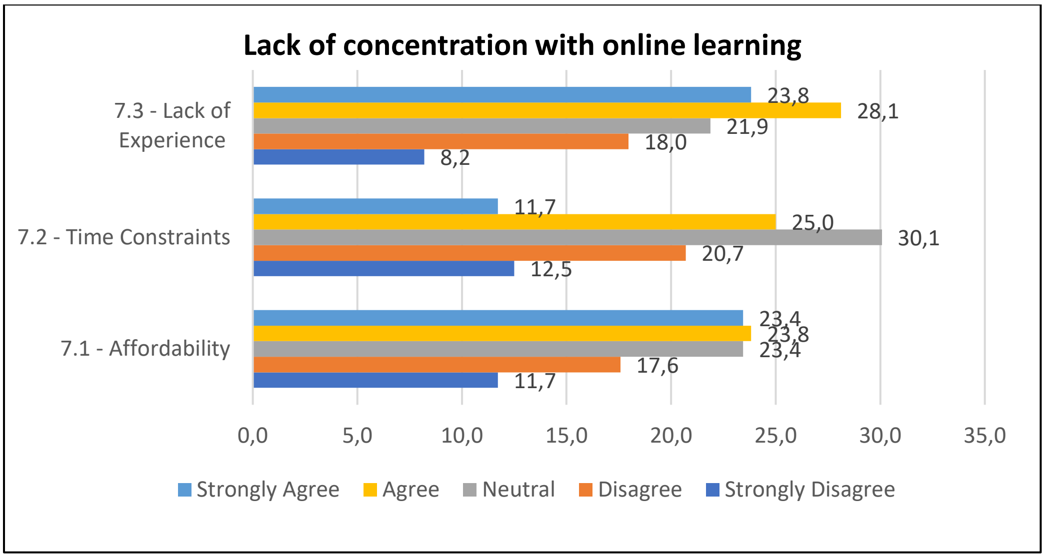


**Figure 5.29: Lack of concentration with online learning**

From the results presented in Figure 5.29 above, the following patterns are observable:

- Both Statements 7.1 and 7.3 indicate a high level of agreement collectively of strongly agree and agree; and
- A significant percentage of respondents remained neutral for all three statements.

The results show a higher level of agreement for statement 7.1 (23,4%) and 7.3 (23,8%). This indicates that the respondents view the unaffordability of devices and the lack of experience as a challenge in concentrating on online learning.

Figure 5.29 shows the results on each of the sub-themes relating to lack of concentration on online learning: -

- **Statement 7.1 – Affordability:** Collectively, 47,2% of the respondents agreed (23,4% strongly agreed and 23,8% agreed) that they cannot concentrate on online learning as they cannot afford the technology for online courses. In addition, 29,3% of respondents collectively disagreed (11,7% strongly disagree and 17,6% disagree), while 23,4% were neutral.
- **Statement 7.2 - Time Constraints:** Collectively, 36,7% of respondents agreed (11,7% strongly agreed and 25,0% agreed) that they cannot concentrate on online learning because of insufficient time to study whilst 33,2% collectively disagreed (12,5% strongly disagreed and 20,7% disagreed) and the remainder (30,1%) were neutral.
- **Statement 7.3 - Lack of experience:** 51,9% of respondents collectively agreed (23,8% strongly agreed and 28,1% agreed) that they cannot concentrate on online learning because of a lack of experience in using the technology. Collectively, 26,2% of respondents disagreed (8,2% strongly disagreed and 18,0% disagreed) while 21,9% chose to be neutral.

The findings indicate that some of the respondents are reluctant to engage in online learning as they lack the experience to engage with technology for learning and that they cannot concentrate on online learning because of insufficient time to study. On the other hand, almost half of them lack concentration on online learning as they cannot afford the technology for online courses as compared to those who lack concentration due to insufficient time to study.

These findings concur with Subramanian and Uchimahali (2016: 313) and Olutola and Olatye (2015: 303), who believe that students who are not trained in using technological devices or not trained in the online environment will be challenged in benefitting fully from online courses. With regard to affordability being the reason for a lack of concentration on online courses, Britto and Rush (nd: 30) believe that affordability is one of the factors for the poor retention of students in online courses (Britto and Rush nd: 30).

### 5.7.4.3 The use of technology requires more time

Respondents were asked to indicate their level of agreement with statements relating to why they believed that using technology for learning takes up more time when participating in online activities. The results are illustrated in Figure 5.30 below.

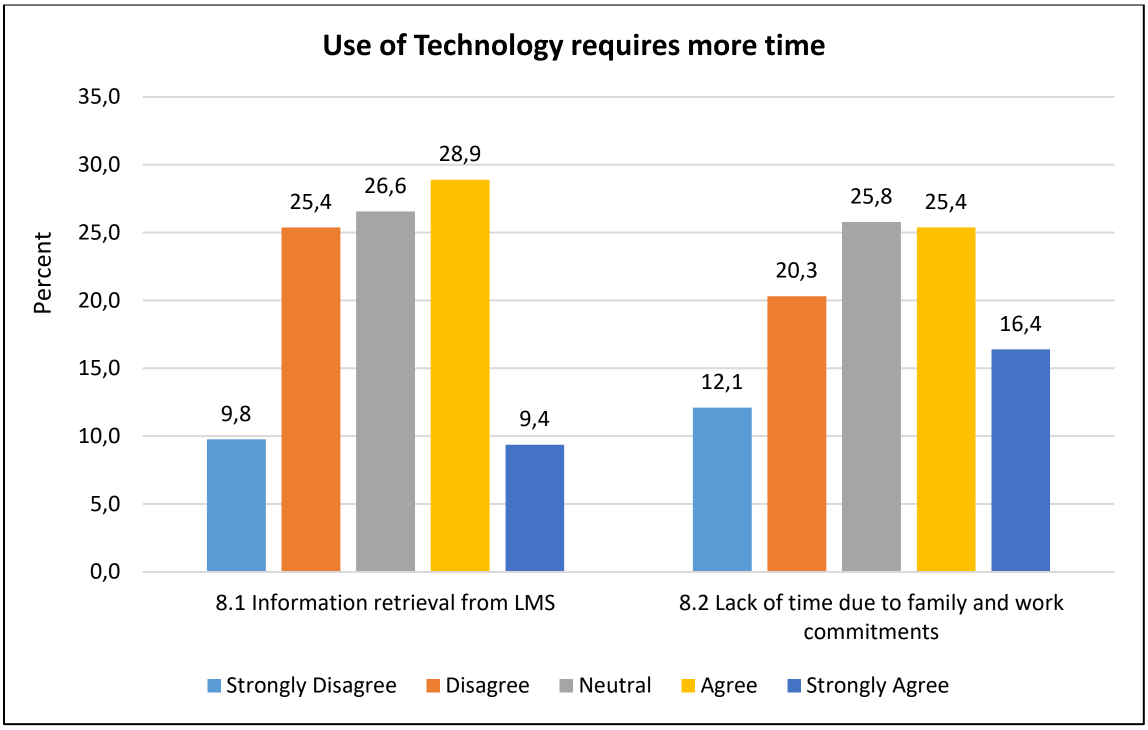


**Figure 5.30: Use of technology requires more time**

Figure 5.30 shows the following results: -

- **Statement 8.1 - Use of technology takes up more time because of information retrieval from the LMS:** Collectively, 38,3% of respondents agree (9,4% strongly agree and 28,9% agree) that e-learning takes up more of their time as they need to retrieve information from the LMS. However, 35,2% of respondents disagree (9,8% strongly disagree and 25,4% disagree), while 26,6% were neutral.

- **Statement 8.2 - Lack of time to engage in e-learning due to family and work commitments:** Collectively, 41,8% of respondents agree (16,4% strongly agree and 25,4%) that they do not have the time to engage in live e-learning sessions due to family and work commitments, while 32,4% disagree (12,1% strongly disagree and 20,3% disagree) and 25,8% remained neutral.

The findings illustrate that some of the respondents believed that engaging in online sessions takes up time due to retrieving information from the LMS, rather than engaging with online activities. This finding concurs with the view of Selwyn (2016: 102), who affirms that retrieving information from the LMS is time-consuming compared to traditional teaching methods. Some of the respondents also had personal responsibilities (family and work), thus making it difficult for them to participate in online classes. Gillet-Swan (2017: 27) believes that personal responsibilities impact on online classes, as students lack time for participation.

#### 5.7.4.4 The impact of e-learning on interactions between peers, lecturers and learning material

The respondents were asked to indicate their level of agreement with statements relating to how e-learning impacts on their interactions between peers, lecturers and learning materials. The results are revealed in Figure 5.31.

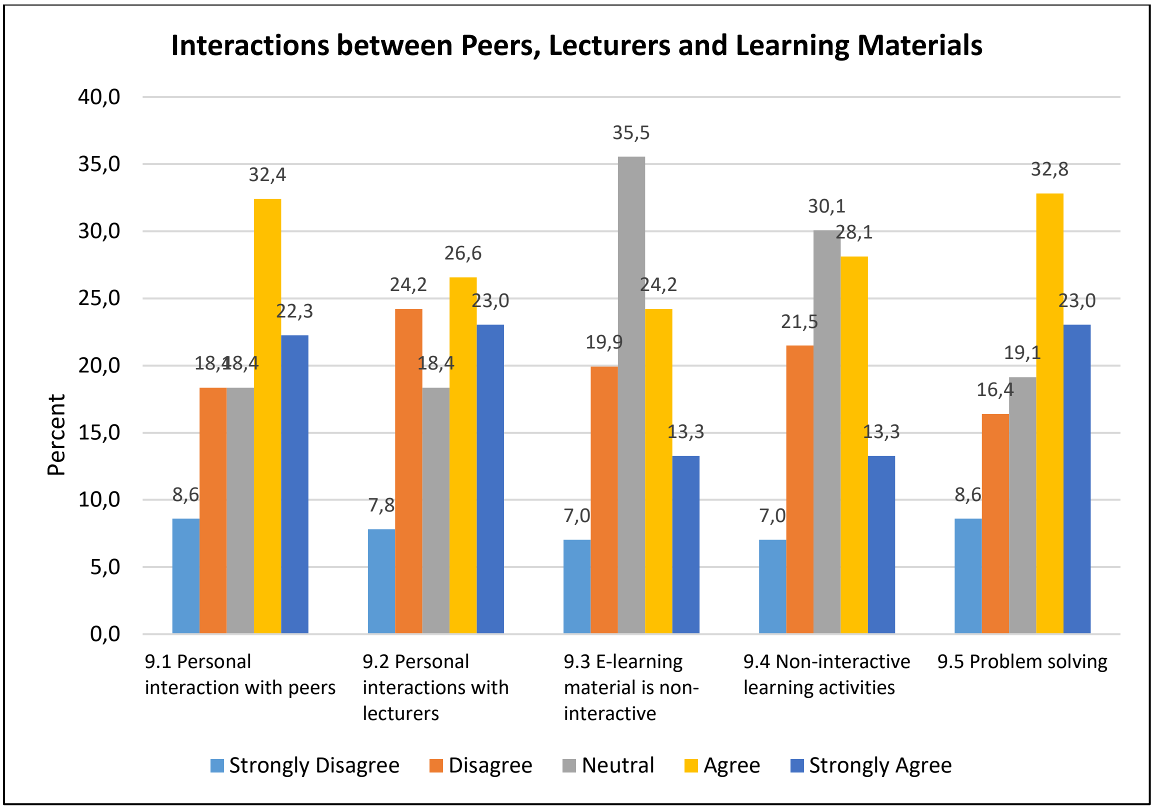


**Figure 5.31: The impact of e-learning on interactions between peers, lecturers and learning material**

From the results presented in Figure 5.31 above, the following patterns are observable:

- Statements 1, 2 and 5 indicate a high level of agreement;
- Statements 2 indicates more or less an equal number that agreed and disagreed; and
- A significant percentage of respondents remained neutral for statements 3 and 4.

Statements 9.2 (23,0%) and 9.5 (23,0%) show a high level of agreement, which implies that the respondents viewed the lack of personal interactions with lecturers and problem-solving as challenges in e-learning.

The results shown in Figure 5.31 above for individual sub-themes, for the theme interaction between peers, lecturers and learning material, show that:

- **Statement 9.1 - Personal interactions with peers:** Collectively, more than half the respondents (54,7%) either strongly agreed (22,3%) or agreed (32,4%) that they do not get to interact personally with their peers when engaged in e-learning. A smaller percentage of respondents (27%) disagreed (8,6% strongly disagreed and 18,4% disagreed), while 18,4% chose to be neutral.
- **Statement 9.2 - Personal interactions with lecturers:** Collectively, 49,6% of respondents either strongly agreed (23,0%) or agreed (26,6%) that they do not get to interact personally with their lecturers in an online environment, while 32% of respondents disagreed (7,8% strongly disagreed and 24,2% disagreed) and 18,4% were neutral.
- **Statement 9.3 - E-learning material is non-interactive:** Collectively, more than a third of respondents (37,5%) either strongly agreed (13,3% or agreed (24,2%) that they find it difficult to engage with e-learning material as it is not interactive. A further 26,9% of respondents disagreed (7,0% strong disagreed and 19,9% disagreed), while 35,5% were neutral.
- **Statement 9.4 - Non-interactive learning activities:** Collectively, 41,4% of respondents agreed (13,3% strongly agreed and 28,1% agreed) that e-learning is concerned with digital learning material only and does not provide them with interactive learning activities; almost a third of respondents disagreed (7,0% strongly disagreed and 21,5% disagreed); and 30,1% of them remained neutral.
- **Statement 9.5 - Problem-solving:** The majority of respondents (55,8%) either strongly agreed (23,0%) or agreed (32,8%) that e-learning does not provide them with the opportunity to problem-solve with their peers. However, some of the respondents (25%) disagreed (8,6% strongly disagree and 16,4% disagree) and 19,1% were neutral.

The findings indicate that the majority of respondents do not get to interact with their peers and also that e-learning does not provide them with the opportunity to problem- solve with their peers. These findings are in agreement with the views expressed by Johnson, Hornik and Salas (2007: 356-369) Kanwal and Rehman, (2017: 10976), and Mapuva (2009: 9), who believe that since all interactions are technology based in an online environment, students do not have the opportunity to communicate and share knowledge and skills or problem-solve. Furthermore, only some of the respondents felt that they do not get to interact with their lecturers; that they find it difficult to engage with e-learning material as it is not interactive and that e-learning does not provide them with interactive learning activities.

### 5.7.4.5 Lack of Human Contact as a challenge

The respondents were asked to indicate their level of agreement to statements relating to whether e-learning affects human contact.

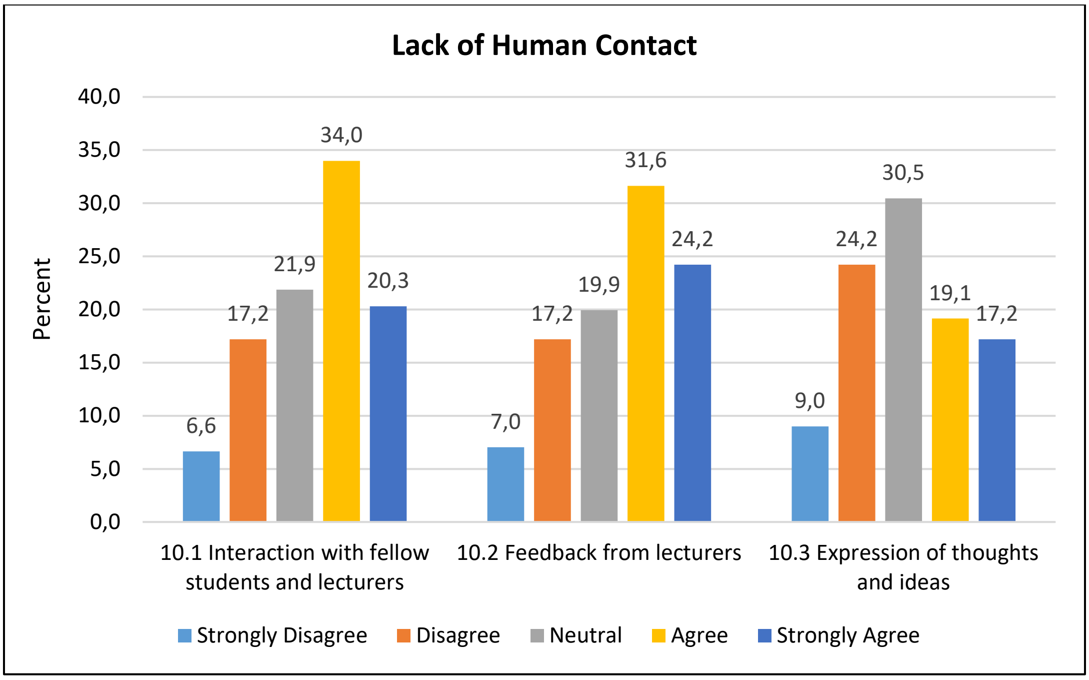


**Figure 5.32: Lack of Human Contact as a challenge**

Figure 5.32 above illustrates the results for each of the sub-themes that relate to the factors that contribute to the lack of human contact in e-learning.

From the results presented in Figure 5.32 above, the following patterns are observable:

- Statements 1 and 2 indicate a high level of agreement; and
- Statement 3 indicates that a significant percentage of respondents remained neutral.

Statement 10.2 (24,2%) shows a higher level of agreement, which indicates that the lack of feedback from lecturers is a challenge in e-learning as it contributes to the lack of human contact.

The results shown above in Figure 5.32 for individual sub-themes, for the theme lack of human contact as a challenge, show that:

- **Statement 10.1 - Interaction with fellow students and lecturers:** Collectively, a higher percentage of respondents (54,3%) either strongly agreed (20,3%) or agreed (34,0%) that e-learning does not give them the opportunity to interact with fellow students and lecturers. Furthermore, 23,8% disagreed (6,6% strongly disagreed and 17,2% disagreed), while 21,9% remained neutral.
- **Statement 10.2 - Feedback from lecturers:** Collectively, the majority of respondents (55,8%) either strongly agreed (24,2%) or agreed (31,6%) that e-learning does not give them the opportunity to get feedback immediately from lecturers. Collectively, 23,8% disagreed (6,6% strongly disagreed and 17,2% disagreed), while 21,9% remained neutral.
- **Statement 10.3 - Expression of thoughts and ideas:** Collectively, 36,3% of respondents either strongly agreed (17,2%) or agreed (19,1%) that e-learning does not allow for the expression of thoughts and ideas. Collectively, 33,2% disagreed (9,0% strongly disagreed and 24,2% disagreed), and almost a third of respondents (30,5%) were neutral.

The findings reveal that the majority of respondents indicated that e-learning does not give them the opportunity to interact with fellow students and lecturers, nor does it afford them the opportunity to get feedback from their lecturers. These findings concur with the views of Vadivoo (2016: 60-61) who believes that students will be reluctant to engage fully in e-learning because of the absence of face-to-face teaching and feelings of isolation. Only some of the respondents indicated that e-learning does not allow for the expression of thoughts and ideas.

### 5.7.4.6 Lack of access to technology

The respondents were asked to indicate their level of agreement or disagreement on statements relating to the challenges students experienced with access to technology. Figure 5.33 indicates the results.

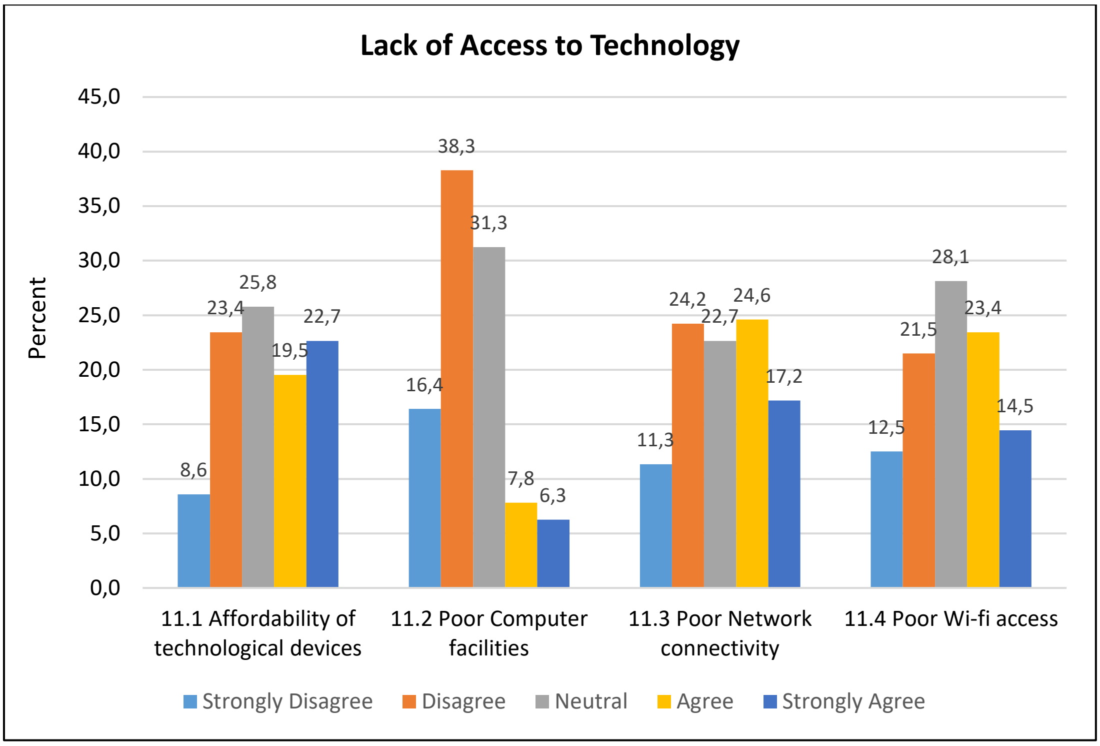


**Figure 5.33: Lack of access to technology**

From the results presented in Figure 5.33 above, the following patterns are observable:

- Statements 1, 3 and 4 indicate similar levels of disagreement;

- Statements 1,3, and 4 also indicate similar levels of neutral responses; and
- Statement 2 indicates a higher level of disagreement.

The results indicate a high level of disagreement (38,3%) for statement 11.2. This shows that respondents do not agree that the institution provides poor computer facilities and this therefore may not be regarded as a challenge contributing to the lack of access to technology.

Figure 5.33 illustrates the results for each of the sub-themes that relate to the theme of lack of access to technology:

- **Statement 11.1 - Affordability of technological devices:** Collectively, 42,2% of respondents either strongly agreed (22,7%) or agreed (19,5%) that they cannot afford technological devices to study via e-learning; while 8,6% disagreed (8,6% strongly disagreed and 23,4% disagreed) and 25,8% remained neutral.
- **Statement 11.2 – Poor computer facilities:** Collectively, 14,1% of respondents either strongly agreed (6,3%) or agreed (7,8%) that there are poor computer facilities within the institution for e-learning purposes, while 54,7% disagreed (16,4% strongly disagree and 38,3% disagree) and just about a third (31,3%) were neutral.
- **Statement 11.3 – Poor network connectivity:** Collectively, 41,8%of respondents either strongly agreed (17,2%) or agreed (24,6%) that there is poor network connectivity in the institution for e-learning. Furthermore, collectively 35,5% of respondents either strongly disagreed (11,3%) or disagreed (24,2%), while 22,7% were neutral.
- **Statement 11.4 – Poor Wi-Fi Access:** Collectively, 37,9% of respondents either strongly agreed (14,5%) or agreed (23,4%) that there is poor Wi-Fi access in the institution for e-learning purposes. In addition, 34% disagreed (12,5% strongly disagreed and 21,5% disagreed), while 28,1% chose to remain neutral.

The findings reveal that some of the respondents cannot afford technological devices for e-learning. Vadivoo (2016: 60-61) posits that human and economic factors intertwine in e-learning, with some students not being able to afford computers or other technological devices. Some of the respondents also indicated that computing facilities are adequate at the institution, while the majority disagreed. Furthermore, some of the respondents also indicated that there is a lack of network infrastructure and Wi-Fi access at the institution. Various studies have indicated that technological infrastructure and the availability of the internet is imperative for continuous learning in an online environment (Gomathi 2016: 146; Natow, Reddy and Grant 2017: 13-14; Olutola and Olatoye 2015: 303).

### 5.7.4.7 Technological skills challenges

The respondents were asked to indicate their level of agreement on statements relating to how their technological skills impact on their e-learning capabilities. Figure 5.34 below illustrates the results.

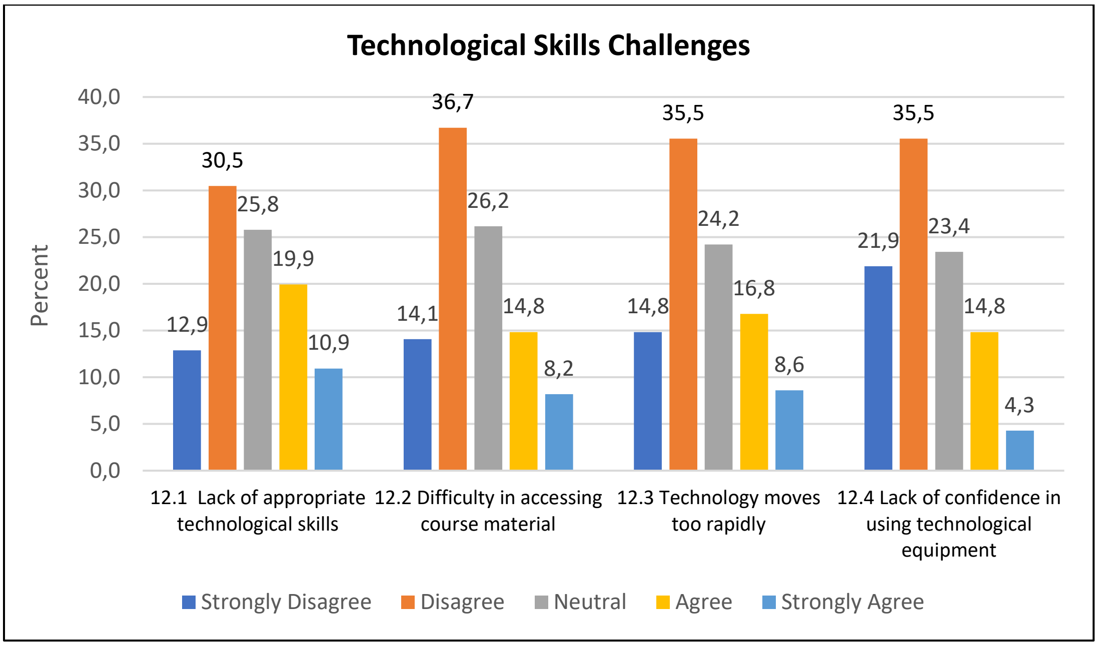


**Figure 5.34: Technological skills challenges**

From the results presented in Figure 5.34 above, the following patterns are discernable:

- Statements 1, 2, 3 and 4 all indicate a high level of disagreement collectively of strongly disagree and disagree; and
- All statements indicate similar levels of neutral responses.

The results indicate a high level of disagreement for statement 12,4 (21,9%). This indicates that the respondents do not view the lack of confidence in using technological equipment as a challenge in e-learning.

Figure 5.34 above illustrates the results for each of the sub-themes that relate to technological skills challenges:

- **Statement 12.1 – Lack of appropriate technological skills:** Collectively, a higher percentage of respondents (43,4%) either strongly disagreed (12,9%) or disagreed (30,5%) that e-learning proves difficult as they do not have the appropriate technological skills. However, collectively, 30,8% of respondents agreed (10,9% strongly agreed and 19,9% agreed), while 25,8% of respondents remained neutral.
- **Statement 12.2 - Difficulty in accessing course material:** Collectively, only 23% of respondents either strongly agreed (8,2%) or agreed (14,8%) that they are afraid to use technology for learning because they find it difficult to access course material or prepare for online assessments. A higher percentage of respondents (50,8%) collectively either strongly disagreed (14,1%) or disagreed (36,7%), while 26,2% of respondents chose to be neutral.
- **Statement 12.3 - Technology moves too rapidly:** Collectively, only 25,4% of respondents either strongly agreed (8,6%) or agreed (16,8%) that technology moves too rapidly and it is a challenge to keep up with the advancements. However, a higher percentage of respondents (50,3%) collectively disagreed (14,8% strongly disagreed and 35,5% disagreed), while 24,2% were neutral.
- **Statement 12.4 - Lack of confidence in using technological equipment:** Collectively, 19,1% of respondents agreed (4,3% strongly

agreed and 14,8% agreed) that they lack the confidence to use technological equipment to engage in online learning, while 57,4% disagreed (21,9% strongly disagreed and 35,5% disagreed). Almost a quarter (23,4%) of the respondents were neutral.

The findings have revealed that about half of the respondents disagreed that they found e-learning difficult because they do not have appropriate technological skills. Contrarily, students who are not trained in using technological devices for learning will not experience the full benefits offered by the e-learning environment (Olutola and Olatye 2015: 303). Only some of the respondents indicated that they are afraid to use technology because they find it difficult to access course material or prepare for online assessments, while half the respondents disagreed. A majority of the respondents disagreed that technology moves too rapidly and it is a challenge to keep up with the advancements, and also that they lacked the confidence and the skill in using technology to engage in e-learning. Students who lack confidence in using technology for e-learning will not successfully engage in e-learning (Mapuva 2009: 8).

#### 5.7.4.8 The risks associated with online studies

Respondents were asked to indicate their level of agreement regarding the following statements relating to whether they believed that online studies were risky: That submitting work via e-learning is risky as work could be lost; and that submitting work via e-learning is risky as sensitive information could be disclosed. Figure 5.35 illustrates the results.

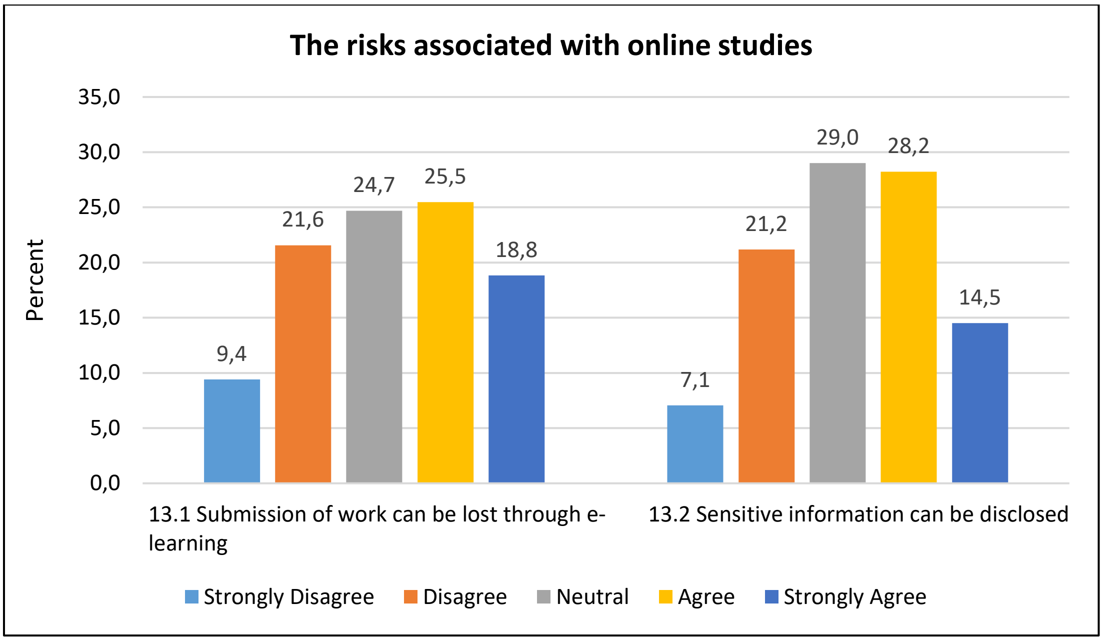


**Figure 5.35: Risks associated with online studies**

Figure 5.35 above illustrates the results for each of the sub-themes that relate to the risks associated with online studies as a challenge:

- **Statement 13.1 - Submission of work can be lost through e-learning:** Collectively, 44,3% of respondents either strongly agreed (18,8%) or agreed (25,5%) that submitting work via e-learning is risky as work could be lost. In addition, 31,0% disagreed (9,4% strongly disagreed and 21,6% disagreed) while a further 24,7% of respondents remained neutral.

- **Statement 13.2 - Sensitive information can be disclosed:** Collectively, 42,7% of respondents either strongly agreed (14,5%) or agreed (28,2%) that submitting work via e-learning is risky as sensitive information could be disclosed. A lower percentage of respondents (28,3%) disagreed (7,1% strongly disagreed and 21,2% disagreed), while 29% of respondents remained neutral.

The findings reveal that some of the respondents believed that submitting work via e-learning is risky as work could be lost and also that sensitive information can be disclosed when submitting work online. These findings are in agreement with views expressed by Wang (2014: 10) that students are fearful when engaging in online learning as there are risks associated with losing submitted work; disclosure of sensitive information; wastage of time and money; as well as the absence of face-to-face interactions

### 5.7.4.9 The poor quality of e-learning systems

The respondents were asked to indicate their level of agreement on statements relating to the impact of the quality of e-learning systems on their online learning experiences. The results are depicted in Figure 5.36 below.

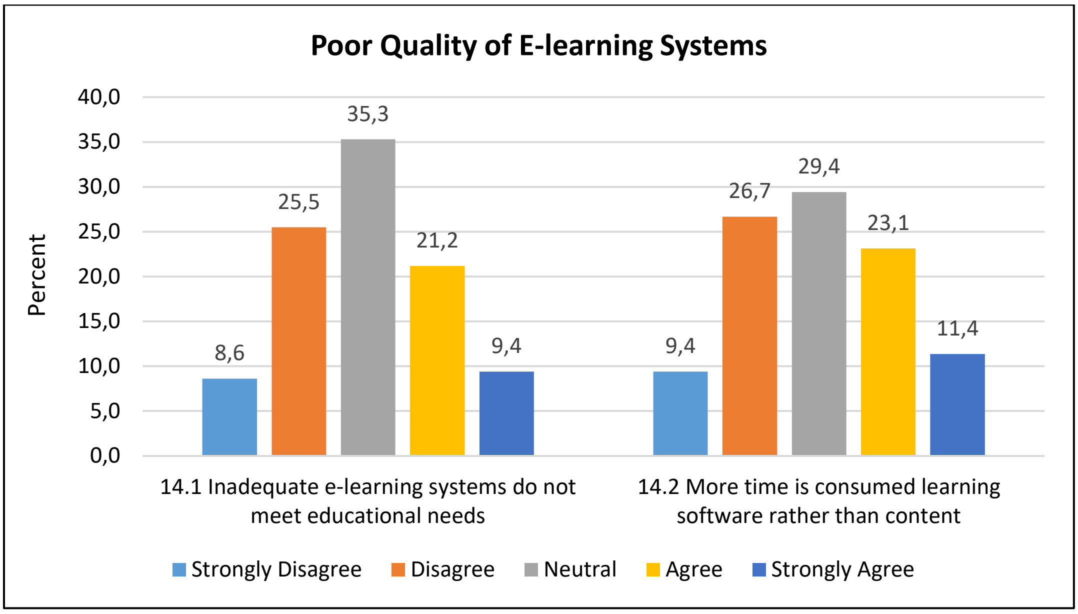


**Figure 5.36: Poor quality of e-learning systems**

Figure 5.36 above illustrates the results for each of the sub-themes that relate to the poor quality of e-learning systems:

- **Statement 14.1 - Inadequate e-learning systems do not meet educational needs:** Collectively, 30,6% of respondents agreed (9,4% strongly agreed and 21,2% agreed) that the quality of the e-learning system in the institution is not adequate to meet educational needs, while collectively, 34,1% disagreed (8,6% strongly disagreed and 25,5% disagreed). In addition, 35,3% of respondents were neutral.

- **Statement 14.2 - More time is consumed learning software rather than content:** Collectively, 36,1% of respondents disagreed (strongly disagreed 9,4% or disagreed 26,7%) that learners spend more time learning how to use the software rather than learning the content, while 34,5% collectively agreed (11,4% strongly agreed and 23,1% agreed). A further 29,4% remained neutral.

The findings illustrate that students find the LMS at the institution adequate for their online learning requirements. E-learning success is dependent on the system and service quality of e-learning systems, according to Aparicio, Bacao and Oliveira (2016: 392). In addition, only some of the respondents believe that the quality of the e-learning system in the institution is not adequate to meet educational needs. Back *et al.* (2016: 271) argue that students want an LMS to support "efficient learning, with clear, practice-oriented contents, which are easy to use".

### 5.7.4.10 Poor effort from lecturers

The respondents were asked to indicate their level of agreement on statements relating to the effort made by lecturers to integrate technology and subject content properly to enable adequate learning. Figure 5.37 below illustrates the results.

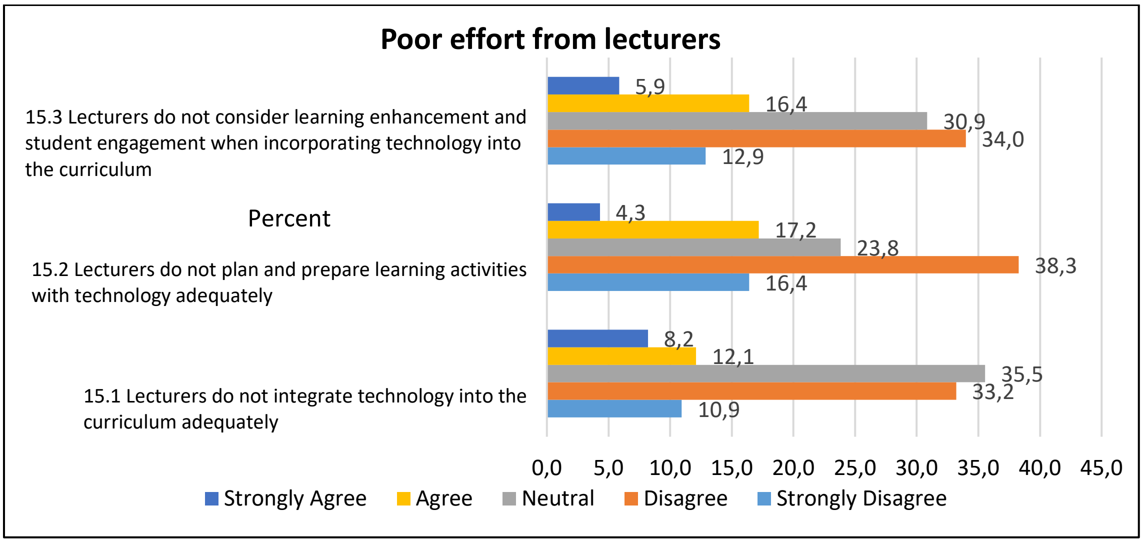


**Figure 5.37: Poor effort from lecturers**

From the results presented in Figure 5.37, the following patterns are discernable:

- All statements show high levels of disagreement; and
- All statements show a significant level of neutral responses.

The results indicate a high level of disagreement for statement 15.2 (38,3%). This indicates that the respondents did not view the planning and preparation of learning activities by lecturers as a challenge in e-learning.

Figure 5.37 illustrates the results for each of the sub-themes that relate to the theme ‘poor effort from lecturers’:

- **Statement 15.1 - Lecturers do not integrate technology into the curriculum adequately:** Collectively, 44,1% of respondents disagreed (10,9% strongly disagreed and 33,2% disagreed) that lecturers do not integrate technology into the curriculum adequately, while 20,3% agreed (8,2% strongly agreed and 12,1% agreed). A significant percentage of respondents (35,5%) were neutral.
- **Statement 15.2 - Lecturers do not plan and prepare learning activities with technology adequately:** Collectively, 54,7% of respondents disagreed (16,4% strongly disagreed and 38,3% disagreed) that lecturers do not plan and prepare learning activities with technology adequately. In addition, 21,5% collectively agreed (4,3% strongly agreed and 17,2% agreed), with 23,8% of respondents being neutral.
- **Statement 15.3 - Lecturers do not consider learning enhancement and student engagement when incorporating technology into the curriculum:** Collectively, 46,9% of respondents disagreed (12,9% strong disagreed and 34,0% disagreed) that lecturers do not consider learning enhancement and student engagement when incorporating technology into the curriculum. A further 22,3% agreed (5,9% strongly

agreed and 16,4% agreed) and 30,9% of respondents remained neutral.

The findings indicate that more or less half the respondents believed that their lecturers integrate technology into the curriculum adequately; plan and prepare learning activities with technology adequately; and consider learning enhancement and student engagement when incorporating technology into the curriculum. Hence, these factors were not viewed as a challenge to e-learning. The findings are in agreement with the views expressed by Gillet-Swan (2017: 21) and Vadivoo (2016: 60-61) that learning enhancement and student engagement, as well as lesson planning and preparation, must be considered for collaborative teaching strategies.

### 5.7.4.11. The lack of training, workshops and/or orientation

The respondents were asked to indicate their level of agreement on statements relating to for the lack of training, workshops and orientation by the institution for e-learning purposes. The results are illustrated in Figure 5.38 below.

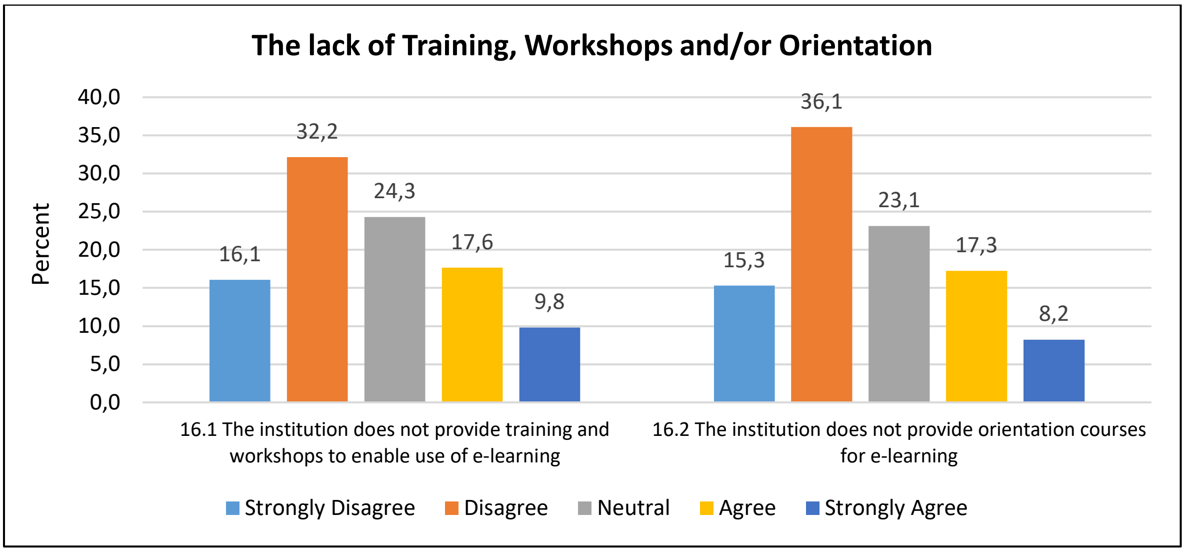


**Figure 5.38: Lack of training, workshops and/or orientation**

The results shown in Figure 5.38 above for each of the sub-themes that relate to the lack of training, workshops and/orientation show that:

- **Statement 16.1 - The institution does not provide training and workshops to enable the use of e-learning:** Collectively, almost half the respondents (48,3%) disagreed (16,1% strongly disagreed and 32,2% disagreed) that the institution does not provide training and workshops to enable the use of e-learning. Collectively, a lower percentage of respondents (27,4%) agreed (9,8% strongly agreed and 17,6% agreed), with 24,3% of respondents being neutral.
- **Statement 16.2 - The institution does not provide orientation courses for e-learning to improve the understanding of course material:** Collectively, more than half the respondents (51,4%) disagreed (15,3% strongly disagreed and 36,1% disagreed) that the institution does not provide orientation courses for e-learning to improve the understanding of course material. A much lower percentage of respondents (25,5%) agreed (8,2% strongly agreed and 17,3% agreed), with 23,1% of respondents remaining neutral.

The findings show that more or less half the respondents believed that the institution does provide training and workshops for enabling e-learning, as well as orientation courses for improving the understanding of course material and that this is therefore not a challenge. Roddy *et al.* (2017: 6) and Britto and Rush (nd: 31) believe that training courses or orientation programmes are tools that can be used to improve the academic performance of online learners.

#### 5.7.4.12 The lack of technical support

The respondents were asked to indicate their level of agreement on statements relating to the technical support given to them for e-learning purposes. Figure 5.39 shows the results.

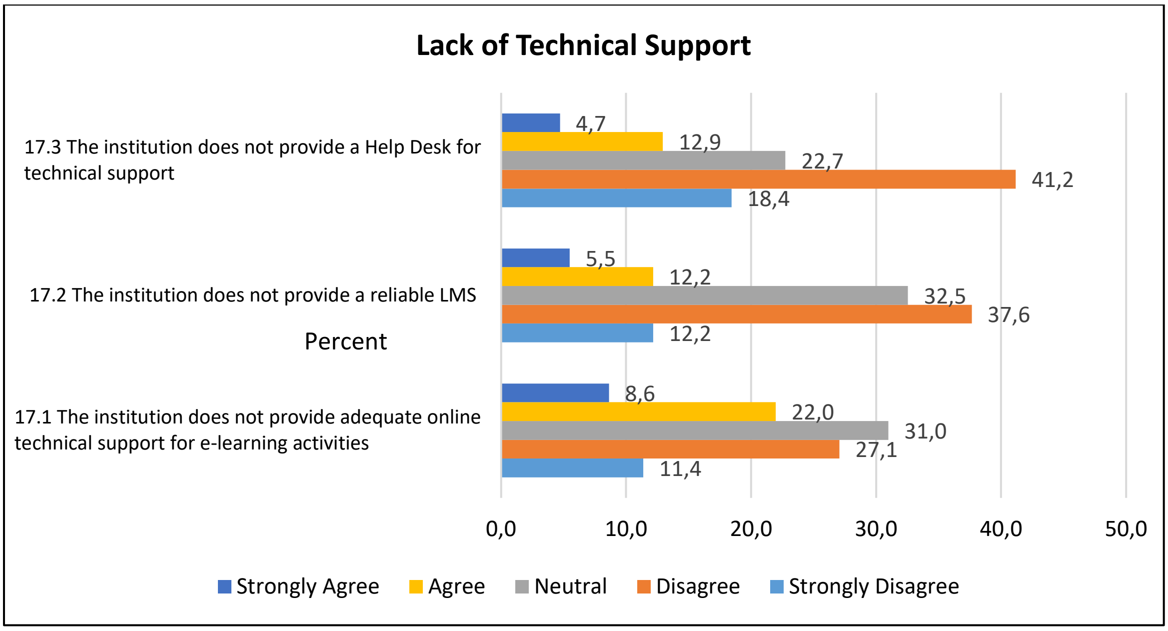


**Figure 5.39: Lack of technical support**

From the results presented in Figure 5.39, the following patterns are discernable:

- All statements show a high level of disagreement; and
- All statements show a significant level for neutral.

The results indicate a high level of disagreement for statement 17.3 (41,2%). This indicates that the respondents did not view the lack of a help desk for technical support as a challenge for e-learning.

Figure 5.39 above illustrates the results for each of the sub-themes that relate to the lack of technical support:

- **Statement 17.1 - The institution does not provide adequate online technical support for e-learning activities:** Collectively, 38,5% of respondents disagreed (11,4% strongly disagree and 27,1% disagreed) that the institution does not provide adequate online technical support for e-learning activities, while 30,6% agreed (8,6% strongly agreed and 22,0% agreed). A further 31,0% respondents were neutral.

- **Statement 17.2 - The institution does not provide a reliable LMS (Learning Management System):** Collectively, 49,8% of respondents disagreed (12,2% strongly disagreed and 37,6% disagreed) that the institution does not provide a reliable LMS (Learning Management System). A small percentage of respondents (17,7%) agreed (5,5% strongly agreed and 12,2% agreed), while 32,5% remained neutral.
- **Statement 17.3 - The institution does not provide a Help Desk for technical support (phone/email/chat):** Collectively, 59,6% of respondents disagreed (18,4% strongly disagreed and 41,2% disagreed) that the institution does not provide a Help Desk for technical support, either via phone or email or chat, whereas, collectively, 17,6% agreed (4,7% strongly agreed and 12,9% agreed), with 22,7% of respondents being neutral.

The findings indicate that a majority of the students believe that the institution provides adequate online technical support, a reliable LMS and a help desk for e-learning technical support. Roddy *et al.* (2017: 6) and Britto and Rush (nd: 31) maintain that online technical support, a reliable LMS and a help desk for technical support are essential resources in ensuring the online course expectations of students.

#### 5.7.4.13 Other e-learning challenges faced by Students

The respondents were asked to indicate what other challenges were prevalent in e-learning, apart from those which were presented to them. The results are illustrated in Figure 5.40.

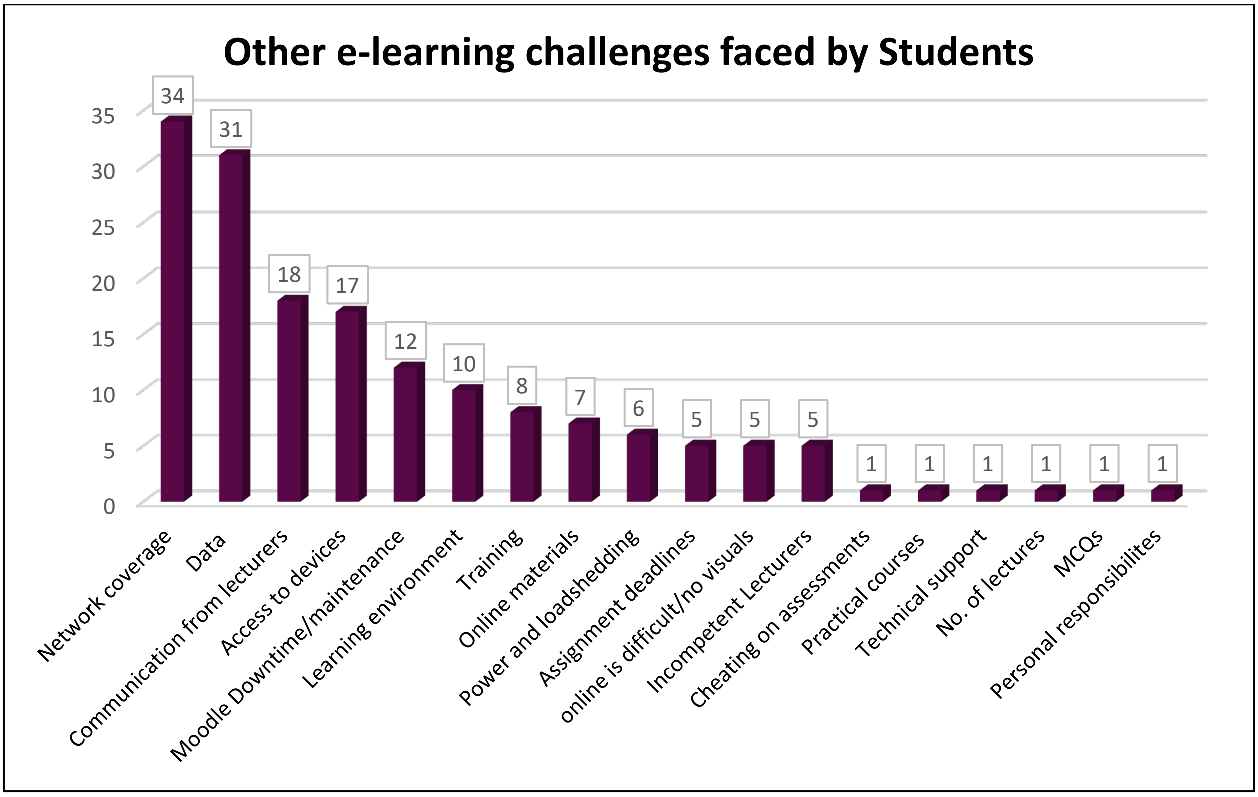


**Figure 5.40: Other e-learning challenges faced by Students**

The results from the open-ended questions were formatted according to themes created by the frequency of responses to particular challenges. The frequency is calculated as per the responses received from the number of respondents for each particular challenge.

- **Resources and infrastructure-related challenges:** These included –
  - network coverage (34);
  - data (31);
  - access to devices (17);
  - technical support (1); and
  - power and load-shedding (6).
- **The lecturer-related challenges** included**:**
  - communication from lecturers (18); and

- incompetent lecturers (5).

- **Student-learning related challenges** were as follows**:**
    - training (8);
    - online is difficult/no visuals (5);
    - practical courses (1);
    - cheating (1);
    - online materials (7);
    - learning environment (10);
    - personal responsibilities (1); and
    - assignment deadlines.
- **LMS related challenges** were as follows**:**
    - Moodle downtime/maintenance (12),
- **Other challenges** indicated:
    - MCQs (1)

The findings revealed that the challenge that was most common to those who responded to the question was the lack of access to the network, data and devices. Tarus and Gichoya (2015: 7) believe that the lack of access to technological devices and lack of network connectivity are important components contributing to inadequate e-learning successes. Dhawan (2020: 16) states that digital equity is crucial in ensuring the success of e-learning. The author states further that HEIs need to ensure that students do not lose out on learning opportunities due to the unavailability of proper digital tools and internet connections, i.e. every student must have access to the required resources.

The lecturer-related challenges (communication from lecturers and incompetent lecturers) as revealed by the findings are supported by the views expressed by Selwyn (2016: 1013) who argues that a poor standard of e-learning classes by lecturers allows for students to disengage from learning online.

LMS-related challenges, mainly relating to Moodle downtime or maintenance, contribute to how students perceive e-learning, as argued by Aparicio, Bacao and Oliveira (2016: 392). The authors posit that when students perceive that a system is responsive and available, then the e-learning experience is more enjoyable.

### 5.7.5 Best-practices for e-learning

This section focuses on the best practices for e-learning at HEIs as reported in terms of the student survey. The respondents were asked to indicate their level of agreement with six statements relating to these best-practices. The results are revealed in Figure 5.41.

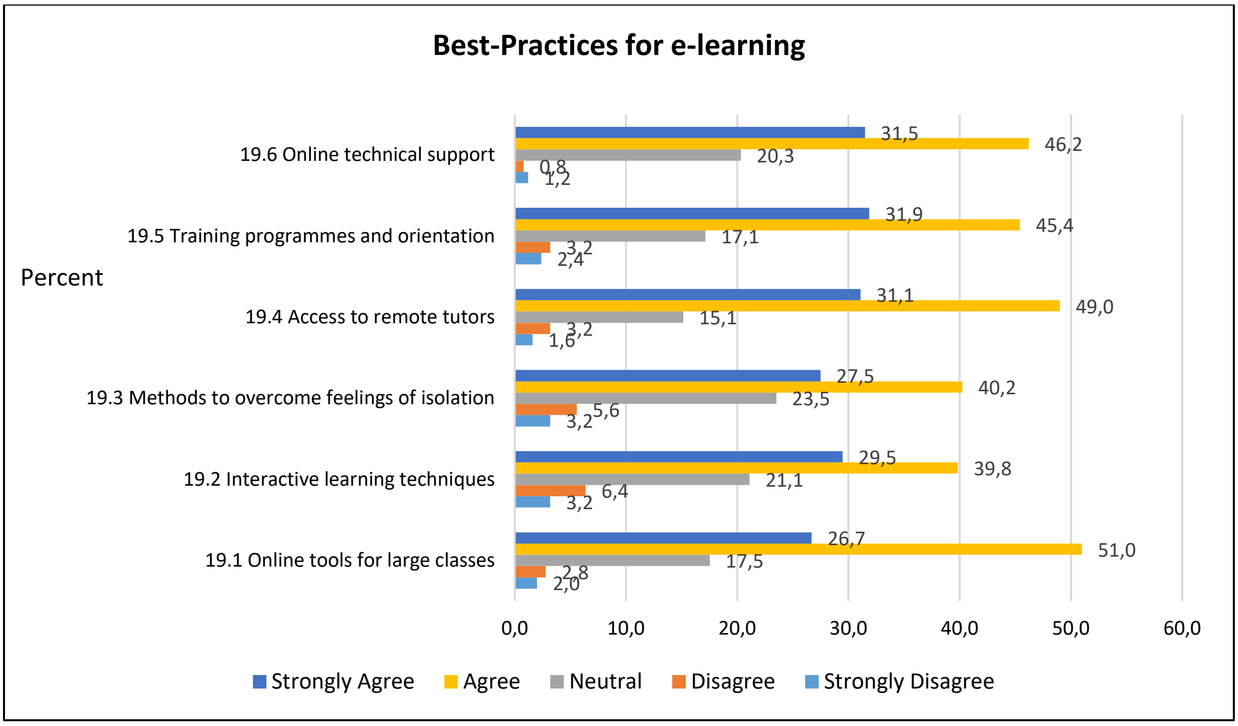


**Figure 5.41: Best-practices for e-learning**

From the results presented in Figure 5.41, the following patterns are discernable:

- All statements show a fairly high level of agreement;
- All statements show a significant level of “strongly agree”; and
- All statements show that a significant percentage of respondents chose to be neutral.

The results show higher levels of agreement for statements 19.4 (31,1%), 19.5 (31,9,0%) and 19.6 (31,5%). This indicates that the respondents view online technical support, training programmes and orientation, and access to remote tutors as best practices for e-learning.

The analysis of results as depicted in Figure 5.41 shows that the majority of the respondents believed that the following are best-practices for e-learning:

- online tools, such as social networking, micro blogging and other applications should be made available, especially with large groups;
- interactive learning techniques, where lecturers deliver online courses via social media, lecture recordings, online educational games and other similar technologies;
- feelings of isolation experienced by students using e-learning may be overcome by discussion boards and group video conferences, as well as access to remote tutors;
- training programmes and orientation can be used to improve the pass rates with e-learning; and
- flexible online support is important for a user-friendly environment for e-learning success.

Figure 5.41 above illustrates the results for each of the sub-themes that relate to best practices for e-learning:

- **Statement 19.1 - Online tools for large classes:** Collectively, 77,7% of respondents agreed (26,7% strongly agreed and 51,0% agreed) that tools such as social networking, micro blogging and other applications should be made available in classes with large groups. A minor percentage of respondents (4,8%) disagreed (2,0% strongly disagreed and 2,8% disagreed), while 17,5% of respondents were neutral.

- **Statement 19.2 - Interactive learning techniques:** Collectively, 69,3% of respondents agreed (29,5% strongly agreed and 39,8% agreed) that learning will be more interactive if lecturers deliver online courses via social media, lecture recordings, online educational games and other similar technologies. Collectively, 9,6% of respondents disagreed (3,2% strongly disagreed and 6,4% disagreed) and 21,1% of respondents were neutral.
- **Statement 19.3 - Methods to overcome feelings of isolation:** A vast 67,7% of respondents collectively agreed (27,5% strongly agreed and 40,2% agreed) that the feelings of isolation in online classes can be overcome by online peer tutoring, discussion boards and group video conferences. Collectively, a minor percentage of respondents (8,8%) disagreed (3,2% strongly disagreed and 5,6% disagreed) and 23,5% were neutral.
- **Statement 19.4 - Access to remote tutors:** Collectively, 80,1% of respondents agreed (31,1% strongly agreed and 49,0% agreed) that having online access to remote tutors will assist in their studies via e-learning. A minor percentage of respondents (4,8%) disagreed (1,6% strongly disagreed and 3,2% disagreed), while 15,1% remained neutral.
- **Statement 19.5 - Training programmes and orientation:** A significant 77,3% of respondents collectively agreed (31,9% strongly agreed and 45,4% agreed) that training programmes and orientation will improve pass rates in the e-learning environment. Collectively, 5,6% of respondents disagreed (2,4% strongly disagreed and 3,2% disagreed) and a further 17,1% were neutral.

- **Statement 19.6 - Online technical support:** Collectively, 77,7% of respondents agreed (31,5% strongly agreed and 46,2% agreed) that flexible online technical support is important for a user-friendly environment for e-learning success. A very minor percentage of respondents (2%) disagreed (1,2% strongly disagreed and 0,8% disagreed) and 20,3% of respondents remained neutral.

The finding that online tools assist with large groups concurs with the view expressed by Martin (2018: 9), who confirms that online tools or technology (social networking, micro blogging) to re-cast courses to large groups of students is a best-practice suited to enable and to improve student experiences with e-learning. In addition, the finding on interactive learning techniques (social media, lecture recordings, online educational games) as a best-practice to deliver an online curriculum is supported by Grajek (2015: 11-12), who states that this best-practice allows for students to achieve and engage at higher levels, when technology is integrated in such ways.

The finding that training programmes and orientation can be used to improve pass rates in e-learning courses is further revealed in literature by Roddy *et al.* (2017: 6), Britto and Rush (nd: 31) and Grajek (2015: 11-15). The authors confirm that orientation programmes, training courses and workshops boost the confidence levels of students and prepare them for online classes.

Technical support and technological components (network connectivity and internet bandwidth) as a best-practice for meeting online learning requirements as revealed in the finding on 'flexible online support is important for the success of online learning'. This is further attested to by Tarus and Gichoya (2015: 7), Britto and Rush (nd: 31), Grajek (2015: 14-15) and Roddy *et al.* (2017: 6).

### 5.7.6 Best-practices as recommended by the respondents

In an open-ended question, the respondents were asked to indicate other best-practices which they believed would prove successful for e-learning in a HEI.

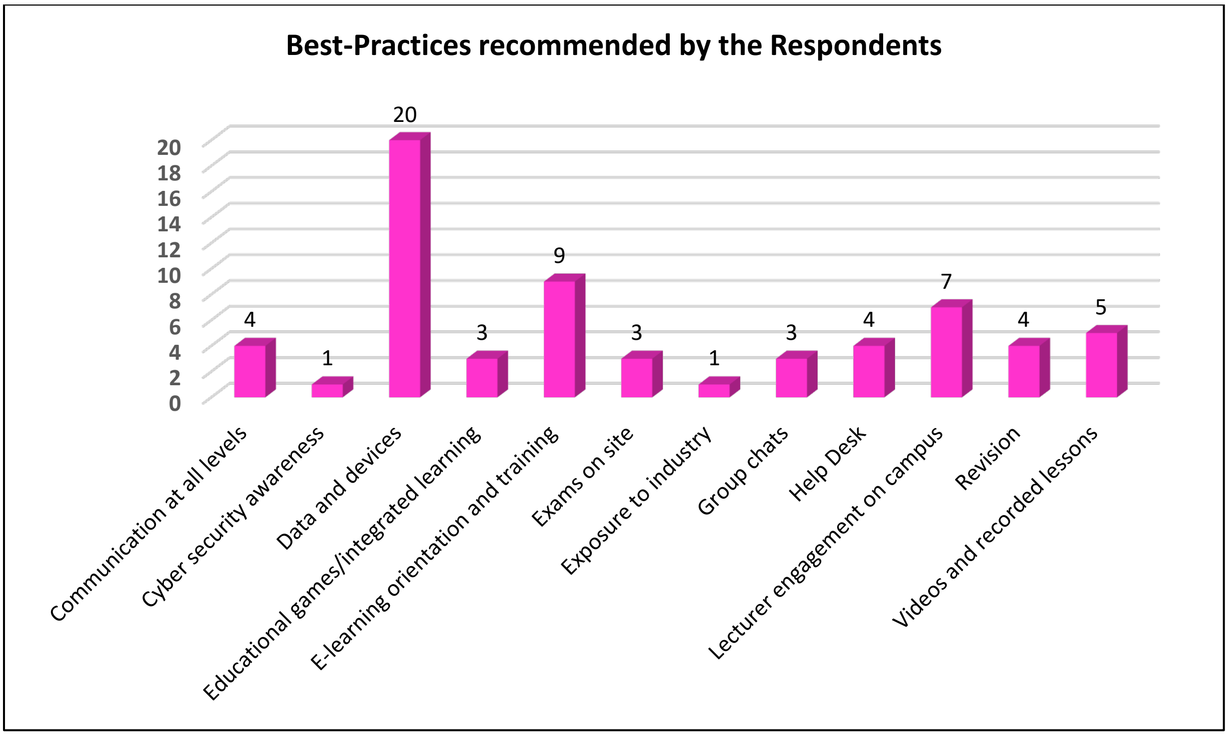


**Figure 5.42: Best-practices as recommended by the respondents**

As shown in Figure 5.42 above, the other best-practices indicated by the respondents were as follows: -

- **Student support initiatives**:
    - group chats (3);
    - help desk (4);
    - e-learning orientation and training (9); and
    - data and devices (20).
- **Lecturer-driven initiatives:**
    - lecturer engagement on campus (7);
    - communication at all levels (4);
    - revision (4);
    - videos and recorded lessons (5);

- educational games and integrated learning (3); and
- examinations on site (3).

- **Other best-practices:**
  - cyber security awareness (1); and
  - exposure to industry (1).

The findings revealed that many respondents indicated adequate access to data and devices as a best-practice for HEIs. Tarus and Gichoya (2015: 7) argue that access to computers and other e-learning technological devices is necessary for the success of e-learning initiatives.

Many of the findings illustrated above are in agreement with the findings from the previous Likert scale question on best-practices. There was a high level of agreement indicated by the respondents to group chats, help desk for technical support, e-learning orientation and training, videos and recorded lessons and educational games and integrated learning.

Further findings revealed that access to data and devices lecturer driven initiatives, lecturer engagement on campus, communication at all levels, revision, examinations on site, cyber security awareness and exposure to industry should be considered as best-practices in HEIs.

The finding on the access to data and devices for successful e-learning, is in agreement with Dhawan's belief (2020: 16) that HEIs should make every effort to ensure that every student has access to the required resources, working educational applications on mobile phones, as well as in the cases of students who do not own laptops.

The finding on communication and revision concurs with the views expressed by Dhawan (2020: 9) that communication is key in ensuring students adapt to the e-learning environment. The author further argues that social media and various group forums should be used to communicate with students and that lecturers must allow for effective online programmes where students can actively revise, ask questions and get feedback, broadening the learner horizon for course content.

The findings on ‘lecturer-driven initiatives and lecturer engagement on campus’ are also in agreement with the views of Rachfall, Foerster-Trallo and Zimbelmann (2019: 5336), who recommend that the acceptance of e-learning is influenced by the availability of the lecturer, i.e. “A high accessibility of the lecturer, as well as additional offers such as online consultations and group appointments, increases the acceptance of e-learning among the students”.

The finding on cyber security awareness is further in agreement with Majid *et al.* (2015: 217-219), who state that e-learning activities differ from traditional learning methods, therefore students need to be made aware of threats which allow them to become victims of cyber security attacks, which can be brought forth by the system hardware itself, network infrastructure and social engineering attacks.

## 5.8 Inferential Statistics

Waller (2012: 2) states that, “Inferential statistics are used to examine data for differences, associations and relationships to answer hypotheses”. As with the analysis of the staff survey, statistical inferences were also drawn up from the analysis of the student survey. The reliability and validity of the student survey instrument were tested, with inferences drawn about the student population from the sample obtained. As with the analysis of the staff data, the student data was also analyzed with the Statistical Package for the Social Sciences (SPSS) Version 26 for Windows. This ensured that the data could be organised and the relationships between the measures understood. The use of correlations and chi square test values were adopted and interpreted using the p-values.

### 5.8.1 Reliability Statistics

As with the analysis of the staff statistics, the Cronbach's alpha co-efficient technique was used to test the reliability of the instrument.

### 5.8.1.1 Cronbach's Alpha

The Cronbach's alpha score for all the items that constituted the questionnaire are illustrated in Table 5.25 below.

**Table 5.25: Cronbach's Alpha Score**

| | Section | Number of Items | Cronbach's Alpha |
|---|---|---|---|
| Q3 | Experience with technological devices | 5 | 0,684 |
| Q6 | Distraction to weaker students | 2 | 0,601 |
| Q7 | Concentration on online learning | 3 | 0,630 |
| Q8 | Use of technology requires more time | 2 | 0,638 |
| Q9 | Interactions between peers, lecturers and learning material | 5 | 0,830 |
| Q10 | Lack of human contact | 3 | 0,763 |
| Q11 | Lack of access to technology | 4 | 0,685 |
| Q12 | Technological skills challenges | 4 | 0,853 |
| Q13 | Working online | 2 | 0,832 |
| Q14 | Poor quality of e-learning systems | 2 | 0,598 |
| Q15 | Poor effort from lecturers | 3 | 0,844 |
| Q16 | Training/workshops/orientation | 2 | 0,796 |
| Q17 | Technical support | 3 | 0,756 |
| Q19 | Best practices | 6 | 0,801 |

The reliability scores for all sections exceed the recommended Cronbach's alpha value (scores for all sections are more than 0.60). The scores indicate a degree of acceptable and consistent scoring for these sections of the research.

### 5.8.1.2 Factor Analysis

Factor analysis was once again adopted for the analysis of the student statistics, with the main purpose being data reduction. The analyses of results from the KMO and Bartlett's test are set out below.

#### 5.8.1.2.1 Kaiser-Meyer-Olkin (KMO) and Bartlett's test

The results of KMO and Bartlett's Test are reflected in Table 5.26 below in a summarised version. The matrix tables that follow present certain components, which are further divided into finer components. As with the analysis of the staff statistics, the requirement is that the Kaiser-Meyer-Olkin Measure of Sampling Adequacy should be greater than 0.50 and Bartlett's Test of Sphericity less than 0.05. In all instances, the conditions are satisfied, which allows for the factor analysis procedure.

**Table 5.26: KMO and Bartlett's Test**

| | | |
|---|---|---|
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy. | | 0,849 |
| Bartlett's Test of Sphericity | Approx. Chi-Square | 5246,419 |
| | df | 1035 |
| | Sig. | 0,000 |

Table 5.26 above reveals that all of the conditions are satisfied for factor analysis. This means that the Kaiser-Meyer-Olkin Measure of Sampling Adequacy value should be greater than 0.500 and the Bartlett's Test of Sphericity sig. value should be less than 0.05.

Factor analysis is done only for the Likert scale items. The components which are divided into finer components are further explained below in the rotated component matrix.

## 5.8.1.2.1.1 Rotated Component Matrices

| **Table 5.27: Rotated Component Matrices** | Component | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | |
| Personal Computer (PC) | 0,048 | -0,154 | -0,027 | 0,038 | 0,017 | -0,070 | 0,710 | -0,079 | -0,074 | 0,063 | -0,113 | 0,056 | 0,293 | -0,015 | Q3.1 |
| Smart Phone | 0,009 | -0,153 | 0,047 | -0,109 | 0,010 | -0,110 | 0,139 | -0,014 | -0,001 | -0,037 | 0,143 | -0,049 | 0,833 | 0,089 | Q3.2 |
| Tablet | -0,019 | -0,104 | 0,035 | -0,034 | -0,005 | -0,082 | 0,828 | -0,084 | -0,014 | -0,099 | 0,054 | -0,036 | -0,002 | -0,083 | Q3.3 |
| Laptop | -0,130 | -0,300 | 0,023 | -0,078 | 0,075 | 0,198 | 0,496 | 0,067 | -0,044 | -0,324 | -0,058 | 0,167 | 0,367 | -0,108 | Q3.4 |
| Wearables (Smart Watches) | -0,077 | -0,126 | 0,108 | -0,050 | -0,070 | -0,088 | 0,605 | -0,042 | 0,062 | -0,225 | 0,071 | -0,156 | -0,301 | 0,311 | Q3.5 |
| I am often distracted by social media and other entertaining content when using technology for learning | 0,068 | 0,113 | -0,035 | 0,079 | 0,028 | 0,073 | 0,018 | 0,108 | 0,002 | 0,031 | 0,811 | 0,156 | 0,131 | -0,101 | Q6.1 |
| I am often distracted when using technology for learning, as lessons with technology lack innovation | 0,297 | 0,146 | 0,110 | 0,015 | -0,001 | 0,205 | -0,033 | 0,052 | 0,111 | -0,009 | 0,676 | -0,088 | -0,011 | 0,088 | Q6.2 |
| because I cannot afford the technology for online courses | 0,215 | 0,082 | 0,135 | 0,097 | 0,053 | 0,428 | -0,050 | 0,138 | -0,004 | 0,585 | 0,060 | -0,258 | 0,126 | -0,179 | Q7.1 |
| because of insufficient time to study | 0,216 | 0,210 | 0,062 | -0,039 | 0,020 | 0,672 | -0,103 | 0,033 | 0,262 | -0,088 | 0,039 | -0,033 | -0,064 | 0,110 | Q7.2 |
| because of lack of experience in online learning | 0,175 | 0,186 | 0,307 | 0,056 | 0,067 | 0,624 | -0,086 | 0,108 | -0,065 | 0,146 | 0,181 | -0,112 | -0,004 | 0,043 | Q7.3 |
| E-learning takes up more of my time as I need to retrieve information from the LMS | 0,235 | 0,229 | -0,076 | 0,171 | -0,003 | 0,430 | 0,005 | 0,275 | 0,039 | 0,039 | 0,202 | 0,278 | -0,002 | 0,068 | Q8.1 |
| I do not have the time to engage in live e-learnings sessions due to family and work commitments | 0,163 | 0,186 | -0,046 | 0,102 | -0,036 | 0,537 | -0,029 | 0,115 | 0,150 | 0,262 | 0,154 | 0,285 | -0,137 | 0,126 | Q8.2 |
| With e-learning, I do not get to interact personally with my peers | 0,719 | 0,080 | -0,038 | 0,087 | 0,136 | 0,098 | 0,032 | 0,067 | 0,179 | 0,107 | 0,061 | 0,034 | -0,152 | -0,038 | Q9.1 |
| With e-learning, I do not get to interact personally with my lecturers | 0,809 | 0,056 | 0,177 | -0,039 | 0,020 | 0,032 | -0,080 | 0,087 | -0,023 | 0,064 | 0,054 | -0,056 | 0,036 | 0,116 | Q9.2 |
| I find it difficult to engage with e- learning material as it is not interactive | 0,664 | 0,130 | 0,169 | 0,139 | -0,069 | 0,166 | -0,020 | 0,142 | 0,099 | 0,153 | 0,214 | 0,033 | -0,077 | 0,168 | Q9.3 |
| E-learning is concerned with digital learning material only, and does not provide me with interactive learning activities. | 0,544 | 0,176 | 0,184 | 0,345 | 0,068 | 0,169 | -0,050 | 0,099 | -0,054 | 0,045 | 0,142 | 0,141 | 0,060 | 0,039 | Q9.4 |
| E-learning does not provide me with the opportunity to problem solve with my peers | 0,642 | 0,099 | 0,154 | 0,226 | 0,071 | 0,257 | -0,034 | 0,027 | -0,042 | -0,031 | 0,143 | 0,293 | 0,069 | -0,122 | Q9.5 |
| e-learning does not give me the opportunity to interact with my fellow students and lecturers | 0,635 | 0,093 | 0,179 | 0,099 | 0,025 | 0,110 | 0,082 | 0,110 | 0,079 | 0,095 | -0,120 | 0,327 | 0,159 | -0,110 | Q10.1 |
| e-learning does not give me the opportunity to get feedback immediately from my lecturers | 0,438 | 0,000 | 0,263 | 0,041 | 0,133 | 0,014 | -0,002 | 0,094 | 0,039 | -0,001 | 0,030 | 0,642 | -0,075 | 0,030 | Q10.2 |
| e-learning does not allow me to express my thoughts and ideas | 0,460 | 0,090 | 0,318 | 0,121 | -0,031 | -0,007 | -0,078 | -0,008 | 0,093 | 0,049 | 0,167 | 0,561 | 0,046 | 0,099 | Q10.3 |
| I cannot afford technological devices to study via e-learning | 0,204 | 0,174 | 0,037 | 0,102 | 0,077 | 0,054 | -0,204 | 0,010 | 0,066 | 0,762 | 0,019 | 0,068 | -0,111 | 0,079 | Q11.1 |
| There are poor computer facilities in my institution for e-learning purposes | -0,015 | 0,103 | 0,221 | 0,090 | -0,129 | -0,020 | -0,022 | 0,038 | 0,479 | 0,568 | -0,039 | 0,156 | 0,041 | 0,170 | Q11.2 |
| There is poor network connectivity in my institution for e-learning | 0,154 | 0,116 | 0,120 | 0,088 | 0,019 | 0,170 | -0,064 | -0,029 | 0,861 | 0,078 | 0,037 | -0,035 | 0,008 | -0,008 | Q11.3 |
| There is poor Wi-Fi access in my institution for e-learning purposes. | 0,031 | -0,103 | 0,129 | 0,126 | 0,118 | 0,033 | 0,007 | 0,058 | 0,819 | 0,044 | 0,058 | 0,071 | -0,028 | 0,009 | Q11.4 |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| E-learning proves difficult as I do not have the appropriate technological skills | 0,034 | 0,698 | 0,125 | -0,046 | 0,074 | 0,265 | -0,176 | 0,116 | -0,052 | 0,243 | -0,028 | 0,045 | -0,162 | -0,050 | Q12.1 |
| I am afraid to use technology for learning as I find it difficult to access course material or prepare for online assessments | 0,228 | 0,772 | 0,131 | 0,202 | -0,013 | 0,003 | -0,056 | 0,111 | -0,023 | -0,023 | 0,046 | 0,000 | -0,025 | 0,089 | Q12.2 |
| Technology moves too rapidly and I cannot keep up with the advancements | 0,068 | 0,792 | 0,123 | -0,041 | -0,082 | 0,211 | -0,104 | 0,140 | 0,014 | 0,178 | 0,112 | 0,023 | 0,030 | -0,071 | Q12.3 |
| I lack the confidence to use technological equipment to engage in online learning | 0,094 | 0,805 | -0,021 | 0,197 | -0,051 | 0,113 | -0,143 | 0,118 | 0,102 | -0,027 | 0,134 | 0,055 | -0,071 | 0,053 | Q12.4 |
| Submitting my work via e-learning is risky as my work could be lost | 0,231 | 0,262 | 0,080 | 0,067 | 0,056 | 0,101 | -0,156 | 0,772 | 0,048 | 0,012 | 0,089 | 0,083 | 0,047 | 0,053 | Q13.1 |
| Submitting my work via e-learning is risky as sensitive information could be disclosed | 0,125 | 0,198 | 0,235 | 0,073 | 0,071 | 0,123 | -0,038 | 0,803 | 0,010 | 0,050 | 0,070 | 0,014 | -0,034 | 0,051 | Q13.2 |
| The quality of the e-learning system in my institution is not adequate to meet my educational needs | 0,207 | 0,165 | 0,549 | 0,132 | -0,107 | 0,274 | 0,023 | 0,143 | 0,053 | 0,019 | -0,099 | 0,183 | -0,058 | -0,102 | Q14.1 |
| I spend more time learning how to use the software rather than learning the contents | 0,144 | 0,414 | 0,254 | 0,198 | 0,009 | 0,134 | -0,135 | 0,389 | -0,022 | 0,221 | 0,224 | -0,019 | -0,149 | -0,006 | Q14.2 |
| My lecturers do not integrate technology into the curriculum adequately | 0,134 | -0,008 | 0,703 | 0,195 | 0,014 | 0,030 | 0,079 | 0,228 | 0,107 | 0,207 | 0,015 | 0,155 | -0,046 | 0,066 | Q15.1 |
| My lecturers do not plan and prepare learning activities with technology adequately | 0,101 | 0,084 | 0,747 | 0,263 | 0,021 | 0,009 | 0,038 | 0,116 | 0,155 | 0,045 | 0,056 | 0,076 | 0,077 | -0,010 | Q15.2 |
| My lecturers do not consider learning enhancement and student engagement when incorporating technology into the curriculum | 0,230 | 0,120 | 0,841 | 0,133 | -0,019 | 0,042 | -0,003 | -0,014 | 0,080 | -0,023 | 0,023 | -0,022 | 0,037 | 0,009 | Q15.3 |
| The institution does not provide training and workshops to enable my use of e-learning | 0,092 | 0,238 | 0,335 | 0,572 | -0,001 | 0,070 | -0,088 | -0,270 | 0,088 | 0,075 | 0,164 | 0,061 | 0,002 | 0,106 | Q16.1 |
| The institution does not provide orientation courses for e-learning, to improve understanding of course material | 0,019 | 0,121 | 0,386 | 0,667 | 0,033 | 0,078 | -0,112 | -0,213 | -0,004 | -0,011 | 0,151 | 0,125 | -0,034 | 0,213 | Q16.2 |
| My institution does not provide adequate online technical support for my e-learning activities. | 0,127 | 0,164 | 0,170 | 0,737 | 0,064 | 0,080 | 0,061 | 0,064 | 0,084 | 0,246 | -0,026 | 0,097 | 0,024 | 0,048 | Q17.1 |
| My institution does not provide a reliable LMS (Learning Management System) | 0,117 | 0,022 | 0,126 | 0,749 | -0,020 | 0,099 | -0,033 | 0,209 | 0,093 | 0,047 | 0,019 | 0,001 | -0,229 | 0,040 | Q17.2 |
| My institution does not provide a Help Desk for technical support (phone/email/chat) | 0,131 | -0,018 | 0,054 | 0,751 | -0,073 | -0,108 | 0,021 | 0,143 | 0,078 | -0,049 | -0,029 | -0,052 | 0,043 | -0,109 | Q17.3 |
| In classes with large groups, tools such as social networking, micro blogging, other applications should be made available | 0,077 | 0,129 | 0,063 | -0,052 | 0,412 | 0,248 | -0,117 | -0,089 | -0,050 | 0,143 | -0,148 | 0,114 | -0,050 | 0,483 | Q19.1 |
| Learning will be more interactive if lecturers deliver online courses via social media, lecture recordings, online educational games and other similar technologies | 0,076 | -0,024 | -0,029 | 0,191 | 0,353 | 0,106 | 0,041 | 0,198 | 0,076 | 0,053 | 0,023 | 0,026 | 0,154 | 0,673 | Q91.2 |
| The feelings of isolation in online classes can be overcome by online peer tutoring, discussion boards and group video conferences | 0,243 | 0,147 | -0,180 | -0,025 | 0,687 | -0,012 | -0,032 | -0,044 | 0,102 | -0,124 | -0,096 | 0,057 | 0,219 | 0,147 | Q19.3 |
| Having online access to remote tutors will assist in my studies via e-learning | 0,052 | -0,028 | 0,085 | -0,058 | 0,826 | 0,036 | -0,043 | -0,023 | -0,074 | 0,004 | -0,009 | -0,035 | 0,118 | 0,147 | Q19.4 |
| Training programmes and orientation will improve pass rates in the e-learning environment | -0,040 | 0,004 | -0,023 | -0,003 | 0,824 | -0,068 | -0,006 | 0,089 | -0,002 | 0,058 | 0,122 | -0,019 | -0,143 | 0,024 | Q19.5 |
| Flexible online technical support is important for a user-friendly environment for e-learning success | -0,005 | -0,175 | 0,007 | 0,065 | 0,825 | 0,051 | 0,084 | 0,077 | 0,134 | 0,023 | -0,002 | 0,065 | -0,078 | -0,028 | Q19.6 |
| Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization | | | | | | | | | | | | | | | |
| a. Rotation converged in 11 iterations. | | | | | | | | | | | | | | | |

As with the analysis of the staff survey responses, Table 5.26 above indicates how factor analysis for the student survey responses was articulated. The extraction method was derived from the principle component analysis. The table also indicates that the rotation method was Varimax with Kaiser Normalization. Varimax with Kaiser Normalisation, being an orthogonal rotation method, ensures that the number of variables that have high loadings on each factor are minimised. The interpretation of the factors is thus simplified.

Factor techniques are applicable to a variety of situations. Factor analysis/loading thus shows the inter-correlations between variables. This indicates that items of questions that loaded similarly imply measurement along a similar factor. Similarly, as in the analysis for the staff survey, an examination concluded the content of items loading at or above 0.5 (and using the higher or highest loading in instances where items cross-loaded at greater than this value) effectively measured along the various components. The splits within the section are colour coded.

The statements that constituted Questions 6 (distraction to weaker students), 8 (use of technology requires more time), 9 (interactions between peers, lecturers and learning materials), 12 (technological skills challenges), 13 (working online), 16 (training, workshops and orientation) and 17 (technical support) loaded perfectly along a single component. This indicates that the statements that constituted these sections perfectly measured what they set out to measure.

The variables that constituted Questions 3 (Exposure to electronic devices), 7 (difficulty in concentrating on online learning), 10 (lack of human contact), 11 (lack of access to technology), 14 (poor quality of e-learning systems) and 19 (best-practices) loaded along 2 components. This illustrates that the respondents identified different trends within the section.

It is once again noted that there is an overlap amongst the statements, i.e. statements from different questions loaded along the same themes. This illustrates again that this is due mainly to the interpretation of the statements by the respondents.

### 5.8.2 Cross-tabulations

The second Chi square test performed was to determine whether there was a statistically significant relationship between the variables (rows versus columns). While the null hypothesis states that there is no association between the two, the alternate hypothesis indicates that there is an association. Using the Pearson's Chi Square Test, the significant relationships between variables versus Faculty and variables versus Level are indicated in Table 5.28 below. If the p-value (Asymptotic Significance (2-sided)) < 0.05, it implies that there is a significant relationship or difference between the variables. All p-values more than 0.05 indicate that there is no significant relationship.

The significant relationships between the variables versus Faculty and the variables versus Level are indicated in Table 5.28 below.

**Table 5.28 Cross-tabulations**

| VARIABLE | SIGNIFICANCE | RESULT |
|---|---|---|
| Were you trained in school to use a computer? | 0.022 | The 2nd and 3rd year students showed a higher level of agreement than 1st year students to being trained in the use of computers at school. |
| Access to laptops | 0.047 | The faculties of Management Sciences, Health Sciences and Applied Sciences show a higher level of access to laptops than the remaining faculties. |
| Access to Personal computers | 0.032 | The 3rd year students show higher level of access to personal computers as compared to the 1st and 2nd year students. |
| Access to Smart Phones | 0.013 | The 1st and 3rd year students show a higher level of access to smart phones as compared to the 2nd year students. |
| Access to Moodle (Faculty) | 0.002 | The Faculties of Engineering and the Built Environment and Accounting and Informatics indicate a higher level of access to Moodle by students as compared to the other faculties. |

| | | |
|---|---|---|
| Access to Moodle (Level) | 0.010 | The 1st year students indicated a higher level of access to Moodle than the 2nd and 3rd year students. |
| Blended Learning | 0.010 | The Faculty of Engineering and the Built Environment showed a higher level of use of blended learning as compared to the other 5 faculties. |
| Difficulty in concentrating on online learning due to lack of experience | 0.003 | There was a higher level of agreement by the 2nd year students that they find it difficult to concentrate on online learning due to the lack of experience in online learning, as compared to the 1st and 3rd year students. |
| With e-learning, I do not get to interact personally with my lecturers | 0.043 | The Faculties of Management Sciences and Applied Sciences scored a higher level of agreement, as compared to the remaining faculties. |
| I find it difficult to engage with e- learning material as it is not interactive | 0.016 | The 2nd year students showed a higher level of agreement as compared to the 1st and 3rd year students, |
| I am afraid to use technology for learning as I find it difficult to access course material or prepare for online assessments | 0.049 | The Faculty of Management Sciences scored a higher level of agreement as compared to all the other faculties. |
| My lecturers do not integrate technology into the curriculum adequately | 0.003 | The 2nd year students showed a higher level of agreement as compared to the 1st and 3rd year students. |
| My institution does not provide a Help Desk for technical support (phone/email/chat) | 0.030 | The 3rd year students showed a higher level of agreement as compared to the 1st and 2nd year students. |

### 5.8.3 Correlation Analysis

As with the analysis on the staff survey, bivariate correlation was also performed on the (ordinal) data produced from the student survey. While positive values indicated a directly proportional relationship between the variables, a negative value indicated an inverse relationship. All significant relationships were indicated by a * or **. The results are illustrated in Appendix B.

#### 5.8.3.1 Significant correlations

The selected significant correlations are set out below. The statements which indicated directly related proportionalities, and that were considered significant for the study, were analysed and are indicated below according to the sub-themes:

- The correlation value between “Technology moves too rapidly and I cannot keep up with the advancements” and “E-learning proves difficult as I do not have the appropriate technological skills” is 0.068. This is a directly proportional relationship. The more students are unable to keep up with advancements with rapidly moving technology, the more likely it is that they have found e-learning difficult because of a lack of appropriate technological skills.
- The correlation value between “I am afraid to use technology for learning as I find it difficult to access course material or prepare for online assessments” and “I lack the confidence to use technological equipment to engage in online learning” is 0.669. This is a directly related proportionality. The more likely the existence of students’ fear to use technology for learning through difficulty in accessing course materials or preparing for assessments, the more likely it is that they lack confidence to use technological equipment to engage in online learning.
- The correlation value between “My lecturers do not consider learning enhancement and student engagement when incorporating technology into the curriculum” and “The quality of the e-learning system in my institution is not adequate to meet my educational needs” is 0.500. This indicates a directly proportional relationship. The greater the challenge that lecturers do not consider learning enhancement and student engagement when incorporating technology into the curriculum, the more likely it is that the quality of the e-learning system in the institution is not adequate to meet their educational needs.
- The correlation value between “The institution does not provide orientation courses for e-learning to improve understanding of course material” and “The institution does not provide training and workshops to enable my use of e-learning” is 0.689. This is a directly related proportionality. The greater the challenge that the institution does not

provide orientation courses for e-learning to improve the understanding of course material, the more likely it is that there are also no training and workshops provided to enable the use of e-learning.

- The correlation value between “E-learning does not give me the opportunity to get feedback immediately from my lecturers” and “E-learning does not allow me to express my thoughts and ideas” is 0.574. This is a directly proportional relationship. The more the “lack of opportunity for students to express their thoughts and ideas” is seen as a challenge, the more likely it is that e-learning does not give them an opportunity to get feedback immediately from lecturers.
- The correlation value between “E-learning proves difficult as I do not have the appropriate technological skills” and “Technology moves too rapidly and I cannot keep up with the advancements” is 0.668. This is a directly related proportionality. The lesser the student’s level of technological skills, the more likely it is that the student has indicated the lack of the ability to keep up with advancements in technology.
- The correlation value between “Having online access to remote tutors will assist in my studies via e-learning” and “Flexible online technical support is important for a user-friendly environment for e-learning success” is 0.538. This is a directly proportional relationship. The respondents indicate that the more flexible online technical support is viewed as important for a user-friendly environment for e-learning success, the more likely it is that students have online access to remote tutors to assist them via e-learning.
- The correlation value between “With e-learning, I do not get to interact personally with my lecturers” and “I find it difficult to engage with e-learning material as it is not interactive” is 0.528. This is a directly related proportionality. The lesser the interaction with lecturers on e-learning, the more likely it is that the student found it difficult to engage with e-learning material.

- The correlation value between “I find it difficult to engage with e-learning material as it is not interactive” and “E-learning does not provide me with the opportunity to problem-solve with my peers” is 0.500. This is a directly proportional relationship. The greater the lack of opportunity for students to problem-solve with peers, the more likely it is that they have indicated a lack of opportunity to engage with e-learning material.
- The correlation between “My lecturers do not integrate technology into the curriculum adequately” and “My lecturers do not plan and prepare learning activities with technology adequately” is 0.653. This is a directly related proportionality. The lesser the planning and preparation by lecturers for learning activities with technology, the less likely it is that they integrate technology into the curriculum adequately.

#### 5.8.3.2 Negative correlations

As indicated earlier, negative values imply an inverse relationship, i.e. the variables have an opposite effect on each other. As the value of one variable increases, the value of the other decreases.

The analysis of statements significant to the study revealed the following inverse relationships:

- The correlation value between “Flexible online technical support is important for a user-friendly environment for e-learning success” and “There are poor computer facilities in my institution for e-learning purposes” is -0.076. This illustrates that the higher the level of poor computer facilities for e-learning, the lower the technical support for e-learning success.
- The correlation value between “The feelings of isolation in online classes can be overcome by online peer tutoring, discussion boards and group video conferences” and “The quality of the e-learning system in my institution is not adequate to meet my educational needs” is -

0.046. This indicates that the more the inadequacy of the e-learning system is viewed as a challenge, the less likely it is that the feelings of isolation in online classes can be overcome by online peer tutoring, discussion boards and group video conferences.

- The correlation value between “Flexible online technical support is important for a user-friendly environment for e-learning success” and “Technology moves too rapidly and I cannot keep up with the advancements” is -0.196. This indicates that the more rapidly technology moves forward, resulting in the inability to keep up with advancements, the less significant flexible online support becomes as one of the areas that are important for e-learning success.

### 5.8.4 Chi-square tests

As with the staff analysis, a chi square test was also done to determine the relationships, differences and associations in the scoring patterns of student responses in the study. This determined whether the scoring patterns per statement were significantly different per option. The null hypothesis claims that similar numbers of respondents scored across each option for each statement (one statement at a time) and the alternate hypotheses states that there is a significant difference between how they responded.
The sig. values or p-values (as reflected in the tables below) indicate the level of significance. P-values less than 0.05 indicate distributions that are not similar, therefore illustrating that the ways in which respondents scored are significant.

Specific sections are analysed within the themes of challenges of learning with technology and best-practices.

#### 5.8.4.1 Technology in learning is a distraction to weaker students

This section analyses how respondents viewed technology in learning as being a distraction to weaker students. Table 5.29 below shows that both statements indicate a p-value of 0.001. As the significant p-values are less than 0.05 for both statements, this indicates that the differences between the ways respondents scored (Strongly disagree, Disagree, Neutral, Agree, Strongly agree) were significant.

**Table 5.29: Technology in learning is a distraction to weaker students**

| | | Strongly Disagree | | Disagree | | Neutral | | Agree | | Strongly Agree | | Chi Square |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Count | Row N % | Count | Row N % | Count | Row N % | Count | Row N % | Count | Row N % | p-value |
| 6.1 | I am often distracted by social media and other entertaining content when using technology for learning | 35 | 13,7 % | 50 | 19,5 % | 77 | 30,1 % | 66 | 25,8 % | 28 | 10,9 % | < 0.001 |
| 6.2 | I am often distracted when using technology for learning, as lessons with technology lack innovation | 24 | 9,4% | 57 | 22,3 % | 97 | 37,9 % | 55 | 21,5 % | 23 | 9,0% | < 0.001 |

### 5.8.4.2 Lack of concentration with online learning

This section analyses how respondents scored the lack of concentration with online learning. Table 5.30 below shows that statements 7.2 and 7.3 indicate a p-value of 0.001. As the significant p-values are less than 0.05 for those statements, this indicates that the differences between the ways respondents scored (Strongly disagree, Disagree, Neutral, Agree, Strongly agree) were significant. Statement 7.1 indicates a p-value of 0.006 ***

**Table 5.30 Lack of concentration with online learning**

| | | Strongly Disagree | | Disagree | | Neutral | | Agree | | Strongly Agree | | Chi Square |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Count | Row N % | Count | Row N % | Count | Row N % | Count | Row N % | Count | Row N % | p-value |
| 7.1 | because I cannot afford the technology for online courses | 30 | 11,7 % | 45 | 17,6 % | 60 | 23,4 % | 61 | 23,8 % | 60 | 23,4 % | 0,006 |
| 7.2 | because of insufficient time to study | 32 | 12,5 % | 53 | 20,7 % | 77 | 30,1 % | 64 | 25,0 % | 30 | 11,7 % | < 0.001 |
| 7.3 | because of lack of experience in online learning | 21 | 8,2 % | 46 | 18,0 % | 56 | 21,9 % | 72 | 28,1 % | 61 | 23,8 % | < 0.001 |

### 5.8.4.3 The use of technology requires more time

This section analyses how respondents scored the challenge of time in the use of technology for learning. Table 5.31 below shows that both statements indicate a p-value of 0.001. As the significant p-values are less than 0.05 for both statements, this indicates that the differences between the ways respondents scored (Strongly disagree, Disagree, Neutral, Agree, Strongly agree) were significant.

**Table 5.31: The use of technology requires more time**

| | | Strongly Disagree | | Disagree | | Neutral | | Agree | | Strongly Agree | | Chi Square |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Count | Row N % | Count | Row N % | Count | Row N % | Count | Row N % | Count | Row N % | p-value |
| 8.1 | E-learning takes up more of my time as I need to retrieve information from the LMS | 25 | 9,8% | 65 | 25,4 % | 68 | 26,6 % | 74 | 28,9 % | 24 | 9,4% | < 0.001 |
| 8.2 | I do not have the time to engage in live e-learnings sessions due to family and work commitments | 31 | 12,1 % | 52 | 20,3 % | 66 | 25,8 % | 65 | 25,4 % | 42 | 16,4 % | 0,001 |

### 5.8.4.4. The impact of e-learning on interactions between peers, lecturers and learning material

This section analyses how the respondents rated the impact of e-learning on interactions between peers, lecturers and learning material. The scoring patterns indicated in Table 5.32 indicate p-values of less than 0.05 for all statements thus implying distributions that were not similar, and that the ways in which respondents scored (Strongly disagree, Disagree, Neutral, Agree, Strongly agree) were significant.

**Table 5.32: Impact of e-learning on interactions between peers, lecturers and learning material**

| | | Strongly Disagree | | Disagree | | Neutral | | Agree | | Strongly Agree | | Chi Square |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Count | Row N % | Count | Row N % | Count | Row N % | Count | Row N % | Count | Row N % | p-value |
| 9.1 | With e-learning, I do not get to interact personally with my peers | 22 | 8,6 % | 47 | 18,4 % | 47 | 18,4 % | 83 | 32,4 % | 57 | 22,3 % | < 0.001 |
| 9.2 | With e-learning, I do not get to interact personally with my lecturers | 20 | 7,8 % | 62 | 24,2 % | 47 | 18,4 % | 68 | 26,6 % | 59 | 23,0 % | < 0.001 |
| 9.3 | I find it difficult to engage with e-learning material as it is not interactive | 18 | 7,0 % | 51 | 19,9 % | 91 | 35,5 % | 62 | 24,2 % | 34 | 13,3 % | < 0.001 |
| 9.4 | E-learning is concerned with digital learning material only, and does not provide me with interactive learning activities. | 18 | 7,0 % | 55 | 21,5 % | 77 | 30,1 % | 72 | 28,1 % | 34 | 13,3 % | < 0.001 |
| 9.5 | E-learning does not provide me with the opportunity to problem solve with my peers | 22 | 8,6 % | 42 | 16,4 % | 49 | 19,1 % | 84 | 32,8 % | 59 | 23,0 % | < 0.001 |

### 5.8.4.5 Lack of human contact as a challenge

This section analyses how respondents saw the lack of human contact as a challenge. Table 5.33 shows that each statement indicates a p-value of 0.001. As the significant p-values are less than 0.05 for all three statements, this indicates that the differences between the ways in which respondents scored (Strongly disagree, Disagree, Neutral, Agree, Strongly agree) were significant.

**Table 5.33: Lack of human contact as a challenge**

| | | Strongly Disagree | | Disagree | | Neutral | | Agree | | Strongly Agree | | Chi Square |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Count | Row N % | Count | Row N % | Count | Row N % | Count | Row N % | Count | Row N % | p-value |
| 10.1 | e-learning does not give me the opportunity to interact with my fellow students and lecturers | 17 | 6,6 % | 44 | 17,2 % | 56 | 21,9 % | 87 | 34,0 % | 52 | 20,3 % | < 0.001 |
| 10.2 | e-learning does not give me the opportunity to get feedback immediately from my lecturers | 18 | 7,0 % | 44 | 17,2 % | 51 | 19,9 % | 81 | 31,6 % | 62 | 24,2 % | < 0.001 |
| 10.3 | e-learning does not allow me to express my thoughts and ideas | 23 | 9,0 % | 62 | 24,2 % | 78 | 30,5 % | 49 | 19,1 % | 44 | 17,2 % | < 0.001 |

### 5.8.4.6. Lack of access to technology

This section analyses how respondents rated the lack of access to technology in learning as a challenge. Table 5.34 below shows that statements 11.1, 11.2 and 11.3 indicate a p-value of 0.001. As the significant p-values are less than 0.05 for these statements, this indicates that the differences between the ways respondents scored (Strongly disagree, Disagree, Neutral, Agree, Strongly agree) were significant. Statement 11.3 indicates a p-value of 0.002***

**Table 5.34: Lack of access to technology**

| | | Strongly Disagree | | Disagree | | Neutral | | Agree | | Strongly Agree | | Chi Square |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Count | Row N % | Count | Row N % | Count | Row N % | Count | Row N % | Count | Row N % | p-value |
| 11.1 | I cannot afford technological devices to study via e-learning | 22 | 8,6 % | 60 | 23,4 % | 66 | 25,8 % | 50 | 19,5 % | 58 | 22,7 % | < 0.001 |
| 11.2 | There are poor computer facilities in my institution for e-learning purposes | 42 | 16,4 % | 98 | 38,3 % | 80 | 31,3 % | 20 | 7,8 % | 16 | 6,3 % | < 0.001 |
| 11.3 | There is poor network connectivity in my institution for e-learning | 29 | 11,3 % | 62 | 24,2 % | 58 | 22,7 % | 63 | 24,6 % | 44 | 17,2 % | 0,002 |
| 11.4 | There is poor Wi-Fi access in my institution for e-learning purposes. | 32 | 12,5 % | 55 | 21,5 % | 72 | 28,1 % | 60 | 23,4 % | 37 | 14,5 % | < 0.001 |

### 5.8.4.7 Technological skills challenge

This section analyses how the respondents rated technological skills challenges. The scoring patterns indicated in Table 5.35 below indicate p-values of less than 0.05 for all statements, thus implying distributions that were not similar, and that the ways in which respondents scored (Strongly disagree, Disagree, Neutral, Agree, Strongly agree) were significant.

**Table 5.35: Technological skills challenge**

| | | Strongly Disagree | | Disagree | | Neutral | | Agree | | Strongly Agree | | Chi Square |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Count | Row N % | Count | Row N % | Count | Row N % | Count | Row N % | Count | Row N % | p-value |
| 12.1 | E-learning proves difficult as I do not have the appropriate technological skills | 33 | 12,9 % | 78 | 30,5 % | 66 | 25,8 % | 51 | 19,9 % | 28 | 10,9 % | < 0.001 |
| 12.2 | I am afraid to use technology for learning as I find it difficult to access course material or prepare for online assessments | 36 | 14,1 % | 94 | 36,7 % | 67 | 26,2 % | 38 | 14,8 % | 21 | 8,2 % | < 0.001 |
| 12.3 | Technology moves too rapidly and I cannot keep up with the advancements | 38 | 14,8 % | 91 | 35,5 % | 62 | 24,2 % | 43 | 16,8 % | 22 | 8,6 % | < 0.001 |
| 12.4 | I lack the confidence to use technological equipment to engage in online learning | 56 | 21,9 % | 91 | 35,5 % | 60 | 23,4 % | 38 | 14,8 % | 11 | 4,3 % | < 0.001 |

### 5.8.4.8 The risks associated with online studies

This section analyses how respondents scored the risks associated with online studies. Table 5.36 shows that both statements indicate a p-value of 0.001. As the significant p-values are less than 0.05 for both statements, this indicates that the differences in the ways in which respondents scored (Strongly disagree, Disagree, Neutral, Agree, Strongly agree) were significant.

**Table 5.36: Risks associated with online studies**

| | | Strongly Disagree | | Disagree | | Neutral | | Agree | | Strongly Agree | | Chi Square |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Count | Row N % | Count | Row N % | Count | Row N % | Count | Row N % | Count | Row N % | p-value |
| 13.1 | Submitting my work via e-learning is risky as my work could be lost | 24 | 9,4 % | 55 | 21,6 % | 63 | 24,7 % | 65 | 25,5 % | 48 | 18,8 % | < 0.001 |
| 13.2 | Submitting my work via e-learning is risky as sensitive information could be disclosed | 18 | 7,1 % | 54 | 21,2 % | 74 | 29,0 % | 72 | 28,2 % | 37 | 14,5 % | < 0.001 |

### 5.8.4.9 The poor quality of e-learning systems

This section analyses how respondents scored the poor quality of e-learning systems. Table 5.37 below shows that both statements indicate a p-value of 0.001. As the significant p-values are less than 0.05 for both statements, this indicates that the differences between the ways in which respondents scored (Strongly disagree, Disagree, Neutral, Agree, Strongly agree) were significant.

**Table 5.37: Poor quality of e-learning systems**

| | | Strongly Disagree | | Disagree | | Neutral | | Agree | | Strongly Agree | | Chi Square |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Count | Row N % | Count | Row N % | Count | Row N % | Count | Row N % | Count | Row N % | p-value |
| 14.1 | The quality of the e-learning system in my institution is not adequate to meet my educational needs | 22 | 8,6 % | 65 | 25,5 % | 90 | 35,3 % | 54 | 21,2 % | 24 | 9,4 % | < 0.001 |
| 14.2 | I spend more time learning how to use the software rather than learning the contents | 24 | 9,4 % | 68 | 26,7 % | 75 | 29,4 % | 59 | 23,1 % | 29 | 11,4 % | < 0.001 |

### 5.8.4.10 Poor effort from lecturers

This section analyses how the respondents rated poor effort from lecturers. The scoring patterns indicated in Table 5.38 below indicate p-values of less than 0.05 for all statements, thus implying distributions that were not similar, and that the ways in which respondents scored (Strongly disagree, Disagree, Neutral, Agree, Strongly agree) were significant.

**Table 5.38: Poor effort from lecturers**

| | | Strongly Disagree | | Disagree | | Neutral | | Agree | | Strongly Agree | | Chi Square |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Count | Row N % | Count | Row N % | Count | Row N % | Count | Row N % | Count | Row N % | p-value |
| 15.1 | My lecturers do not integrate technology into the curriculum adequately | 28 | 10,9 % | 85 | 33,2 % | 91 | 35,5 % | 31 | 12,1 % | 21 | 8,2 % | < 0.001 |
| 15.2 | My lecturers do not plan and prepare learning activities with technology adequately | 42 | 16,4 % | 98 | 38,3 % | 61 | 23,8 % | 44 | 17,2 % | 11 | 4,3 % | < 0.001 |
| 15.3 | My lecturers do not consider learning enhancement and student engagement when incorporating technology into the curriculum | 33 | 12,9 % | 87 | 34,0 % | 79 | 30,9 % | 42 | 16,4 % | 15 | 5,9 % | < 0.001 |

#### 5.8.4.11 The lack of training, workshops and/or orientation

This section analyses how respondents scored the lack of training, workshops and orientation. Table 5.39 shows that both statements indicate a p-value of 0.001. As the significant p-values are less than 0.05 for both statements, this indicates that the differences between the ways respondents scored (Strongly disagree, Disagree, Neutral, Agree, Strongly agree) were significant.

**Table 5.39: Lack of training, workshops and/or orientation**

| | | Strongly Disagree | | Disagree | | Neutral | | Agree | | Strongly Agree | | Chi Square |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Count | Row N % | Count | Row N % | Count | Row N % | Count | Row N % | Count | Row N % | p-value |
| 16.1 | The institution does not provide training and workshops to enable my use of e-learning | 41 | 16,1 % | 82 | 32,2 % | 62 | 24,3 % | 45 | 17,6 % | 25 | 9,8 % | < 0.001 |
| 16.2 | The institution does not provide orientation courses for e-learning, to improve understanding of course material | 39 | 15,3 % | 92 | 36,1 % | 59 | 23,1 % | 44 | 17,3 % | 21 | 8,2 % | < 0.001 |

#### 5.8.4.12 The lack of technical support

This section analyses how the respondents rated the lack of technical support. The scoring patterns indicated in Table 5.40 below indicate p-values of less than 0.05 for all statements thus implying distributions that were not similar, and that the ways in which respondents scored (Strongly disagree, Disagree, Neutral, Agree, Strongly agree) were significant.

**Table 5.40: Lack of technical support**

| | | Strongly Disagree | | Disagree | | Neutral | | Agree | | Strongly Agree | | Chi Square |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Count | Row N % | Count | Row N % | Count | Row N % | Count | Row N % | Count | Row N % | p-value |
| 17.1 | My institution does not provide adequate online technical support for my e-learning activities. | 29 | 11,4 % | 69 | 27,1 % | 79 | 31,0 % | 56 | 22,0 % | 22 | 8,6 % | < 0.001 |
| 17.2 | My institution does not provide a reliable LMS (Learning Management System) | 31 | 12,2 % | 96 | 37,6 % | 83 | 32,5 % | 31 | 12,2 % | 14 | 5,5 % | < 0.001 |
| 17.3 | My institution does not provide a Help Desk for technical support (phone/email/chat) | 47 | 18,4 % | 105 | 41,2 % | 58 | 22,7 % | 33 | 12,9 % | 12 | 4,7 % | < 0.001 |

#### 5.8.4.13 Best-practices for e-learning

This section analyses how the respondents rated best-practices for e-learning. The scoring patterns indicated in Table 5.41 below indicate p-values of less than 0.05 for all statements thus implying distributions that were not similar, and that the ways in which respondents scored (Strongly disagree, Disagree, Neutral, Agree, Strongly agree) were significant.

**Table 5.41: Best practices for e-learning**

| | | Strongly Disagree | | Disagree | | Neutral | | Agree | | Strongly Agree | | Chi Square |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Count | Row N % | Count | Row N % | Count | Row N % | Count | Row N % | Count | Row N % | p-value |
| 19.1 | In classes with large groups, tools such as social networking, micro blogging, other applications should be made available | 5 | 2,0% | 7 | 2,8% | 44 | 17,5% | 128 | 51,0% | 67 | 26,7% | < 0.001 |
| 19.2 | Learning will be more interactive if lecturers deliver online courses via social media, lecture recordings, online educational games and other similar technologies | 8 | 3,2% | 16 | 6,4% | 53 | 21,1% | 100 | 39,8% | 74 | 29,5% | < 0.001 |
| 19.3 | The feelings of isolation in online classes can be overcome by online peer tutoring, discussion boards and group video conferences | 8 | 3,2% | 14 | 5,6% | 59 | 23,5% | 101 | 40,2% | 69 | 27,5% | < 0.001 |
| 19.4 | Having online access to remote tutors will assist in my studies via e-learning | 4 | 1,6% | 8 | 3,2% | 38 | 15,1% | 123 | 49,0% | 78 | 31,1% | < 0.001 |
| 19.5 | Training programmes and orientation will improve pass rates in the e-learning environment | 6 | 2,4% | 8 | 3,2% | 43 | 17,1% | 114 | 45,4% | 80 | 31,9% | < 0.001 |
| 19.6 | Flexible online technical support is important for a user-friendly environment for e-learning success | 3 | 1,2% | 2 | 0,8% | 51 | 20,3% | 116 | 46,2% | 79 | 31,5% | < 0.001 |

## 5.9 Triangulation

Basias and Pollalis (2018: 101) posit that the purpose of triangulation is to increase the credibility and validity of results, thus allowing for the drawing of valid conclusions. Carter *et al.* (2014: 545) state that triangulation tests the validity of results through “the convergence of information from different sources”. The authors also define four types of triangulation, namely method triangulation (the use of multiple methods of data collection about the same phenomena); theory triangulation (analysis and interpretation of data from different theories); investigator triangulation (multiple researchers provide observations and conclusions on the same study); and data source triangulation (collection of data from different types of people, i.e. individuals, groups or communities who contribute multiple perspectives and validation of data).

The nature of this study entailed data source triangulation as the data was collected from teaching staff and students. Online questionnaires were administered to 220 full-time lecturers and 375 full-time students from all six faculties of the Durban campuses at DUT. The information from these two data sources was triangulated according to the following themes within the study:

The following themes were used in this study and hence, some of the sub-themes within each theme are triangulated accordingly:

1. E-learning practices/trends
    - Asynchronous methods
    - Synchronous methods
2. Challenges of e-learning in teaching and learning
    - Lack of skills/knowledge in the use of technology
    - Lack of access to technology
    - Poor infrastructure

- Lack of technical support
- Lack of human contact
- Effort from lecturers
- Upgrades to technology
- Feedback from lecturers

3. Best-practices of e-learning in teaching and learning
    - Workshops/training
    - Interactive e-learning techniques

#### 5.9.1 Triangulation: E-learning practices/trends

##### 5.9.1.1. Asynchronous methods

Asynchronous methods of teaching and learning are defined by the flexibility they offer. This type of technology provides for students to be in consultation with lecturers over the internet, but at different times. The findings indicate that the majority of teaching staff conduct their asynchronous teaching via e-mail, as compared to discussion boards, blogs or wikis. The findings from the student survey revealed that a majority of students use e-mail as a method of online learning, as compared to other asynchronous methods.

##### 5.9.1.2 Synchronous methods

Synchronous methods occur in real time, with lecturers and students communicating together at the same time via instant messaging, chats, virtual classrooms, video conferencing and Skype. The findings indicate that the majority of lecturers use instant messaging and chats for e-learning. The findings of the student survey indicate that just under half the students engage in instant messaging and chats for e-learning purposes.

### 5.9.2 Triangulation: Challenges relating to e-learning

With respect to the challenges experienced relating to e-learning, a comparison of the findings on each of the sub-themes reveals the following:

#### 5.9.2.1 Lack of skills/knowledge in the use of technology

A majority of lecturers surveyed disagreed that they do not have the skills to engage with technology for teaching. Similarly, just under half of the students also disagreed that they find e-learning difficult as they do not have the proper technological skills.

#### 5.9.2.2 Lack of access to technology

The findings from the lecturer survey indicate that the majority of lecturers lack access to technology for e-learning as they have outdated computers and laptops. This is in agreement with the findings from the student survey. The findings indicate that just under half of the students lack access to technology for e-learning as they cannot afford technological devices.

#### 5.9.2.3 Poor infrastructure

The findings show that the majority of lecturers have indicated that there is insufficient access to Wi-Fi and bandwidth to access resources for teaching with technology. The findings from the student survey have revealed that just under half of the students believe that there is poor network connectivity and a lack of Wi-Fi access at the institution.

#### 5.9.2.4 Lack of technical support

The findings have indicated that just under half of the lecturers believe that there is a lack of technical support at DUT. This differs from the finding of the student survey. The majority of students indicated that they do not agree that there is a lack of technical support.

#### 5.9.2.5 Lack of human contact

Although technology is beneficial for communicating to learners, the findings indicate that the majority of lecturers are concerned about losing face-to-face interaction with students, which is in agreement with the findings from the student survey, which shows that the majority of the respondents believe that they do not get to interact personally with their lecturers in an online environment.

#### 5.9.2.6 Effort from lecturers

The findings show that the majority of lecturers are reluctant to invest additional effort into delivering curricula via technology. However, the findings from the student survey differ as just under half the respondents disagreed that lecturers do not integrate technology into the curriculum adequately.

#### 5.9.2.7 Upgrades to technology

The findings indicate that almost half the lecturers agreed that the rapid evolution of technology creates overwhelming stress in their teaching practices, which differed from the findings of the student survey. The majority of students do not believe that the advancements in technology are a challenge.

#### 5.9.2.8 Feedback from lecturers

The findings from the lecturer survey have revealed that the majority of respondents believed that the lack of technological skills hinders them from providing appropriate feedback to students. This was in agreement with the findings from the student survey, which revealed that the majority of students agree that e-learning does not give them the opportunity to get feedback immediately from lecturers.

### 5.9.3 Triangulation: Best-practices for teaching and learning with e-learning

A comparison of the findings relating to the sub-themes on the best practices for teaching and learning with e-learning reveals the following:

#### 5.9.3.1 Workshops and Training

The findings from the staff survey indicate that a majority of lecturers believe that workshops and seminars are necessary to ensure academic development for technologically enhanced practices. Similarly, the findings from the student survey show that the majority of respondents believe that training programmes and orientation are important for improving pass rates in an e-learning environment.

#### 5.9.3.2 Interactive techniques

The findings show that a majority of lecturers believe that social media, lecture recordings, online collaboration tools and other similar technologies will prove beneficial if integrated into their teaching practices. This is in agreement with the findings from the student survey which indicate that the majority of students believe that learning will be more interactive if lecturers deliver online courses via social media, lecture recordings and online educational games.

## 5.10 Hypothesis testing

Larini and Barthes (2018:76) explain that once a researcher collects data relating to variables concerning a sample population, the analysis of that data can result in formulating hypotheses. The authors state further that testing hypotheses leads to results whereby conclusions can be reached on the basis of these results. Hypothesis testing was conducted using the Structural Equation Model methodology, as discussed below.

### 5.10.1 Use of the Structural Equation Model for hypothesis testing

The Structural Equation Model (SEM) is a multivariate statistical result obtained using structural relationships, applying a combination of factor analysis and multiple regression analysis techniques. SEM is used to analyse the structural relationship between measured variables and latent constructs (Habib, Pathik and Maryam (2014: 60). SEM was used to analyse the relationship between variables based on the lack of skills/knowledge/engagement in the use of technology and rigid teaching practices; challenges in integrating technology into teaching practices and the lack of skills/knowledge/engagement in the use of technology; and best-practices in staff development and effective teaching practices through the use of technology.

The null hypothesis states that there is no relationship between variables, while the alternative hypothesis indicates that there is a relationship between the variables. Chi-square tests the null hypothesis that the over-identified (reduced) model fits the data as well as does a just-identified (full, saturated) model (Bryman 2016: 347). In a just-identified model, there is a direct path (not through an intervening variable) from each variable to each other variable. In such a model, the Chi-square will always have a value of zero, since the fit will always be perfect (Wuensch 2017: 8). The probability should **not** be significant. In this model, the chi square p-value is greater than 0.05 (and is therefore not significant) and meets the criteria.

The structural equation model (SEM) methodology was applied to all three hypotheses as discussed below.

#### 5.10.1.1 Hypothesis 1: The lack of skills/knowledge/engagement in the use of technology contributes to rigid teaching practices

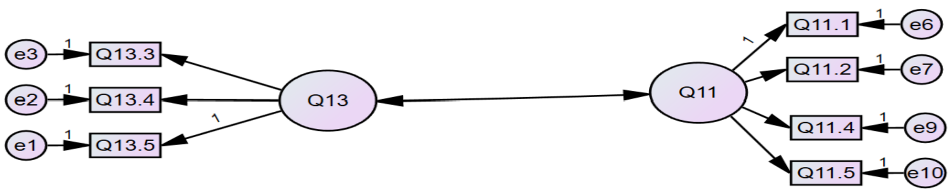


**Figure 5.43: Structural Equation Model 1:** The lack of skills/knowledge/engagement in the use of technology contributes to rigid teaching practices

The path diagram for the modified SEM1 is shown above.

**SEM1: Result (Default model)**

Minimum was achieved

Chi-square = 14.332

Degrees of freedom = 13

Probability level = .351

**Table 5.42: SEM1: Regression Weights: (Group number 1 - Default model)**

| | Estimate | S.E. | C.R. | P | Label |
|---|---|---|---|---|---|
| Q13.5 <--- F1 | 1.000 | | | | |
| Q13.4 <--- F1 | 2.973 | .616 | 4.828 | *** | par_1 |
| Q13.3 <--- F1 | 2.553 | .524 | 4.875 | *** | par_2 |
| Q11.1 <--- F2 | 1.000 | | | | |
| Q11.2 <--- F2 | .924 | .119 | 7.747 | *** | par_3 |
| Q11.4 <--- F2 | 1.040 | .126 | 8.239 | *** | par_4 |
| Q11.5 <--- F2 | .640 | .096 | 6.673 | *** | par_5 |

The variables loaded strongly along their various factors (significant p-values indicated by *** $p < 0.001$).

**Table 5.43: SEM1: Standardized Regression Weights: (Group number 1 - Default model)**

| | | | Estimate |
|---|---|---|---|
| Q13.5 | <--- | F1 | .426 |
| Q13.4 | <--- | F1 | .841 |
| Q13.3 | <--- | F1 | .820 |
| Q11.1 | <--- | F2 | .729 |
| Q11.2 | <--- | F2 | .710 |
| Q11.4 | <--- | F2 | .788 |
| Q11.5 | <--- | F2 | .599 |

Variables that had poor loading coefficients (< 0.60 on the standardized weights table) were omitted from the model. (The suggested value is 0.70.)

The parameters are estimated by maximum likelihood (ML) methods, which (is an iterative procedure that) attempts to maximize the likelihood that obtained values of the criterion variable will be correctly predicted (Maydeu-Olivares, 2017:384). It is observed that most of the first order weights are greater than 0.7, with only the first and last having values less than 0.7. These have been retained as all of the criteria for the fit indices are met.

**SEM1: Model Fit Summary**

The suggested acceptable value for relative chi-square, CMIN/DF, should not be greater than 5, which is used to reduce dependency on sample size. However, the cut-off points for TLI, CFI, NFI and IFI are between zero to one. A good model is indicated by Root Mean Square Error of Approximation (RMSEA) value of less than or equal to 0.05 (Maydeu-Olivares 2017: 388).

**Table 5.44: SEM1: CMIN**

| Model | NPAR | CMIN | DF | P | CMIN/DF |
|---|---|---|---|---|---|
| **Default model** | 15 | 14.332 | 13 | .351 | 1.102 |
| **Saturated model** | 28 | .000 | 0 | | |
| **Independence model** | 7 | 349.712 | 21 | .000 | 16.653 |

CMIN is a Chi-square statistic comparing the tested model and the independence model to the saturated model. The ratio CMIN/DF, the relative chi-square, is an index of how much the fit of data to model has been reduced by dropping one or more paths. The CMIN/DF is less than the acceptable value of 5 (1.102). This meets the CMIN/DF condition.

**Table 5.45: SEM1: RMR, GFI**

| Model | RMR | GFI | AGFI | PGFI |
|---|---|---|---|---|
| **Default model** | .049 | .977 | .950 | .453 |
| **Saturated model** | .000 | 1.000 | | |
| **Independence model** | .389 | .562 | .416 | .422 |

The GFI value (0.977) exceeds the recommended value of 0.95.

**Table 5.46: SEM1: Baseline Comparisons**

| Model | NFI Delta1 | RFI rho1 | IFI Delta2 | TLI rho2 | CFI |
|---|---|---|---|---|---|
| **Default model** | .959 | .934 | .996 | .993 | .996 |
| **Saturated model** | 1.000 | | 1.000 | | 1.000 |
| **Independence model** | .000 | .000 | .000 | .000 | .000 |

These goodness of fit indices compare the model to the independence model rather than to the saturated model. The Normed Fit Index (NFI) is simply the difference between the two models' chi-squares divided by the chi-square for the independence model. For this data, the NFI is 0.959, which exceeds the recommended value of 0.9 for a good fit. The Comparative Fit Index (CFI) uses a similar approach (with a non-central chi-square) and is said to be a good index for use even with small samples. It ranges from 0 to 1, like the NFI, and 0.95 (or 0.9 or higher) indicates good fit. The CFI value is 0.996.

**Table 5.47: SEM1: The Root Mean Square Error of Approximation (RMSEA)**

| **Model** | **RMSEA** | **LO 90** | **HI 90** | **PCLOSE** |
|---|---|---|---|---|
| **Default model** | .025 | .000 | .084 | .686 |
| **Independence model** | .313 | .284 | .342 | .000 |

The Root Mean Square Error of Approximation (RMSEA) estimates the lack of fit compared to the saturated model. A RMSEA of .05 or less indicates good fit, and between .05 and .08 is an adequate fit. LO 90 and HI 90 are the lower and upper ends of a 90% confidence interval on this estimate. The RMSEA value (0.025) and the p-value (0.686) meet the requirements of an excellent model.

**SEM1: Summary**

A few statements from each section were eliminated in the model. An inspection of the coefficients for each latent variable indicated high factor loadings. In addition, the path coefficients are reflected on the diagram. All of the coefficients are high, indicating strong positive correlations between the latent variables.

Even though this was a newly developed construct, the model fit indices are excellent.

The covariance between the dimensions was significant (p = 0.003) and the correlation was 0.362. This is a directly proportional relationship. This implies that **a lack of skills/knowledge/engagement in the use of technology contributes to rigid teaching practices** (as one increases, so does the other, and vice versa).

**5.10.1.2 Hypothesis 2: Challenges in integrating technology into teaching practices contribute to the lack of skills/knowledge/engagement in the use of technology**

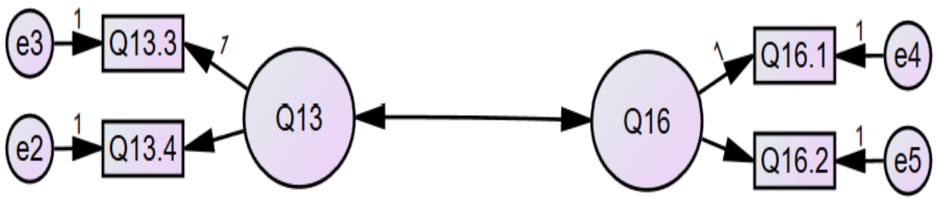


**Figure 5.44: Structural Equation Model 2:** Challenges in integrating technology into teaching practices contribute to the lack of skills/knowledge/engagement in the use of technology

**SEM2: Result (Default model)**

Minimum was achieved

Chi-square = .057

Degrees of freedom = 1

Probability level = .811

As in the case of SEM1In this model, the chi square p-value is also greater than 0.05 (and is therefore not significant) and meets the criteria.

**Table 5.48: SEM2: Regression Weights: (Group number 1 - Default model)**

| | | | Estimate | S.E. | C.R. | P | Label |
|---|---|---|---|---|---|---|---|
| Q13.4 | <--- | Q13 | 1.075 | .310 | 3.466 | *** | par_1 |
| Q13.3 | <--- | Q13 | 1.000 | | | | |
| Q16.1 | <--- | Q16 | 1.000 | | | | |
| Q16.2 | <--- | Q16 | .971 | .346 | 2.802 | .005 | par_2 |

The variables loaded strongly along their various factors (significant p-values indicated by *** $p < 0.001$).

**Table 5.49: SEM2: Standardized Regression Weights: (Group number 1 - Default model)**

| | | | Estimate |
|---|---|---|---|
| Q13.4 | <--- | Q13 | .810 |
| Q13.3 | <--- | Q13 | .855 |
| Q16.1 | <--- | Q16 | .726 |
| Q16.2 | <--- | Q16 | .778 |

Variables that had poor loading coefficients (< 0.60 on the standardized weights table) were omitted from the model (the suggested value is 0.70.).

With the ML methods (as explained for SEM1), it is observed that all of the first order weights are greater than 0.7 in SEM2.

**SEM2: Model Fit Summary**

**Table 5.50:9 SEM2: CMIN**

| Model | NPAR | CMIN | DF | P | CMIN/DF |
|---|---|---|---|---|---|
| **Default model** | 9 | .057 | 1 | .811 | .057 |
| **Saturated model** | 10 | .000 | 0 | | |
| **Independence model** | 4 | 175.119 | 6 | .000 | 29.187 |

As in SEM1, the CMIN/DF is less than the acceptable value of 5 (0.057), meaning that this meets the CMIN/DF condition.

**Table 5.51: SEM2: RMR, GFI**

| Model | RMR | GFI | AGFI | PGFI |
|---|---|---|---|---|
| **Default model** | .003 | 1.000 | .998 | .100 |
| **Saturated model** | .000 | 1.000 | | |
| **Independence model** | .406 | .679 | .466 | .408 |

The GFI value (1.000) exceeds the recommended value of 0.95.

**Table 5.52: SEM2: Baseline Comparisons**

| Model | NFI Delta1 | RFI rho1 | IFI Delta2 | TLI rho2 | CFI |
|---|---|---|---|---|---|
| **Default model** | 1.000 | .998 | 1.005 | 1.033 | 1.000 |
| **Saturated model** | 1.000 | | 1.000 | | 1.000 |
| **Independence model** | .000 | .000 | .000 | .000 | .000 |

The NFI is 1.000, which exceeds the recommended value of 0.9 for a good fit. The Comparative Fit Index (CFI) uses a similar approach (with a non-central chi-square) and is said to be a good index for use even with small samples. It ranges from 0 to 1, like the NFI, and 0.95 (or 0.9 or higher) indicates a good fit. The CFI value is 1.000.

**Table 5.53: SEM2: Root Mean Square Error of Approximation (RMSEA)**

| Model | RMSEA | LO 90 | HI 90 | PCLOSE |
|---|---|---|---|---|
| **Default model** | **.000** | **.000** | **.130** | **.845** |
| **Independence model** | **.420** | **.367** | **.474** | **.000** |

The RMSEA value (0.000) and the p-value (0.845) meet the requirements of an excellent model.

**SEM2: Summary**

As with SEM1, a few statements from each section were eliminated in the model and an inspection of the coefficients for each latent variable indicated high factor loadings. The path coefficients are reflected on the diagram and all of the coefficients are high indicating strong positive correlations between the latent variables. Similarly, as in SEM1, even though this was a newly developed construct, the model fit indices are excellent.

For hypothesis 2 as well, the co-variance between the dimensions was significant ($p = 0.017$) and the correlation was 0.304. This is a directly proportional relationship. This implies that **challenges in integrating technology into teaching practices contributes to lack of skills/knowledge/engagement in the use of technology** (as one increases, so does the other, and vice versa).

**5.10.1.3 Hypothesis 3: Best-practices in staff development contribute to more effective teaching practices through the use of technology**

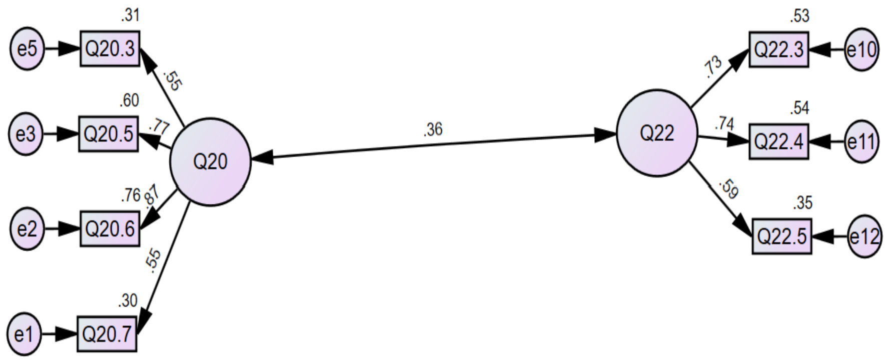


**Figure 5.45: Structural Equation Model 3:** Best-practices in staff development contribute to more effective teaching practices through the use of technology

**SEM3: Result (Default model)**

Minimum was achieved

Chi-square = 21.966

Degrees of freedom = 13

Probability level = .056

As with SEM1 and SEM2, the chi square p-value is greater than 0.05 (and is therefore not significant) and meets the criteria.

**Table 5.54: SEM3: Regression Weights: (Group number 1 - Default model)**

| | | | Estimate | S.E. | C.R. | P | Label |
|---|---|---|---|---|---|---|---|
| Q20.7 | <--- | Q20 | 1.000 | | | | |
| Q20.6 | <--- | Q20 | 1.730 | .262 | 6.615 | *** | par_1 |
| Q20.5 | <--- | Q20 | 1.495 | .229 | 6.529 | *** | par_2 |
| Q20.3 | <--- | Q20 | 1.155 | .215 | 5.366 | *** | par_3 |
| Q22.3 | <--- | Q22 | 1.000 | | | | |
| Q22.4 | <--- | Q22 | .989 | .164 | 6.013 | *** | par_4 |
| Q22.5 | <--- | Q22 | .906 | .158 | 5.725 | *** | par_5 |

The variables loaded strongly along their various factors (significant p-values indicated by *** $p < 0.001$).

**Table 5.55: SEM3: Standardized Regression Weights: (Group number 1 - Default model)**

| | | | Estimate |
|---|---|---|---|
| Q20.7 | <--- | Q20 | .547 |
| Q20.6 | <--- | Q20 | .874 |
| Q20.5 | <--- | Q20 | .773 |
| Q20.3 | <--- | Q20 | .554 |
| Q22.3 | <--- | Q22 | .727 |
| Q22.4 | <--- | Q22 | .736 |
| Q22.5 | <--- | Q22 | .589 |

Variables that had poor loading coefficients (< 0.60 on the standardized weights table) were omitted from the model (The suggested value is 0.70.).

Here it is observed that all but 3 of the first order weights are greater than 0.7. The 3 statements are retained as the fit indices are acceptable.

**SEM3: Model Fit Summary**

**Table 5.56: SEM3: CMIN**

| Model | NPAR | CMIN | DF | P | CMIN/DF |
|---|---|---|---|---|---|
| **Default model** | 22 | 21.966 | 13 | .056 | 1.690 |
| **Saturated model** | 35 | .000 | 0 | | |
| **Independence model** | 7 | 323.616 | 28 | .000 | 11.558 |

As indicated in SEM1 and SEM2, the CMIN/DF is less than the acceptable value of 5 (1.690), thus meeting the CMIN/DF condition.

**Table 5.57: SEM3: Baseline Comparisons**

| Model | NFI Delta1 | RFI rho1 | IFI Delta2 | TLI rho2 | CFI |
|---|---|---|---|---|---|
| **Default model** | .932 | .854 | .971 | .935 | .970 |
| **Saturated model** | 1.000 | | 1.000 | | 1.000 |
| **Independence model** | .000 | .000 | .000 | .000 | .000 |

The NFI is 0.932, which exceeds the recommended value of 0.9 for a good fit. The Comparative Fit Index (CFI) uses a similar approach (with a non-central chi-square) and is said to be a good index for use, even with small samples. It ranges from 0 to 1, like the NFI, and 0.95 (or 0.9 or higher) indicates a good fit. The CFI value is 0.970.

**Table 5.58: SEM3: Root Mean Square Error of Approximation RMSEA**

| Model | RMSEA | LO 90 | HI 90 | PCLOSE |
|---|---|---|---|---|
| **Default model** | .066 | .000 | .112 | .263 |
| **Independence model** | .257 | .232 | .282 | .000 |

As with SEM1 and SEM2, LO 90 and HI 90 are the lower and upper ends of a 90% confidence interval on this estimate. The RMSEA value (0.066) and the p-value (0.263) meet the requirements of an excellent model.

**SEM 3: SUMMARY**

As with SEM1 and SEM2, a few statements from each section were eliminated in the model and an inspection of the coefficients for each latent variable indicated high factor loadings. The path coefficients are reflected on the diagram. Similarly, as in SEM1 and SEM2, all of the coefficients are high, indicating strong positive correlations between the latent variables. Even though this was a newly developed construct, the model fit indices are excellent. The covariance between the dimensions was significant (p = 0.003) and the correlation was 0.356. This is a directly proportional relationship. This implies that **best-practices in staff development contribute to more effective teaching practices through the use of technology** (as one increases, so does the other, and vice versa).

### 5.11 Conclusion

Mligo (2016: 115) states that the raw data collected from a survey has no meaning unless it is turned into evidence by being analysed, organised, broken into manageable units, synthesized and then discovered into what is important, what can be learned and how the information or results are interpreted and communicated. Therefore, the main purpose of this chapter was the presentation, analysis and interpretation of the data gathered from the responses of the teaching staff and the students on the challenges and best-practices of teaching and learning with technology. The first part of the chapter focussed on the descriptive statistics, which were presented using graphs and tables and which illustrated the size and shape of the data collected. Relevant literature reviewed in the preceding chapters was also linked to the data analysis to ensure completeness in the interpretation. Factor analysis, correlation analysis and Pearson's Chi-Square techniques were used for the inferential statistical analysis.

The next chapter presents the conclusion and recommendations of this study.

# CHAPTER SIX

# SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

## 6.1 Introduction

Globally, e-learning has become the focal point in all educational institutions. This study delved into the trends, challenges and best-practices of e-learning that have impacted both lecturers and students. To understand the impact of e-learning on teaching and learning, the researcher unpacked, via the literature review, the concepts of teaching and learning at HEIs, as well as how technology would impact on these concepts for both staff and students. The administered surveys were pivotal for gathering data which contributed to the objectives of this study. The previous chapter focussed on a discussion of the data collected; the analysis of the descriptive statistics and inferential statistics illustrating the reliability and the validity of the data; and the findings of each sub-theme presented. The analysis and interpretation of the data, coupled with the implications of the Covid-19 pandemic, revealed the reasons for HEIs urgently addressing the challenges of e-learning for both teaching and learning. Some of the best-practices suggested by the respondents are supported by the best-practices as revealed in literature.

Many significant findings arose from the analysis of the data from both the staff and student surveys. Mligo (2016: 124) advocates that the concluding chapter should focus on certain aspects derived from the study, i.e. a summary of findings, conclusions, a summary of contributions to knowledge, recommendations for implementation and suggestions for further research. This chapter therefore presents an overview of the study and focuses on providing relevant conclusions.

## 6.2 The objectives of the study

The objectives of the study as articulated in the introduction to the study were:

1. To explore the practices and trends in the use of e-learning technologies for teaching and learning in higher education, particularly at UoTs (through a review of related literature);
2. To investigate the effectiveness of using e-learning technologies in teaching and learning in higher education (through a review of related literature);
3. To ascertain e-learning practices and trends in the use of e-learning technologies for teaching and learning at DUT;
4. To determine the challenges encountered in the use of e-learning technologies for teaching and learning at DUT;
5. To determine the most feasible strategies to address the challenges with e-learning technologies in teaching and learning at DUT; and
6. To develop a suitable framework to address challenges in respect of teaching and learning with e-learning technology and the best-practices that could be applicable in higher education.

## 6.3 Summary of Findings

This section presents a summary of the findings of the study. The first part elucidates the findings from the lecturer survey and the second part pertains to the student survey.

### 6.3.1 The lecturer survey

The lecturer survey was administered online to 220 staff and yielded a 73% response rate. The questionnaire contained 71 items, founded on the themes of teaching practices, general teaching challenges, e-learning trends and practices, challenges of teaching with technology and best-practices.

#### 6.3.1.1 Teaching practices

With respect to the methods that lecturers embrace as being important in their teaching practices:

- The majority of the respondents indicated that developing critical skills, stimulating classroom interaction and encouraging learning through the students' own efforts were important methods in their teaching practices.
- The majority also indicated that the transmission of information, developing the skills and attitudes of students and promoting the development of the students' own conceptual understanding were all important to teaching and learning.

#### 6.3.1.2 General teaching challenges

The following findings were noted regarding general teaching challenges:

- The majority of the respondents felt that limited resources, a diverse population (with multi-lingualism and varied levels of preparedness) and the lack of university capabilities were significant teaching challenges; and
- Almost half of the respondents also agreed that the authoritarian system in South African education stifles development.

#### 6.3.1.3 E-learning practices and trends

The findings reveal that with:

- **The use of LMS:** Almost an equal number of respondents are using Blackboard and Moodle.

➢ **The methods used for effective teaching and learning:** The majority of the respondents prefer a blended or hybrid method.

➢ **Asynchronous vs Synchronous methods:** The majority of the respondents conduct online activities with students via email on an asynchronous basis. With synchronous methods, the majority prefer the use of instant messaging and chats.

#### 6.3.1.4 Effectiveness of using e-learning for teaching and learning

The following findings were revealed regarding the effectiveness of e-learning in teaching and learning:

**6.3.1.4.1 Assessments:** The respondents believed that e-learning contributed to tracking student progress on assessments for large classes, as well as creating assessments that stimulated critical thinking.

**6.3.1.4.2 Access to learning materials:** The respondents indicated that e-learning provides for a repository of visually stimulating learning material as well as additional learning materials which are easily accessible, thus ensuring understanding and ease of communication through information sharing.

**6.3.1.4.3 Improved student performance:** The respondents indicated that e-learning increases students' performance by allowing them to share information; peer review the submissions of others; and solve problems with deductive reasoning via online engagements.

**6.3.1.4.4. Flexibility:** The respondents revealed that e-learning creates a comfortable and flexible learning environment with multi-dimensional tools for their students.

#### 6.3.1.5 Challenges relating to teaching with technology

As far as the respondents' challenges with respect to teaching with technology are concerned, the findings on each of the sub-themes were:

**6.3.1.5.1 Rigid teaching practices:** The majority of the respondents agreed that academics are less eager to adopt e-learning to support their teaching as they find it difficult to adapt to change and they believe that their traditional approach is more feasible. The majority also believed that although technology is beneficial for communicating with learners, lecturers are concerned about losing face-to-face interaction with students. It was affirmed by the majority of respondents that the delivery of a digital curriculum was inhibited due to the reluctance of lecturers to invest the additional effort. The majority also believed that teaching practices are highly influenced by lecturers' pedagogical beliefs and their tried and tested methods of course delivery, thus creating challenges of rigid teaching practices.

**6.3.1.5.2 Lack of skills/knowledge/engagement in the use of technology:** The findings indicated that the majority of respondents believed that the lack of skills necessary to integrate technology into the curricula and provide appropriate feedback to students were not a challenge to teaching with technology. It was deemed by the majority that improving technological skills and knowledge, as well as having the appropriate facilitation skills, are crucial priorities in ensuring success in teaching with technology.

**6.3.1.5.3 Lack of access to technology:** The majority of the respondents agreed that there is a lack of technical support in HEIs; there is insufficient investments in equipment, infrastructure and resources; and that lecturers have outdated desktop computers and laptops which prove challenging when engaging in innovative methods of teaching.

**6.3.1.5.4 Challenges relating to poor infrastructure:** Additionally, findings showed that the majority of respondents indicated that insufficient access to Wi-Fi and bandwidth coupled with technical impediments are challenges to teaching with technology.

**6.3.1.5.5 Challenges in integrating technology into teaching practices:** Almost half the respondents believed that upgrades or various new technologies and the inability to combine “content knowledge, pedagogical knowledge and technological knowledge” are challenges in integrating technology into teaching practices.

**6.3.1.5.6 Use of technology entails more work:** A majority of respondents indicated that a lack of understanding and lack of confidence in using new technologies are challenges which make lecturers more resistant to engaging in technologically enhanced teaching methods. The majority also believed that evolving e-learning technologies are a challenge for lecturers, thus making them less receptive and more reluctant to integrate e-pedagogy.

**6.3.1.6 How teaching with technology impacted on lecturers' understanding of learner differences:** Some of the respondents indicated that only when engaging with students with technology do they realize that students do not have access to data and devices. The majority believe that the digital divide is real and students from lower socio-economic backgrounds generally show less interest in learning with technology. The majority also believed that it is difficult to assess learner differences without face-to-face interactions. Some of the respondents felt that large classes prove challenging in assessing learner differences.

**6.3.1.7 Other challenges to teaching with technology:** Some of the respondents indicated challenges with regard to students' access to resources for online learning, compounded by a lack of effort from students and the inability of students to work independently. The respondents also indicated that a lack of resources and limited time impacted on teaching with technology.

**6.3.1.8 Best-practices**

With respect to best-practices for integrating technology into teaching, the findings in each of the sub-themes showed the following:

**6.3.1.8.1 Best-practices in staff development:** The majority of respondents are not familiar with the TPACK model. Almost half of them believe that the institution invests in online technologies and provides adequate time and support for the respondents' developmental activities for innovative teaching practices with technology. Almost half the respondents also indicated that their development is encouraged by peer observation of innovative teaching practices. Furthermore, the majority of the respondents believed that workshops and seminars enable academic development.

**6.3.1.8.2 Resources and technical support for online teaching:** It was affirmed by a majority of respondents that the institution consults with them on the technologies they require; that the institution provides for proper resources and technical support, guiding and supporting them in the implementation of e-learning; and that the institution also provides for a supportive institutional culture, taking into account the integration between available technologies with existing pedagogic systems and practices. It was further agreed upon by the majority that the institution provides reliable and consistently available resources to innovate their teaching practices; that it informs them on technologies which exist and how such technologies can provide for high quality learning experiences for students; and that it provides a platform for self-service support to rectify issues with technical and resource support.

**6.3.1.8.3 Use of instructional technology:** The majority of respondents believe that they are effective in their practices by integrating technology into their courses, which has had a positive influence on student engagement and course completion. The majority also agreed that the LMS ensures the organisation, course structure and delivery of course material for optimum teaching with technology; and that teaching with technology has enabled communication with students via live chats, video/webcam interactions and virtual classrooms. Most respondents also agreed that teaching with technology enables the monitoring of academic behaviour, course attendance and the performance of students.

**6.3.1.8.4 Significance of community chat groups:** A majority of respondents believed that using online spaces for engaging and exchanging knowledge is regarded as a best-practice. Moreover, promoting and sharing good teaching practices (through assisting each other by engaging in and sharing learning technologies) is deemed a best-practice by some of the respondents.

### 6.3.2 The student survey

The student survey was initially administered via hardcopies to 25 students. However, the Covid-19 pandemic halted the process, leaving the researcher with no option but to administer the survey online. A response rate of 78% was achieved. The survey consisted of 75 items and focused on the themes of: background information to technology in education; e-learning practices and trends; challenges experienced with e-learning; and best-practices.

**6.3.2.1 Ownership of Technological Devices:** The majority of respondents owned smartphones as compared to personal computers, laptops, tablets and smart watches.

**6.3.2.2 Experience with Technological Devices:** The majority of respondents have experience in using smartphones, as compared to personal computers, laptops, tablets and smart watches.

**6.3.2.3 E-learning**

With respect to e-learning:

- **Learning Management System (LMS):** The majority of respondents have been exposed to Moodle.
- **Online course delivery methods:**
    - Asynchronous methods: the majority of the respondents engage in emails; and
    - Synchronous methods: the majority of the respondents used instant messaging and chats.

**6.3.2.4 Challenges experienced with e-learning**

Regarding the challenges experienced with e-learning:

**6.3.2.4.1 Technology in learning is a distraction to weaker students:** Some of the respondents believed that social media and other entertaining online content distracts them from their work.

**6.3.2.4.2 Lack of concentration with online learning:** Some of the respondents cannot concentrate on online learning as they lack the experience to engage with technology for learning, whilst others lack concentration with respect to online learning as they cannot afford the technology for online courses.

**6.3.2.4.3 The use of technology requires more time:** Some respondents indicated that engaging in online sessions takes up time due to retrieving information from the LMS, rather than engaging with online activities. Additionally, some respondents also had personal responsibilities (family and work), thus making it difficult for them to participate in online classes.

**6.3.2.4.4 The impact of e-learning on interactions between peers, lecturers and learning material:** The majority of respondents indicated that they do not get to interact with their peers and that e-learning does not provide them with the opportunity to problem solve with their peers. Moreover, some respondents indicated that they do not get to interact with their lecturers; that they find it difficult to engage with e-learning material as it is not interactive; and that e-learning does not provide them with interactive learning activities.

**6.3.2.4.5 Lack of human contact as a challenge:** A majority of respondents indicated that e-learning does not give them the opportunity to interact with fellow students and lecturers, nor does it afford them the opportunity to get feedback from their lecturers.

**6.3.2.4.6 Lack of access to technology:** Very importantly**,** some of the respondents cannot afford technological devices for e-learning.

**6.3.2.4.7 Technological skills challenges:** Almost half of the respondents disagreed that they found e-learning difficult because they do not have appropriate technological skills, while only some of the respondents indicated that they are afraid to use technology because they found it difficult to access course material or prepare for online assessments. The majority of the respondents disagreed that technology moves too rapidly and that it is a challenge to keep up with advancements. They also disagreed that they lacked the confidence and the skill in using technology to engage in e-learning.

**6.3.2.4.8 The risks associated with online studies:** Some of the respondents believed that submitting work via e-learning is risky as work could be lost and also that sensitive information can be disclosed when submitting work online.

**6.3.2.4.9 Poor quality of e-learning systems:** Some of the respondents find the LMS at the institution adequate for their online learning requirements, whilst others believe that the quality of the e-learning system in the institution is not adequate to meet educational needs.

**6.3.2.4.10 Poor effort from lecturers:** Almost half the respondents believed that their lecturers integrate technology into the curriculum adequately; plan and prepare learning activities with technology adequately; and consider learning enhancement and student engagement when incorporating technology into the curriculum.

**6.3.2.4.11. Lack of training, workshops and/or orientation:** The respondents also indicated that the institution does provide training and workshops for enabling e-learning, as well as orientation courses for improving their understanding of course material. Hence, this is not a challenge.

**6.3.2.4.12 Lack of technical support:** The majority of respondents believe that the institution provides adequate online technical support, a reliable LMS and a help desk for e-learning technical support.

**6.3.2.4.13 Other e-learning challenges faced by students:** It was affirmed by the majority of respondents that the lack of access to the network, data and devices; poor communication from lecturers; unconducive learning environments; and Moodle downtime or maintenance were challenges to e-learning.

#### 6.3.2.5 Best-practices for e-learning

The majority of respondents indicated that online tools for large classes, interactive learning techniques, access to remote tutors and training and orientation programmes would be beneficial in overcoming some of the challenges in learning with technology. The majority also believed that the feelings of isolation in online classes can be overcome by online peer tutoring, discussion boards and group video conferences.

**6.13.2.6 Other best-practices recommended by the respondents:** Access to data and devices, e-learning orientation and training and lecturer engagement were the most common best-practices indicated by the respondents.

## 6.4 Conclusions

The purpose of this study was to assess the impact of e-learning in higher education and to determine the teaching and learning challenges as well as the best-practices of this technology application in DUT. The following discussion encompasses the conclusions as exhibited in the literature review and the empirical study.

### 6.4.1 Conclusions from the literature review

The following conclusions can be drawn from the literature review:

#### 6.4.1.1. Trends in the use of e-learning in Higher Education

The review of related literature indicates varied dimensions of e-learning, each illustrating how e-learning is being used in higher education. These include synchronous, asynchronous and blended learning.

While synchronous learning occurs in real-time with lecturers and students interacting simultaneously via chatrooms, Skype conversations or virtual classrooms, asynchronous learning provides for online learning activities through emails, blogs, discussions boards, etcetera through interactions between lecturers and students at different times. Blended learning is a combination of classroom instruction (face-to-face) and self-paced instruction that is delivered via technology. Many however opt for asynchronous learning due to the flexibility it offers (Mandala, Abdullah and Ismail 2013), although a blended learning environment creates opportunities for harmonious learning which includes face-to-face interaction and online access (Britto, Murugeson and Subramanian 2016: 94).

#### 6.4.1.2 The effectiveness of using e-learning technology for teaching and learning

E-learning provides for an environment that promotes **self-efficacy and self-regulated learning, whereby** students engage with the learning material at their convenience, thus allowing them to determine their own learning needs and respond to their educational demands.

The **accessibility and flexibility** offered by e-learning allows teaching staff the ability to enhance traditional forms of teaching and administration.

E-learning is pivotal in ensuring that **diversity** is embraced by allowing lecturers to deliver learning materials to heterogeneous groups of students on different levels in multi-lingual formats, for example.

E-learning in HEIs allows for the **creation of learning communities** like joint discussion forums within classes or groups that are created to communicate with peers. Lecturers have the flexibility of communicating with students on a "one-to-one" basis or on a "one-to-many" basis.

E-learning systems provide for downloading and uploading of information, with built-in software to detect plagiarism flaws. Such a feature is beneficial for both lecturers and students, making the **evaluation process** much simpler.

Additionally, e-learning affords the opportunity for students to provide **feedback** to lecturers and still remain anonymous. Feedback given to students is equally important in order to understand their strengths and weaknesses.

#### 6.4.1.3 Challenges with teaching and learning with technology

Conclusions from the literature review relating to the challenges of teaching with technology are as follows:

- Some lecturers cannot adapt to change and therefore find it difficult to adopt new methods of teaching. Lecturers are also not willing to invest additional effort in a digital curriculum;

- Lecturers are not willing to adopt a technologically-enhanced curriculum as a result of their rigid teaching practices, which are highly influenced by their pedagogical beliefs and their tried and tested teaching methods of curriculum delivery;
- The lack of access to technological resources, namely outdated equipment, lack of access to Wi-Fi, bandwidth, data, lack of technical support and insufficient investments in technology in higher education, impacts on the delivery of curricula and hinders the e-learning process;
- The dynamic technological environment creates uncertainty amongst academics and forges a lack of understanding and lack of confidence and comfort in engaging with new technologies;
- The challenge for lecturers who are not technically savvy and lack the ability to combine "content knowledge, pedagogical knowledge and technological knowledge" results in unsuccessful curriculum design and delivery. Furthermore, the perceived usefulness of technological tools for teaching impacts on whether or not technology is adopted for teaching purposes;
- Time constraints as a result of high workloads impact on the conversion of courses from a traditional design to an entirely digital design, thereby impacting on how lecturers perceive technology for teaching; and
- The lack of face-to-face interactions results in students being regarded as just a number in the system. Face-to-face interactions are deemed important to assess "learner differences".

The following conclusions may be drawn on the challenges of learning with technology as revealed by the literature review.

- E-learning is perceived as a distraction to weaker students as their attention is diverted away from study material to social media and other entertaining content on the internet;

- The feelings of isolation and the lack of a “sense of belonging” are challenges created by e-learning, as there is no longer any face-to-face interactions in the classroom;
- E-learning defeats the interaction between students and content, students and peers, and students and instructors, as all interactions are technology-based;
- The lack of interactive e-learning materials in terms of a poor standard of visuals, unstimulating presentations and low-resolution images and videos contributes to students disengaging from online classes;
- E-learning impacts on time for learning. Some learning activities, such as the drawing of diagrams and mathematical symbols and retrieving information from the LMS, impact on time as compared to traditional methods of learning;
- The assessment of students in an online environment is challenging. Students who are not comfortable in using technology are not accustomed to online assessments. It is difficult to assess students in practical courses and group work;
- E-learning contributes to the lack of human contact as there is no interpersonal and direct interaction amongst students and lecturers, making it impossible to get immediate feedback as the availability of learners and lecturers differ;
- E-learning results in students submitting assessments just for a pass mark. They do not focus on using using online course resources to communicate, comprehend and memorise, thus not developing any problem-solving skills;
- Students who are not trained in using technological devices for learning and who are more accustomed to traditional learning will experience difficulties in absorbing e-learning course content;

- Students who lack confidence in using technology for learning due to fears about electronic communication, computer self-efficacy ratios and the initial experience of technology will be challenged in using technology for learning;
- E-learning is a challenge for those students who cannot afford or gain access to technological devices;
- Challenges as a result of power outages; technical glitches; the limited or lack of network connectivity; and limited quality or "fit for purpose" software impact on the provision of e-learning. Students are thus adversely affected by inadequate and/or unavailable technological infrastructure and resources; and
- Students in online courses earn lower grades than students in face-to-face groups as e-learning creates anxiety and resistance to learning, making some learners feel isolated as well as overwhelmed by the new innovative pedagogical methods.

#### 6.4.1.4 Best-practices

Regarding the best-practices of e-learning for teaching as highlighted in the literature reviewed, the following are relevant:

- **Staff development and building teacher competencies** via workshops and seminars will ensure that staff are engaged and supported in technology-enhanced practices. Shared e-learning experiences amongst teaching staff via online sessions, emails and blogs provide for a basic support mechanism, which encourages colleagues and promotes knowledge-sharing. Technical competencies, content proficiency and pedagogical knowledge are essential for teaching staff to engage successfully with e-learning;
- Institutions need to develop a **supportive institutional culture**, providing teaching staff with reliable and consistently available resources for e-learning. IT support needs to be provided to staff to suite

their varied levels of expertise, different communication styles and diverse service expectations;

- The **use of instructional technology** such as web-based content, e-books, lecture recordings, social media, simulations and online collaboration tools ensure effective e-learning teaching practices;
- Institutions need to **invest sufficiently in proper LMSs** in order to ensure the organisation, course structure and delivery of course material for successful online classes;
- **Student support technology** via live chats, video/webcam interactions and virtual classrooms are effective tools for monitoring students' progress, as well as the academic behaviour of students (course attendance and performance);
- **Online access to remote tutors** ensures academic assistance for students. Specifically designed software as an early alert system can identify students who are at risk of failing or struggling with their academic activities; and
- The creation of **community chat groups between lecturers** results in the exchange of information and knowledge on general practices, dropout rates, devices for students and students' online learning habits. The exchange of stories and experiences ensures the promotion and sharing of good teaching practices.

The following conclusions may be drawn with respect to the best-practices of e-learning for learning, as highlighted by the literature reviewed:

- The implementation of **training courses, workshops and orientation** programmes for online learning enhances student experiences and improves their academic performance when learning with technology;

- **Access to technological devices** and technical support to students are contributing factors for the successful implementation of e-learning courses;
- Access to learning materials via the use of **social networking platforms and external platforms** (such as micro-blogging and other tools, as well as applications to re-cast courses) improves students' experiences of online learning;
- **Innovations in online learning** provide the flexibility for students to match the course with their learning styles, especially in programmes such as sport which uses gaming technologies and badges for teaching and learning, while performing arts students showcase their work via micro-blogging sites;
- E-learning allows for students to achieve and **engage at higher levels through various online techniques,** namely free web-based content, LMSs, online collaboration tools, social media as a learning tool, lecture recordings, online educational games; and
- E-learning enhances collaborative learning through **online peer tutoring**, **discussion boards and group video-conferences**, thus reducing feelings of isolation and promoting knowledge-sharing.

#### 6.4.1.5 Intervention strategies

The literature reviewed revealed the following intervention strategies:

- HEIs need to ensure the retention of academic staff by providing learning opportunities and ensuring the competencies of staff with regard to upgrades of existing technologies and the introduction of new technologies;
- HEIs must exhibit a range of relevant and practical engagement techniques to ensure that academics are equipped with technological and multi-literacy skills;

- A combination of technological, organisational and pedagogical components are critical for the successful implementation of e-learning; and
- Institutions need to understand the diversity in student populations, thus providing mechanisms to enhance student confidence and abilities in order to develop students' technological skills.

### 6.4.2 Conclusions from the empirical study

The following conclusions can be drawn from the empirical study:

#### 6.4.2.1 Hypothesis Testing

With respect to the research hypotheses developed in Chapter 1, the following conclusions can be drawn from the lecturer survey:

- There is a significant correlation between **the lack of skills/knowledge/engagement in the use of technology** and **rigid teaching practices**;
- There is a significant correlation between **the challenges in integrating technology into teaching practices** and **the lack of skills/knowledge/engagement in the use of technology**; and
- There is a significant correlation between **best-practices in staff development** and **more effective teaching practices through the use of technology**.

The relationship between the variables in the hypotheses indicated above has shown that as one increases, so does the other, and vice versa.

Based on the findings from the lecturer survey, the following conclusions can be drawn:

#### 6.4.2.2 Teaching Practices

General teaching practices at DUT focus on developing students' critical skills, encouraging classroom interactions and inspiring students to learn via their own efforts. Lecturers ensure the transmission of information; the development of students' skills and attitudes; and promote the development of students' own conceptual understanding.

#### 6.4.2.3. General teaching challenges

The general teaching challenges indicated by the respondents included limited resources, a diverse student population and the lack of university capabilities.

#### 6.4.2.4 Challenges relating to teaching with e-learning

The following conclusions may be drawn with respect to challenges of teaching with e-learning:

- Rigid teaching practices, the reluctance to invest additional effort and the loss of face-to-face interaction with students are factors which prove challenging to teaching with technology;
- Outdated desktop computers and laptops are a major challenge for teaching staff when engaging in innovative methods of teaching;
- There is a lack of technical support in HEIs and insufficient investments in equipment, infrastructure and resources;
- There is insufficient access to Wi-Fi and bandwidth, coupled with technical impediments;
- The lack of understanding and lack of confidence in new technologies is a challenge which makes lecturers more resistant to engage in e-learning;
- The dynamic nature of evolving e-learning technologies is a challenge for lecturers, creating a reluctance to integrate e-pedagogy; and
- The integrating of technology in curricula entails more work in designing a curriculum, thus making lecturers less receptive to e-pedagogy.

#### 6.4.2.5 Challenges in relation to learning with e-learning

With regard to challenges in relation to learning with e-learning:

- The inability to afford technological devices for e-learning hinders e-learning;
- A lack of data, the lack of network coverage and unconducive learning environments prove challenging to students who engage in e-learning;
- E-learning impedes interactions with lecturers, interactions with peers and interactions with learning material;
- E-learning does not provide students with the opportunity to get immediate feedback from their lecturers;
- E-learning does not provide students with the opportunity to problem solve with their peers;
- E-learning does not allow students to engage in interactive learning activities as e-learning material is not interactive; and
- System downtimes on Moodle or the maintenance of the LMS spread over a longer time creates further difficulties when students need to upload work or submit assessments.

#### 6.4.2.6 Best-practices in the use of e-learning technologies for teaching and learning

In the use of e-learning technologies for teaching and learning, the following best practices were identified:

- Staff development workshops and seminars are necessary to improve academic activities when engaging with e-learning;
- The institution consults with lecturers on the required technologies for e-learning activities;

- The institution provides proper, reliable and consistent resources and technical support for online teaching;
- The institution informs teaching staff of existing technologies which provide for high quality e-learning activities;
- The use of instructional technology influences student engagement, monitors academic behaviour and ensures effective curriculum delivery; and
- Community chat groups allow for engaging in and exchanging knowledge of good teaching practices.

#### 6.4.2.7 The effectiveness of using e-learning technologies in Teaching and Learning

- The effectiveness of e-learning technologies allows for assessments of large classes and tracking student progress;
- E-learning provides a repository of easily accessible visually stimulating learning material;
- Information-sharing through online engagements leads to improved student performance; and
- E-learning allows for a comfortable and flexible learning environment.

## 6.5 Recommendations

The recommendations made are based on the literature reviewed and the findings of this empirical study.

The following are recommendations that contribute to the provision of successful teaching with e-learning:

### 6.5.1 Staff development

The challenges relating to **rigid teaching practices; the inability to adapt to change; a reluctance to invest the additional effort; and the uncertainty created by the technological metamorphosis of pedagogy** can be overcome if teaching staff extend their capabilities and embrace technology for teaching. Workshops are needed to equip staff with new methods of teaching in the information age. Lecturers must be afforded the time to engage in development workshops and training and be exposed to customized seminars. Departmental-level training on ICT needs to be encouraged, focusing on forums amongst faculty/department staff to encourage and share best-practices that are successful. The academic support structure for e-learning, CELT (Centre for Excellence in Learning and Teaching), should be decentralized to faculties. Teamwork and collaboration was also highly recommended in terms of the findings of this study. Majanja (2020: 330) states that workshops and seminars are the prevalent and preferred means of keeping abreast with e-learning technologies. The author further advocates that workshops, seminars/webinars, personal effort/research and networking with colleagues enrich the e-skills of lecturers. These challenges can be further eradicated when lecturers engage with each other on an informal basis, exchanging knowledge and sharing information on learning technologies. Chat groups between lecturers allow for the exchange of professional knowledge and experiences, thus providing a support structure for those who are challenged by accepting technology in teaching.

### 6.5.2 Resource requirements for teaching

With respect to the **challenges relating to outdated computers and laptops, insufficient access to Wi-Fi and bandwidth and the lack of technical support:** DUT needs to grasp the opportunity of an e-learning trajectory by ensuring sufficient investments in technology for teaching staff, namely equipment, Wi-Fi access, bandwidth, data and technical support. Desktops and laptops that have reached their end-of-life should be replaced with technological tools that are adequate for efficient and effective e-pedagogy. As asserted by Guri-Rosenblit (2018: 96), technical and pedagogical support (both ongoing and just-in-time) are crucial for instructional delivery.

### 6.5.3 Measures to address other teaching challenges

In respect of the other teaching challenges, the following is noted:

- **Lecturers' loss of face-to-face interaction with students**:

The loss of face-to-face interaction with students can be overcome by lecturers by engaging in **live chats, video/webcam interactions or virtual classrooms**. Couros (2014) maintains that technology provides students with a voice via these mediums, thus enabling fluid communications with lecturers and in turn, lecturers are given the opportunity to get to know their students better and understand their learning styles. Technology therefore enhances face-to-face interactions over a digital forum.

- **Lecturers' lack of understanding and lack of confidence in new technologies:**

The lack of understanding and the lack of confidence in new technologies can be addressed by encouraging lecturers to engage **in training and development workshops and seminars for technology-enhanced teaching and learning.** Lim and Wang (2017: 10) believe that apart from developing just the technical skills of lecturers, they should also be developed professionally in order to understand the paradigm shift from traditional teaching to teaching with technology. Moreover, CELT must play a pivotal role in the facilitation of developing lecturers in understanding new technologies for teaching. Measures that enable lecturers to understand technology in teaching allows confidence building in their teaching practices.

### 6.5.4 Student development

Students must be enlisted for a basic computer course in their first year as part of their orientation so they are familiar with basic computer skills. However, it is also necessary to address the challenges of language and comprehension before introducing students to technology. Bao (2020: 115) suggests that HEIs apply the principle of appropriate relevance, whereby “the quantity, difficulty and length of teaching content should match with the academic readiness and online learning behavior characteristics of students”. Students also require educational guidance to use technological devices in a strategic manner for learning purposes, thus enabling them to learn independently and at their own pace (Lim and Wang 2017: 2).

### 6.5.5 Resource requirements for learning

On the learning challenges relating to **the inability to afford technological devices and the lack of data and network coverage**, the following are recommended, particularly to promote digital equity:

Resource requirements should be given priority in order to enable a technologically infused curriculum. **Data and connectivity** should be highlighted priorities, with back-up and technical support. Teacher aides must also be categorised as a resource to ensure best practices with technology for teaching and learning. Although DUT embarked on providing students with data via the major mobile network service providers to enable e-learning, the availability of and access to devices needs to be re-visited. The provision of data is but a temporary measure intended for continuous learning during the lockdown, as a result of the Covid-19 pandemic. However, a more permanent arrangement is required to ensure uninterrupted e-learning for students.

DUT could also engage with network service providers for **complimentary “network packs”** whereby each registered student would receive unlimited network access to the institution’s online classrooms via these packs, thus contributing towards and fostering extreme learning. Similar projects have been initiated by Telkom, which has recently launched its “Lightbulb Education” initiative which provides for a zero-rated site for accessing videos and resources for e-learning (Telkom For Me 2020).

The recent **Smart City initiatives** could also ensure free and high quality network access to students, whether located in the city, townships or rural areas around DUT. Increased access to educational content and improved collaboration between students and lecturers are possible through Smart City initiatives (Belissent 2010: 6).

The institution should also embark on **loaning laptops or tablets** to students, thus bridging the gap of the digital divide (Lim and Wang 2017: 12). Biswas (2020: 2042) proposes that challenges with internet connectivity, power supply and electronic devices need to be solved first in order to re-shape education. Furthermore, Dhawan (2020: 16) emphasizes that digital equity is crucial, hence the institution needs to make every effort to ensure that students have access to the requisite resources, including educational applications on their mobile phones.

### 6.5.6 Lessons and assessments

To resolve challenges with learning with the use of technology (such as the **lack of problem-solving activities, e-learning material that is not interactive and impeded interaction with peers**), the following practices should be adopted for online lessons and assessments:

- Open book, open web is an assessment form to be considered at DUT;
- Referring students to online databases, YouTube videos or other institutions' free resources;
- The use of games, quizzes and such like by some lecturers; and
- The use of platforms that students regularly use, namely students' favourite forms of social media - involve students in discussions on online learning on these social media platforms.

With respect to the **challenges relating to e-learning material that is not interactive:** To ensure that lessons are interactive and maintain the interest of learners, especially in practical courses, Goh and Sandars (2020: 2) suggest simple online platforms such as websites and blogs for hosting videos demonstrating essential practical skills. The authors also suggest that podcasts, computer simulations and games are assisting teaching to facilitate learning and training.

**6.5.7 With respect to the other e-learning challenges, the following solutions are recommended:**

- **Unconducive learning environments:** DUT should foster a partnership with the Department of Higher Education, mobile service providers as well as influential business partners for the establishment of **"connected zones".** The establishment of connected zones in local town halls, community centers or local libraries could provide conducive learning environments for e-learning. DUT should conduct a **needs analysis** on students who reside in under-developed townships or squatter settlements and provide proper learning areas for these students via the student residences. DUT should also provide **exclusive Wi-Fi classrooms** (for instance in student halls or laboratories) where students can engage in e-learning within these dedicated areas.
- **Lack of interaction with lecturers:** LMSs exhibit an array of communication and interactivity features, as well as assessment and evaluation materials with the mindfulness of the diversity of learning styles (Al-Fraihat *et al.* 2019: 80). The authors suggest that more effort by lecturers should be directed at engaging students in their learning by exploiting the full capabilities of these tools offered by the LMS. Engaging with students develops their attitudes toward the e-learning system, students' self-efficacy and their experience with e-learning, thus increasing their satisfaction and their perception of the usefulness of e-learning. Lecturer engagement on campus, as well as online consultations and group appointments increase students' acceptance of e-learning.

- **Lack of immediate feedback**: Dhawan (2020: 9) posits that communication is key in ensuring that students adapt to the e-learning environment. **Social media and various group forums** should be used to communicate with students. Effective online programmes introduced by lecturers would allow for students to actively revise, ask questions and get feedback on course content.

### 6.6 Attainment of Objectives

**1. To explore the practices and trends in the use of e-learning technologies for teaching and learning in higher education, particularly at UoTs (through a review of related literature):** The literature reviewed, particularly in Chapter 3, discusses in detail the challenges and best practices in the use of e-learning technologies in UOTs. The chapter focused on literary reviews by numerous authors and studies conducted by researchers on e-learning challenges and best-practices as experienced at local and international HEIs.

**2. To explore the effectiveness of using e-learning technologies in teaching and learning in higher education (through a review of related literature):** The literature reviewed as well as the findings of the empirical study have revealed the effectiveness of e-learning technologies in teaching and learning. E-learning has contributed to self-efficacy and self-regulated learning; accessibility and flexibility for teaching; is a means to embrace diverse cohorts of students; enables the creation of learning communities; simplifies evaluation processes; and provides the opportunity for feedback while remaining anonymous.

**3. To explore the e-learning practices and trends in the use of e-learning technologies for teaching and learning at DUT:** The surveys conducted by the researcher on teaching and learning with e-learning at DUT produced data which indicated the practices of lecturers and students, as well as the best practices they deemed effective for successful e-learning at the institution.

**4. To determine the challenges with the use of e-learning technologies for teaching and learning at DUT:** The results produced by the empirical study indicated the various challenges as experienced by lecturers and students in using e-learning technologies at DUT.

**5. To determine the most feasible strategies to address challenges with e-learning technologies in teaching and learning at DUT:** After an in-depth analysis and interpretation of the results produced by the empirical survey, the researcher, through the recommendations suggested by the respondents of the survey as well as reviewing relevant studies and literature, was able to produce feasible strategies to address the challenges with e-learning technologies in teaching and learning at DUT. The development of a framework with intervention strategies informs the achievement of this objective.

**6. To develop a suitable framework of strategies to address challenges in respect of teaching and learning with e-learning technology and best-practices:** The achievement of this objective is discussed below.

## 6.7. Development of a framework of strategies to address challenges in respect of teaching and learning with e-learning technology and best-practices

The aim of this research study was to ascertain how technology impacted on teaching and learning with specific reference to the challenges and best-practices of e-learning in higher education. The final objective of the study was to develop a suitable framework based on the conclusions and recommendations from the study. Such a framework focuses on intervention strategies to address challenges in respect of e-learning technologies for teaching and learning and the best-practices which would be applicable in higher education. Plowright (2011: 2) explains that the Oxford Dictionary of English defines a framework as “a basic structure that underlies a system, concept or text”.

As suggested by Stilgoe, Owen and Macnaghthen (2013: 1577), frameworks draw on insights and experiences on the subject being researched by others. Ravi (2020) investigated various models and frameworks for the implementation of technology in education with the aim of improving digital equity in the classroom. The author identified three areas for teachers to focus on, namely planning, implementation and reflection. The framework for this study was thus developed by analysing investigations, recommendations, strategies and implementation of technology enhanced education on the basis of similar studies at other educational institutions. Similar frameworks (Wang and Chen 2009; Naveed *et al.* 2020; Shahraki and Heidarzadegan 2017; Al Kurdi, Alshurideh, and Salloum 2020; Khan 2003) highlight the steps necessary in ensuring successful e-learning platforms with proper access, high quality instruction and reliable support services.

For the purposes of this study, the findings from the empirical study combined with the review of relevant literature informs the framework. Hence, the framework for this study is divided into three aspects. The *first part* sets out intervention strategies to address challenges with respect to teaching with e-learning technology, learning challenges, resource challenges and lesson and assessment challenges. The *second part* indicates best-practices relating to the use of e-learning technology. Moreover, the *third part* of the framework indicates four necessary steps to be followed in order to successfully address the challenges in respect of teaching and learning with e-learning technology. These are planning, assessment, implementation and review.

The framework shown in Table 6 was specifically designed by the researcher with the aim of presenting intervention strategies to overcome challenges faced by lecturers and students at DUT. These may not be blanket solutions to all HEIs, as each one is unique in their challenges of a technology integrated pedagogy and best-practices to suit their cultures and practices. However, the framework may be applied to HEIs that emanate from a similar background to DUT. The table indicating intervention strategies and best-practices is followed by a graphical representation of the framework.

### 6.7.1 Table 6: Framework of strategies to address challenges in respect of teaching and learning with e-learning technology and best-practices

| FRAMEWORK TO ADDRESS CHALLENGES IN RESPECT OF TEACHING AND LEARNING WITH E-LEARNING TECHNOLOGY AND BEST-PRACTICES | |
|---|---|
| **PART 1: INTERVENTION STRATEGIES** | |
| **CHALLENGES** | **RECOMMENDED INTERVENTION STRATEGIES** |
| **SECTION A: TEACHING** | |
| **1. Lack of adequate resources for teaching** | **Provide adequate resource requirements for teaching** |
| 1.1. Outdated computers and laptops | • Adequate equipment;<br>• Wi-Fi access;<br>• Sufficient bandwidth;<br>• Provision of data; and<br>• Technical support (ongoing and just-in-time). |
| 1.2. Insufficient access to Wi-Fi and bandwidth | |
| 1.3. Lack of technical support | |
| **2. Teaching challenges** | **Staff development strategies through:** |
| 2.1. Rigid teaching practices | • Workshops and training;<br>• Customized seminars;<br>• Webinars;<br>• Department level training;<br>• Teamwork and collaboration;<br>• Personal effort research;<br>• Networking with colleagues;<br>• Informal interactions/exchange of knowledge; and<br>• Lecturer chat groups. |
| 2.2. Inability to adapt to change | |
| 2.3. Reluctance to invest the additional effort | |
| 2.4. Uncertainty created by the technological metamorphosis of pedagogy | |
| 2.5. Lack of understanding and lack of confidence in new technologies | |
| 2.6. Dynamic nature of evolving e-learning technology | |

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|---|---|
| 2.7. Less receptive to e-pedagogy as integrating technology into curricula entails more work | |
| **SECTION B: LEARNING** | |
| **3. Learning Challenges** | **Student Development Strategies through:** |
| **3.1.** Lack of adequate computer skills | • Introduction to computers as orientation in 1st level of study; and<br>• Educational guidance in the use of technological devices. |
| 3.2. Unconducive learning environments | • Establishment of “connected zones”;<br>• Designate proper learning spaces within student residences to students in underdeveloped townships and squatter settlements; and<br>• Provision of exclusive Wi-Fi classrooms, e.g. student halls, laboratories. |
| 3.3. Language and comprehension challenges | • Teaching content to be applied in accordance with academic and online readiness of students; and<br>• Educational guidance in the use of technological devices in student’s own language. |
| **4. Lack of adequate resources for learning** | **Provision of adequate resource requirements for learning, including:** |
| 4.1. Inability to afford technological devices | • Laptops and tablets on loan;<br>• Complimentary network packs; and<br>• Smart City initiatives. |
| 4.2. Lack of data | |
| 4.3. Lack of network coverage | |
| **5. Lessons and assessments** | **E-learning strategies through:** |
| 5.1. Lack of problem-solving activities | • Open book/open web assessments; |
| 5.2. E-learning material is not interactive | |

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| 5.3. E-learning impedes interaction with peers<br><br>5.4. E-learning impedes interaction with learning materials | • Online databases and free internet resources and videos;<br>• Games and quizzes;<br>• Social media platforms for interactive discussions;<br>• Websites and blogs for practical skills;<br>• Podcasts; and<br>• Computer simulations. |
| 5.5. E-learning does not allow for immediate feedback from lecturers | • Use of social media and various group forums to provide feedback to students. |
| 5.6. E-learning impedes interaction with lecturers | • Exploit the communication and interactive features of the Learning Management System (LMS) to engage with students;<br>• Online consultations and group appointments; and<br>• Lecturer engagement on campus. |
| 5.7. System downtime on Moodle or maintenance of the LMS makes uploading work or submitting assignments difficult | • Engage a team of experts who are at the forefront of technological advances to ensure constant maintenance, system upgrades and monitoring of CPU utilization, disk capacity and network performance for a reliable and stable LMS. |
| **PART 2: BEST-PRACTICES** | |
| **ACTIVITY AREA** | **BEST-PRACTICE** |
| • To provide training and development opportunities<br><br>• To improve academic activities when engaging with e-learning | • Staff development workshops and seminars;<br>• Use of instructional technology to positively influence student engagement, monitor academic behaviour and ensure effective curriculum delivery;<br>• Use of community chat groups to allow for engaging in and exchanging knowledge of good teaching practices; |

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|---|---|
| | • Training courses, workshops and orientation programs for students;<br>• Social networking platforms and external platforms to access learning materials;<br>• Gaming technologies, badges for teaching and learning, micro-blogging sites, especially for practical courses;<br>• Online peer tutoring, discussion boards and group video-conferences to enhance collaborative learning; and<br>• Free web-based content, LMS, online collaboration tools, social media as a learning tool, lecture recordings, online educational games to engage students on a higher level. |
| • Adequate provision of appropriate resources | • Consult with lecturers on required technology;<br>• Provide proper and reliable resources;<br>• Inform teaching staff of existing technologies which provide for high quality e-learning activities;<br>• Decentralize academic support department to Faculties;<br>• Invest sufficiently in proper LMSs;<br>• Acquire student support technology to monitor student progress and academic behaviour;<br>• Provide online access to remote tutors; and<br>• Create access to technological devices for students. |
| **PART 3: STEPS IN IMPLEMENTATION** | |
| **Planning** | • Determine the level of need for access to technology (hardware, software) for students and lecturers; |

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| | • Determine teaching and learning skills for online communication;<br>• Ensure that e-learning developers and system analysts consult with lecturers for the development of purposeful and effective learning activities that enhance the alliances between lecturers and students, and motivate the effective use of the system;<br>• HEIs to provide special budgets for the purchase or upgrade of technological infrastructure for e-learning; and<br>• Make provision for high-speed internet, sufficient bandwidth, upgraded software and sufficient laboratories with high computer inventory, which are necessary to ensure the successful implementation of e-learning. |
| **Assessment** | • Conduct a needs analysis for access to or lack of technology;<br>• Assess the skills of staff and students in terms of their knowledge and ability to navigate online;<br>• Assess the ability of students to learn through media; and<br>• Develop a user-friendly environment for frequently asked questions (FAQs). |
| **Implementation** | • Host educational classes, e.g. working with computers and internet skills training to ensure increased knowledge for online teaching and learning;<br>• Ensure lecturer support to students, not only at specific times - more flexible times are required for lecturer-student interaction;<br>• Proper training in the use of the e-learning system for both lecturers and students; |

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| | • Lecturers to have an adequate ability to ensure that assignments and tests, discussion boards, course messages and grading allow for effective course management;<br>• Lecturers to provide a rich e-learning environment by introducing teaching notes, videos and multimedia; and<br>• Lecturers to engage in social media to enhance their association with students. |
| **Review** | • Ensure the presence of expert consultants for solving technological teaching and learning issues;<br>• Develop a system to evaluate the success rates of technology integration in learning; and<br>• Engage with other professional networks involved in e-learning to learn more about existing and new technologies for integration into e-classrooms. |

*(Developed by the researcher to address the objectives of this study)*

### 6.7.2 Graphical representation of framework of strategies to address challenges in respect of teaching and learning with e-learning technology and best-practices

Figure 6 below is based on the framework to address challenges in respect of teaching and learning with e-learning technology and best-practices.

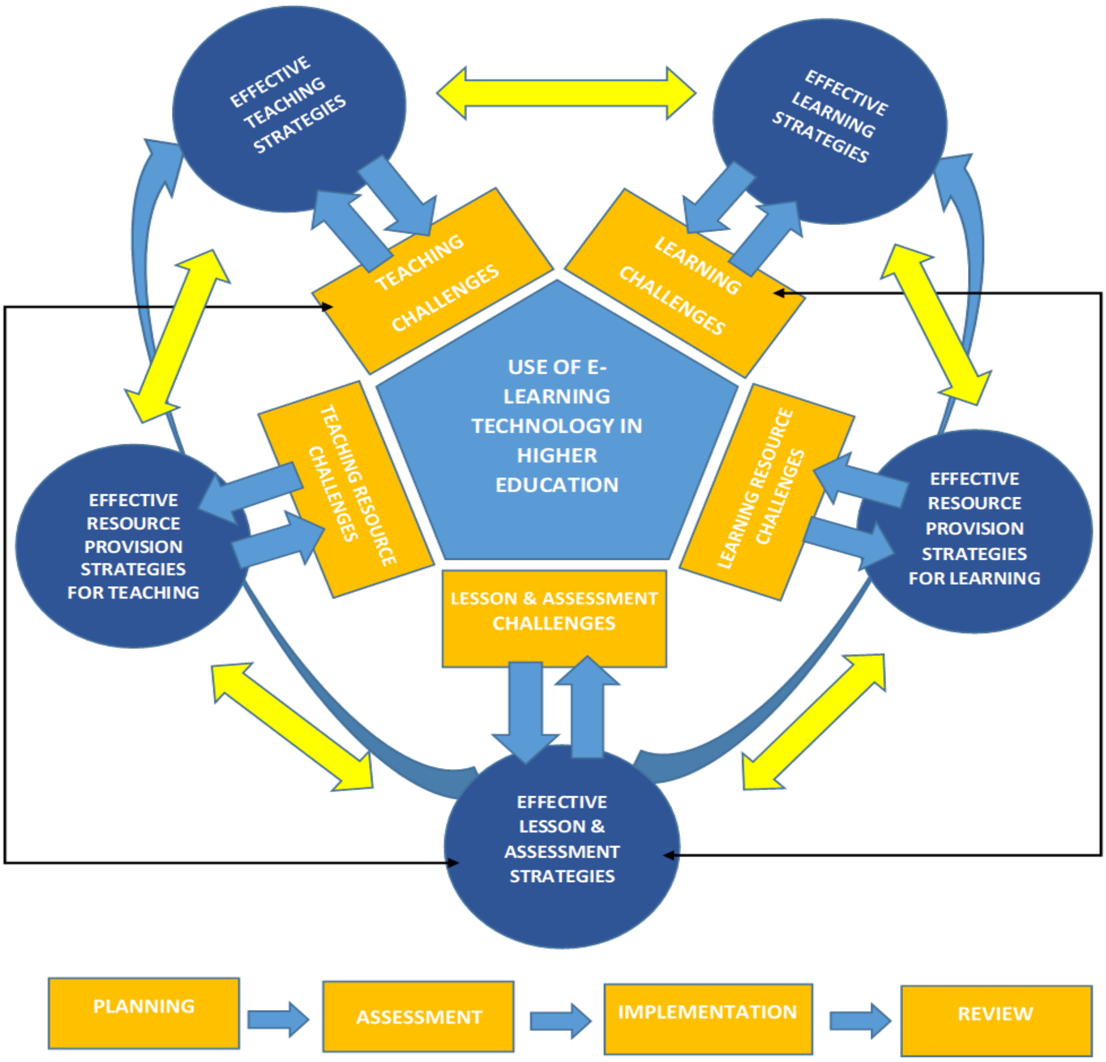


**Figure 6: Graphical representation of framework of strategies to address challenges in respect of teaching and learning with e-learning technology and best-practices**

*(Developed by the researcher for the attainment of the objectives of this study).*

## 6.8 Limitations of the Study

The primary limitations of the study stem from the impact of the Covid-19 pandemic. The initial student survey was to be administered in the classrooms by the researcher to 1st, 2nd and 3rd year students of all faculties at the Durban campuses of DUT. The lockdown of the institution meant that staff and students had to engage in a virtual environment. Consequently, the researcher had to reach out to students via WhatsApp and emails. The students found it difficult to complete the survey in a Microsoft Word or Acrobat Adobe format. Therefore, the returns on the student survey were extremely slow and few.

The researcher had to convert the survey into an online survey and administered this via a link on an email to students. A 2nd reminder and an extension of the due date ensured an acceptable rate of responses.

DUT was the core focus of this research study, thus producing this study as a case study research investigation. Findings revealed by the study may thus not necessarily be applicable to international institutions of higher education or generalised to other HEIs, but could be beneficial to other South African HEIs which are imperilled by similar challenges to DUT.

## 6.9 Suggestions for further research

This study has illustrated the challenges and best-practices of e-learning at other HEIs via the literature review. Moreover, the empirical analysis highlighted the challenges and best-practices of e-learning for teaching and learning at DUT.

Each HEI differs in their historical background, their engagement in practices for teaching and learning, as well as their approach to how they envisage technology for teaching and learning. Moodle has been purchased by DUT and customized to try and meet the needs of both lecturers and students. Given the diversity of students and lecturers and the various programmes offered at DUT, perhaps it is imperative to understand the needs of the DUT community and build tools that best address them (Aguilar 2020: 303). A needs analysis should thus be conducted to recognize diversities within teaching and learning and to find technologies, integrate software applications, building “your own” media platforms which speak to the current requirements. DUT can exploit the expertise of the skill sets in ITSS, CELT and IT departments for a strong coherent e-learning system.

Further investigations into how lecturers can learn and develop their capacity, while designing online teaching and learning programmes, needs to commence to ensure continuous staff development.

The implementation of compulsory online learning has resulted in virtual simulations and other technological innovations.  It is therefore important to gain the perspective of students regarding their online experiences to improve the quality of teaching and learning.

It is also important to determine whether lecturers are willing to embrace a shift in their mindset, by acknowledging that they can be taught by their students, who may be more familiar with the latest technological devices and developments.

The consequences of the Covid-19 pandemic has led HEIs to implement their curricula online. It is therefore necessary to investigate the implications of curricula delivery should it be implemented exclusively via online methods. It needs to be determined whether the quality of online education can match the quality of face-to-face teaching and learning methods.

## 6.10 Concluding remarks

This study explored the role of technology in higher education, as well as the challenges and best practices of e-learning for teaching and learning. To ensure that the researcher attained the objectives of the study, it was paramount to draw attention to how teaching and learning was conducted in HEIs; how technology impacted on the lecturers and students; and the impact of access to technology to engage in e-learning.

The researcher, through the primary and secondary data, was able to draw conclusions emanating from the research study. The findings of the study and the conclusions drawn are relevant and supported with the views expressed within the Constructivist Theory for teaching and learning; the social justice principles which invoke discussions on access to technology; and the TAM (Technology Acceptance Model) which relates to the use of technology in higher education.

Har (2005: 1-7) believes that teaching does not only involve the transmission of information and learning is not only about acquiring knowledge. The author advocates that traditional teaching approaches do not promote interactions between prior and new knowledge which is necessary for internalization and deep understanding. The author suggested that what was required was the inculcation of the Constructivist Theory to teaching and learning which enables students to build on prior knowledge allowing them (students) to build new knowledge from authentic knowledge. Fernando and Marikar (2017: 110) express the view that the Constructivist Theory (as expounded by von Glaserfeld, 1989) is that "the student or the learner is an active participant in the learning process and that the teacher has to take account of that in the teacher's effort to facilitate learning".

Bearing in mind the Constructivist Theory relevant to teaching and learning, HEIs should implement e-learning strategies which allow for the flexibility of time, providing lecturers with the opportunities to engage in personal mentorship and project-based learning. Curriculum delivery is more engaging and effective with e-learning, thus creating interactive teaching methods.

E-learning in HEIs has developed into a tool which endorses professionalism in teaching practices by allowing for the planning and preparation of subject content, sharing of resources, expertise and advice amongst students and peers.

The findings from the review of related literature indicate that e-learning in HEIs has become an effective tool for teaching staff to keep track of the learning progress of individual learners, thus allowing for the appropriate levels of materials to be disseminated to learners. Teaching staff can effectively manage education and training and tailor curricula to meet the needs of students.

However, the dominant reality illustrates that although HEIs and the Department of Higher Education and Training have emphasized the role of e-learning for the past decade, the concept of e-learning was not forcibly instituted at DUT. Lecturers were comfortable with face-to-face interactions with their students. In many cases, the LMS was seen as just a repository for learning materials and another method of communication. It was necessary to pay heed to the Technology Acceptance Model (TAM) if the perceived usefulness of technology in higher education was to be determined and implemented for teaching and learning. The TAM, developed by Davies in the late 1980s, illustrated the users' approach towards technology, which is the users' perceived ease of use and perceived usefulness of technology (Ramraj and Marimuthu 2020: 36; Lee, Kozar and Larsen 2003: 752). Although TAM focusses on usage (which is necessary), it is not sufficient, as indicated by the findings, to explore performance improvements due to engaging with technology-driven practices.

The comfort of using technology and the LMS as just a repository and communication channel reached its end-of-life in 2020. Educational institutions globally have largely transitioned to online learning due to the massive restrictions that the Covid-19 pandemic imposed on normal teaching and learning practices (Radha *et al.* 2020: 1088). The researcher, in her capacity as an IT Service Desk Administrator in the Department of Information Technology Support Services (ITSS), engages on a daily basis with lecturing staff on their challenges with using technology. In addition, the empirical study indicated the level of expertise of teaching staff and the inhibitions of a digital curriculum and the inherent challenges of outdated equipment, access to data, digital literacy levels and time constraints which inhibit the journey forward to a successful e-learning environment. The results of the empirical study further indicated that teaching staff engage in specific teaching practices which develop their students. This then lends impetus towards the (lack of) effort and investment of resources by DUT to enable the primary purpose of a HEI – scholarly graduates.

E-learning in HEIs provides for visual learning. This has become more inherent in all students as they are now exposed to a world of technology. Visual demonstration allows for the captivating of the students' attention, thus resulting in mental pictures to comprehend on a better level (Bester and Brand 2013: 4). The findings from the review of literature indicate that students are better educated and understand well through the interactive and motivating sessions provided by e-learning. The positive impact of this is motivated students who are more likely to engage in the learning process.

However, much still needs to be done to ensure the principles of digital equity amongst students. Social factors are inherently significant and relate to the students' adoption of e-learning (Kurdi, Alshurideh and Salloum 2020: 6491). Access to technology, learning facilities with appropriate e-learning capabilities and the development of skills to ensure a positive attitude to e-learning would help in easing negative perceptions and inculcate a learning behavior that will ensure the acceptance of e-learning. Apart from limiting the challenges of access to technology, the historical inadequacies which resulted in Historically Disadvantaged Institutions (HDIs) led to poor educational performance of the majority of the student population (Shay 2015: 434). Lambert (2018: 239) believes that there needs to be intense focus on social justice principles for these institutions to ensure "greater educational and societal equality". Institutions must be attentive to students who are less privileged, and provide the support, access and services for ensuring progress, as compared to their more privileged peers. This approach to providing additional resources to disadvantaged groups will result in overcoming historical injustices and ensure that students reach their full potential. The trajectory from conventional teaching and learning to an e-learning platform requires minimum essentials for e-learning and maximum effort. However, unreliable technology; technical issues for both lecturers and students; time and commitment to training in e-learning; resistance to change; and adapting to new teaching approaches are impediments to a successful e-learning environment.

This study began in a period where a blended e-learning approach was acceptable at all HEIs. However, with the tragedies and uncertainties inflicted by Covid-19, HEIs were ushered into teaching solely via e-learning. As much as the teaching staff at DUT have been inhibited by their varying experiences with digital literacy, it is commendable that curriculum delivery did not halt. The comparison of the statistics from the staff survey and the student survey varies in terms of digital literacy and the access to devices. With a majority of the staff inclined towards using existing pieces of technology with an ever-evolving technological environment, technical operational obstacles do not hinder students. The lack of a good learning attitude, self-discipline or good learning environment during this time is a higher concern. By adopting best-practices and ensuring that attempts are made to overcome the challenges presented, DUT can engage successfully in its entirety as an online educational institution.

***“Technology won’t replace teachers, but teachers who use technology will probably replace teachers who do not”.***

(Unique Teaching Resources 2017)

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## Annexure 1: Gatekeeper's Letter – 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*

9th May 2018

Mrs Navitha Ramroop
c/o Department of Public Management and Economics
Faculty of Management Sciences
Durban University of Technology

Dear Mrs Ramroop

**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 permission for you to conduct your research "Challenges and best practice in the use of e-learning technologies for teaching and learning at UOTs- A case study of the Durban University of Technology" at the Durban University of Technology.

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

Kindest regards.
Yours sincerely

PROF CARIN NAPIER
DIRECTOR (ACTING): RESEARCH AND POSTGRADUATE SUPPORT DIRECORATE

## Annexure 2: IREC Approval

DUT
DURBAN
UNIVERSITY OF
TECHNOLOGY

**Institutional Research Ethics Committee**
Research and Postgraduate Support Directorate
2nd Floor, Berwyn 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**

12 November 2019

Mrs N Ramroop
C/o ITSS Department
M L S Campus
Durban University of Technology

Dear Mrs Ramroop

**Challenges and best practice in the use of e-learning technologies for teaching and learning at UOTs- A case study of the Durban University of Technology**
**Ethical Clearance number IREC 035/18**

The Institutional Research Ethics Committee acknowledges receipt of your notification regarding the piloting of your data collection tools.

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,

Professor J K Adam
Chairperson: IREC

DUT DURBAN UNIVERSITY OF TECHNOLOGY
2019 -11- 12
INSITUTUTIONAL RESEARCH ETHICS COMMITTEE
P O BOX 1334 DURBAN 4000 SOUTH AFRICA

## Annexure 3: Letter of information to participants

**LETTER OF INFORMATION**

Dear Participant

I am currently registered for a Doctoral Degree (D-Tech) at the Durban University of Technology. This entails me conducting a study related to the use of e-learning technologies in higher education and thechallenges and best practices of e-learning technologies at the University.

**Title of the Research Study:**
Challenges and best practice in the use of e-learning technologies for teaching and learning at UoTs -A case study of the Durban University of Technology

**Principal Investigator/s/researcher:**
Navitha Ramroop (M-Tech: Entrepreneurship)

**Co-Investigator/s/supervisor/s:**
Professor K. Reddy (BCom, LLB, LLM, LLD)

**Brief Introduction and Purpose of the Study:**
The purpose of this study will be to assess the impact of e-learning in higher education and to determinethe teaching and learning challenges of technology application in the Durban University of Technology.

**Outline of the Procedures:**
Participation in this study is voluntary. The questions are based on various aspects of digital technology for higher education, best practice and challenges of e-learning. The information you provide will prove invaluable and contribute to the findings of this study. Recommendations foundedon the analysis of the challenges and best practices of e-learning will be forwarded to the university,thus paving a way for an improved application of digital technologies for teaching and learning.
Students will be requested to complete a questionnaire, which will be administered in the classroom. Lecturers will be completing an online survey, and a request to participate in an interview session withthe researcher will also be forwarded.

**Risks or Discomforts to the Participant:**
There are no known or foreseeable risks to the participants chosen for this study.

**Benefits:** (To the participant and to the researcher/s e.g. publications)
The benefits of this study will be to understand the e-learning challenges, thus enabling the university to offer a more holistic and improved teaching and learning environment to the participants and DUT asa whole. The potential benefit to the researcher will be publishing articles in accredited journals as wellas conference papers.

**Reason/s why the Participant May Be Withdrawn from the Study**
Should you no longer wish to participate, you can withdraw yourself from this study by informing theresearcher. You can be fully assured that there will be no adverse or negative effects.

**Remuneration:**
Please note that there are no monetary gain or other types of remuneration for your participation inthis study.

**Costs of the Study:**
There are no costs to be borne by you as a participant.

**Confidentiality:**
All information provided by the participant is maintained strictly confidential, and names will not bedivulged under any circumstances.

**Research-related Injury:**
This study will not result in any injuries or adverse reactions.

**Persons to Contact in the Event of Any Problems or Queries:**
In the event of any problems arising, please feel free to contact the researcher (tel no. 031-373 5207),my supervisor, Prof. K Reddy (tel no. 031-373 5367.) or the Institutional Research Ethics Administratoron 031 373 2375. Complaints can be reported to the Acting Director: Research and Postgraduate Support, Prof K. J. Duffy on 031 373 2576 or KevinD@dut.ac.za

## Annexure 4: Consent to participate in study

**CONSENT**

**Statement of Agreement to Participate in the Research Study:**

- I hereby confirm that I have been informed by the researcher, Navitha Ramroop, about the nature, conduct, benefits and risks of this study - Research Ethics Clearance Number: **IREC 035/18**,
- 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, Navitha Ramroop herewith confirm that the above participant has been fully informed about the nature, conduct and risks of the above study.

| Navitha Ramroop | 20/11/19 | **Signature** |
|---|---|---|
| **Full Name of Researcher** | **Date** | |

| __________________ | | __________ | __________________ |
|---|---|---|---|
| **Full Name of Witness (If applicable)** | **Date** | | **Signature** |

| __________________ | __________ | __________________ |
|---|---|---|
| **Full Name of Legal Guardian (If applicable) Date** | | **Signature** |

## Annexure 5: Staff survey questionnaire

**QUESTIONNAIRE TO DUT ACADEMIC STAFF**

This questionnaire aims to extract information focussing on the impact of technology in higher education and the challenges and best practices of e-learning technologies for teaching and learning in higher education, with particular reference to DUT.

Your response to all 24 questions are fundamental to the objectives of this study. The information will be treated with the utmost confidentiality, and will be used solely for the purpose of this Doctoral study. Thank you for taking the time to complete this questionnaire.

**Section 1**

1. Biographical Information

| | |
|---|---|
| Faculty | |
| Department | |

**Section 2: Teaching Practices**

Teaching is that which embodies the transference of knowledge from one individual to another (Brew, 2006:21).

2. Indicate the level of importance/unimportance of each of the methods that you deem necessary for ensuring that your students are stimulated, guided and encouraged by your teaching practices:

| METHODS RELATING TO TEACHING PRACTICES | Not Important | Slightly Important | Moderately Important | Important | Very important |
|---|---|---|---|---|---|
| Develop critical thinking skills. | | | | | |
| Stimulate valuable classroom interaction. | | | | | |
| Encouraging learning through students own efforts. | | | | | |
| Use of tutor manuals. | | | | | |
| Use of resource books. | | | | | |

3. Indicate the level of importance/unimportance of each of the concepts that are necessary for teaching and learning?

| IMPORTANCE FOR TEACHING AND LEARNING | Not Important | Slightly Important | Moderately Important | Important | Very Important |
|---|---|---|---|---|---|
| Transmission of information. | | | | | |
| Developing skills and attitudes of students. | | | | | |
| Promoting the development of the students' own conceptual understanding. | | | | | |

**Section 3: General Teaching Challenges**

4. Please rate your level of agreement or disagreement with regards to teaching challenges in Higher Education institutions (HEIs).

| | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree |
|---|---|---|---|---|---|
| South African teaching systems are authoritarian and stifles the development of students. | | | | | |
| HEIs are expected to increase throughput with limited resources while catering for large classes. | | | | | |
| Teaching at HEIs is difficult as there is a diverse population informed by multilingualism and varied levels of preparedness. | | | | | |
| Graduates of secondary education lack capabilities as required at university level. | | | | | |

5. List other reasons apart from those listed above that, in your opinion, are challenges to teaching in a HEI.

______________________________________________

______________________________________________

______________________________________________

______________________________________________

______________________________________________

______________________________________________

**Section 4: E-learning Practices/Trends**

Technology in education promotes "exploratory and inquiry-based modes of learning" thus enabling collaboration and interactive learning (Perumal, 2010:77-78).

6. Please complete the information requested below with regard to the types of technology you believe is/are most applicable in your teaching practices.

   Indicate the LMS (Learning Management System) that you are using for effective teaching and learning.

| **Learning Management System** | Tick |
|---|---|
| Blackboard | |
| Moodle (Modular object-oriented dynamic learning environment) | |
| Currently not using a LMS | |

7. Indicate the reasons why your choice is best suited to your teaching practice.

| |
|---|
| |
| |
| |
| |
| |

8. There are diverse online course delivery methods. Please indicate the type of method you use for effective teaching and learning:-

| **Online course delivery methods used:** | Tick. |
|---|---|
| **Blended/Hybrid:** Online and face-to-face delivery | |
| **Online: Most/all content is online** | |

9. List your ASYNCHRONOUS online course delivery methods mostly used

| ***Asynchronous (interacting with learners/lecturers online at different times) via:*** | |
|---|---|
| Emails | |
| Wikis – low stress environment (consult with learners at different times) | |
| Discussion boards | |
| Blogs | |

10. List your SYNCHRONOUS online course delivery methods mostly used

| ***Synchronous (Interacting with learners/lecturers at the same time) via:*** | |
|---|---|
| Chatrooms | |
| Videoconferencing | |
| Skype | |
| Virtual classrooms | |
| Instant messaging/chats | |

**Section 5: Challenges of Teaching with Technology**

Literature has identified certain challenges experienced by lecturers in adopting technology for teaching and learning. Please read the statements within the sub themes which follow and rate your level of agreement or disagreement according to your experiences at DUT.

11. **RIGID TEACHING PRACTICES**

| | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree |
|---|---|---|---|---|---|
| Academics are less eager to adopt e-learning to support their teaching as they find it difficult to adapt to change. | | | | | |
| Academics need to be convinced that the technology enhanced method, which is different from their traditional approach, is more feasible for their students, before they actually are willing to adopt any such method. | | | | | |
| Although technology is beneficial for communicating to learners, lecturers are concerned about losing the face-to-face interaction with students. | | | | | |
| Delivering curricula via technology is inhibited due to the reluctance of lecturers to invest the additional effort. | | | | | |
| Teaching practices are highly influenced by lecturers' pedagogical beliefs and their tried and tested methods of course delivery. | | | | | |

12. List other reasons apart from those listed above that, in your opinion, explains why teaching staff are not willing to modify their teaching practices.

13. **LACK OF SKILLS/KNOWLEDGE/ENGAGEMENT IN THE USE OF TECHNOLOGY**

| | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree |
|---|---|---|---|---|---|
| Navigation into educational programmes using technology is difficult because I do not have the necessary skills. | | | | | |
| Improving technological skills and knowledge is a crucial priority to ensure success in teaching with technology. | | | | | |
| Lecturers who lack technological skills cannot provide appropriate feedback to students. | | | | | |
| Lecturers who lack technological skills grapple with preparation of course content. | | | | | |
| Lecturers need to have the appropriate facilitation skills and develop technological skills for effective e-learning delivery. | | | | | |
| Lecturers may not be resistant to technological application, but are simply confused as to how to implement technology into their formal teaching methods. | | | | | |

14. **LACK OF ACCESS TO TECHNOLOGY**

| | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree |
|---|---|---|---|---|---|
| 12.1 There is a lack of technical support in HEIs. | | | | | |
| 12.2 There is a lack of technical support in my institution. | | | | | |
| 12.3 There is insufficient investments in equipment, infrastructure and resources. | | | | | |
| 12.4 Lecturers have outdated desktop computers and laptops which prove challenging when engaging in innovative methods of teaching. | | | | | |

15. **CHALLENGES RELATING TO POOR INFRASTRUCTURE**

| | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree |
|---|---|---|---|---|---|
| There is insufficient access to WiFi and bandwidth to access resources for teaching with technology. | | | | | |
| Technical errors, slowness in systems and bugs hinder my e-learning processes. | | | | | |

16. **CHALLENGES IN INTEGRATING TECHNOLOGY INTO TEACHING PRACTICES**

| | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree |
|---|---|---|---|---|---|
| Upgrades to existing technologies and various new technologies create overwhelming stresses in my teaching practices | | | | | |
| The inability to combine “content knowledge, pedagogical knowledge and technological knowledge”, which impacts negatively on student needs and learning outcomes | | | | | |

17. **USE OF TECHNOLOGY ENTAILS MORE WORK**

| | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree |
|---|---|---|---|---|---|
| Evolving e-learning technologies creates challenges and tension for lecturers, thus making them less receptive and more reluctant to integrate e-pedagogy. | | | | | |
| The lack of understanding and lack of confidence in new technologies makes lecturers more resistant to engaging in technologically enhanced teaching methods. | | | | | |

18. How does your teaching practice (with technology) impact on your understanding of learner differences (i.e. backgrounds and personalities)?

19. Apart from the challenges listed above, please list any challenges you may be experiencing in your teaching practices with e-learning.

______________________________________________

______________________________________________

______________________________________________

______________________________________________

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______________________________________________

**SECTION 6: BEST PRACTICES**

The education sector has adopted technology-enhanced learning (TEL) to reshape the teaching and learning activities. Literature maintains that while technology provides for radical changes to education, good practice impedes a successful transformation. Taking into account teaching and learning with technology, please categorise the following which you believe constitutes best practice:-

20. **BEST PRACTICES IN STAFF DEVELOPMENT**

| | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree |
|---|---|---|---|---|---|
| I am familiar with Mishra and Koehler's TPACK (Technological Pedagogical Content Knowledge) model. | | | | | |
| The TPACK model promotes a meaningful integration of technology, content knowledge and pedagogy for my teaching purposes. | | | | | |
| My institution provides adequate time and support for my developmental activities to innovate my teaching practices with technology. | | | | | |
| My institution invests in online technologies to build teacher competencies. | | | | | |
| My colleagues share their e-learning experiences, thus encouraging me and provides a basic support mechanism. | | | | | |
| My development is encouraged by peer observation of innovative teaching practices. | | | | | |
| Workshops and seminars enable my academic development by ensuring that I'm engaged and supported in technology-enhanced practices. | | | | | |

21. E-learning can be adopted on a positive level if:

| RESOURCES AND TECHNICAL SUPPORT | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree |
|---|---|---|---|---|---|
| My institution consults with me on technologies I require thus providing for reliable and consistently available resources. | | | | | |
| My institution provides for proper resources and technical support, guiding and supporting me in the implementation of e-learning. | | | | | |
| My institution provides for a supportive institutional culture taking into account integration between available technologies with existing pedagogic systems and practices. | | | | | |
| My institution provides reliable and consistently available resources to innovate my teaching practices. | | | | | |
| My institution provides for proper resources and technical support, guiding and supporting me in the implementation of e-learning. | | | | | |
| My institution informs me on technologies which exist and how such technologies can provide for high quality learning experience for my students | | | | | |
| My institution provides a platform for self-service support to rectify issues with technical and resource support | | | | | |

22. My teaching practices are more effective because:

| USE OF INSTRUCTIONAL TECHNOLOGY | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree |
|---|---|---|---|---|---|
| I am more effective in my practices by integrating web based content, e-books, lecture recordings, social media, simulations and online collaboration tools into my courses. | | | | | |
| My institution provides for an LMS (Learning management system) to ensure organisation, course structure and delivery of course material for optimum teaching with technology. | | | | | |
| Teaching with technology has enabled communication with my students via live chat, video/webcam interactions and virtual classrooms, thus having a positive influence on student engagement and course completion. | | | | | |
| Teaching with technology enables me to monitor academic behaviour, course attendance, and performance of my students. | | | | | |
| I provide academic assistance to my students through remote tuition sessions, thus ensuring resolution of key learning queries. | | | | | |

23. My professional development is enhanced informally because:

| SIGNIFICANCE OF COMMUNITY CHAT GROUPS | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree |
|---|---|---|---|---|---|
| I use my online space for professional learning by engaging with colleagues and exchanging professional knowledge. | | | | | |
| My colleagues and I assist each other in recognising changing fields and organising the mix of learning technologies in support of learning thus ensuring the promotion and sharing of good teaching practices. | | | | | |

24. Apart from the best practices listed above, please list any other best practices you think may be beneficial to learning with technology at DUT.

**THANK YOU FOR YOUR TIME**

# Annexure 6: Student survey questionnaire

**STUDENT QUESTIONNAIRE**

Thank you for taking the time to complete this questionnaire.

The questionnaire focuses on the challenges and best practices of e-learning at DUT that you are experiencing.

Your response to ALL the questions are important to the objectives of this study. The information will be treated with the utmost confidentiality, and will be used solely for the purpose of this Doctoral study

Please complete the table below with regard to your current status as a DUT student.

| | | | | | | |
|---|---|---|---|---|---|---|
| Faculty: | Management Sciences | | Arts and Design | | Engineering and the Built Environment | |
| | Health Sciences | | Accounting and Informatics | | Applied Sciences | |
| Programme: | | | | | | |
| Level of Study (please indicate your answer with a tick √ ) | 1st year | | | | | |
| | 2nd year | | | | | |
| | 3rd year | | | | | |

**SECTION 1: BACKGROUND INFORMATION TO TECHNOLOGY IN EDUCATION**

**This section helps identify your experience with technology before you enrolled as a student at DUT. Your responses will possibly contribute to the challenges you may be experiencing currently in using technology for learning.**

Please enter your response with a tick (√) in the appropriate block.

1. Technology in Secondary School

| | | Yes | No |
|---|---|---|---|
| 1.1. | Did you have access to computers at school? | | |
| 1.2. | Were you trained in school to use a computer? | | |
| 1.3. | Did you have access to the internet and social media sites at school? | | |
| 1.4. | Did you use a computer for research purposes in school? | | |
| **Additional comments** | | | |
| | | | |
| | | | |
| | | | |

2. "Electronic devices" include various types of equipment. Do you own any of the equipment listed below?

| DEVICE | Yes | No |
|---|---|---|
| 2.1. Personal computer (PC) | | |
| 2.2. Smart Phone | | |
| 2.3. Tablet | | |
| 2.4. Laptop | | |
| 2.5. Wearables (Smart Watches) | | |
| **Additional comments** | | |
| | | |
| | | |
| | | |

3. If "NO" to Question 2, have you had any exposure to the following devices:

| DEVICE | Never | Rarely | Sometimes | Very Often | Always |
|---|---|---|---|---|---|
| 3.1. Personal computer (PC) | | | | | |
| 3.2. Smart Phone | | | | | |
| 3.3. Tablet | | | | | |
| 3.4. Laptop | | | | | |
| 3.5. Wearables (Smart Watches) | | | | | |
| **Additional comments** | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

**SECTION 2: E-LEARNING**

This section focuses on using technology for learning at DUT. E-learning can take place online, offline, or in a combination thereof. E-learning occurs via a LMS (Learning Management System).

4. Please indicate with a (√) the LMS (Learning Management System) that you are exposed to

| | |
|---|---|
| 4.1. Blackboard | |
| 4.2. Moodle (Modular object-oriented dynamic learning environment) | |
| 4.3. Currently not exposed to a LMS | |

5. E-learning occurs through diverse online course delivery methods. Please indicate with a tick (√) the type of method you are exposed to:

| | |
|---|---|
| **5.1. Blended/Hybrid:** | |
| 5.1.1. Online and face-to-face delivery | |
| | |
| **5.2. Online: Most/all content is online** | |
| ***5.2.1. Asynchronous (Interacting with peers/lecturers at different times) via:*** | |
| a) Emails | |
| b) Blogs | |
| c) Discussion boards | |
| d) Wikis – low stress environment | |
| | |
| ***5.2.2. Synchronous (Interacting with peers/lecturers at the same time) via:*** | |
| a) Chatrooms | |
| b) Videoconferencing | |
| c) Skype | |
| d) Virtual classrooms | |
| e) Instant messaging/chats | |

**SECTION 3: CHALLENGES EXPERIENCED WITH E-LEARNING**

**NOTE: For questions 6-17, indicate your level of agreement/disagreement with each of the statements in the respective tables, as per your experience.**

Literature has identified that there are challenges in using technology for learning. These stem from access, lack of skills, affordability and poor infrastructure.

Please enter your response with a tick (√) in the appropriate block.

6. In your experience as a DUT student:

| DISTRACTION TO WEAKER STUDENTS | **Strongly Disagree** | **Disagree** | **Neutral** | **Agree** | **Strongly Agree** |
|---|---|---|---|---|---|
| 6.1 I am often distracted by social media and other entertaining content when using technology for learning | | | | | |
| 6.2 I am often distracted when using technology for learning, as lessons with technology lack innovation | | | | | |

Please indicate which of the following reasons you agree/disagree with as possible reasons for students withdrawing from online courses or performing poorly.

7. It is difficult for me to concentrate on online learning:

| | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree |
|---|---|---|---|---|---|
| 7.1 because I cannot afford the technology for online courses | | | | | |
| 7.2 because of insufficient time to study | | | | | |
| 7.3 because of lack of experience in online learning | | | | | |

8. E-learning impacts on the allocation of my time since:

| USE OF TECHNOLOGY REQUIRES MORE TIME | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree |
|---|---|---|---|---|---|
| 8.1 E-learning takes up more of my time as I need to retrieve information from the LMS | | | | | |
| 8.2 I do not have the time to engage in live e-learnings sessions due to family and work commitments | | | | | |

9. Interactions in e-learning are technology based. Indicate your level of agreement/disagreement on technology defeating interactions within the classroom.

| INTERACTIONS BETWEEN PEERS, LECTURERS AND LEARNING MATERIAL | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree |
|---|---|---|---|---|---|
| 9.1 With e-learning, I do not get to interact personally with my peers | | | | | |
| 9.2 With e-learning, I do not get to interact personally with my lecturers | | | | | |
| 9.3 I find it difficult to engage with e-learning material as it is not interactive | | | | | |
| 9.4 E-learning is concerned with digital learning material only, and does not provide me with interactive learning activities. | | | | | |
| 9.5 E-learning does not provide me with the opportunity to problem solve with my peers | | | | | |

10. E-learning produces an environment that may be flexible and convenient, but E-learning lacks human content as:

| LACK OF HUMAN CONTACT | **Strongly Disagree** | **Disagree** | **Neutral** | **Agree** | **Strongly Agree** |
|---|---|---|---|---|---|
| 10.1 e-learning does not give me the opportunity to interact with my fellow students and lecturers | | | | | |
| 10.2 e-learning does not give me the opportunity to get feedback immediately from my lecturers | | | | | |
| 10.3 e-learning does not allow me to express my thoughts and ideas | | | | | |

11. Please indicate the challenges that you experienced with access to technology at DUT.

| LACK OF ACCESS TO TECHNOLOGY | **Strongly Disagree** | **Disagree** | **Neutral** | **Agree** | **Strongly Agree** |
|---|---|---|---|---|---|
| 11.1 I cannot afford technological devices to study via e-learning | | | | | |
| 11.2 There are poor computer facilities in my institution for e-learning purposes | | | | | |
| 11.3 There is poor network connectivity in my institution for e-learning | | | | | |
| 11.4 There is poor Wi-Fi access in my institution for e-learning purposes. | | | | | |

12. E-learning can be difficult if a student lacks confidence or does not have the ability to use the technology. Indicate your level of agreement/disagreement on the statements below relating to your technological skills:

| TECHNOLOGICAL SKILLS CHALLENGES | **Strongly Disagree** | **Disagree** | **Neutral** | **Agree** | **Strongly Agree** |
|---|---|---|---|---|---|
| 12.1 E-learning proves difficult as I do not have the appropriate technological skills | | | | | |
| 12.2 I am afraid to use technology for learning as I find it difficult to access course material or prepare for online assessments | | | | | |
| 12.3 Technology moves too rapidly and I cannot keep up with the advancements | | | | | |
| 12.4 I lack the confidence to use technological equipment to engage in online learning | | | | | |

13. Please indicate your agreement/disagreement with the following statements which show that learning via technology proves risky to your studies:

| WORKING ONLINE | **Strongly Disagree** | **Disagree** | **Neutral** | **Agree** | **Strongly Agree** |
|---|---|---|---|---|---|
| 13.1 Submitting my work via e-learning is risky as my work could be lost | | | | | |
| 13.2 Submitting my work via e-learning is risky as sensitive information could be disclosed | | | | | |

14. With regard to the quality of the e-learning system that you are familiar with at DUT:

| POOR QUALITY OF E-LEARNING SYSTEMS | **Strongly Disagree** | **Disagree** | **Neutral** | **Agree** | **Strongly Agree** |
|---|---|---|---|---|---|
| 14.1 The quality of the e-learning system in my institution is not adequate to meet my educational needs | | | | | |
| 14.2 I spend more time learning how to use the software rather than learning the contents | | | | | |

15. It is important for lecturers to integrate technology and subject content properly to enable adequate learning.

| POOR EFFORT FROM LECTURERS | **Strongly Disagree** | **Disagree** | **Neutral** | **Agree** | **Strongly Agree** |
|---|---|---|---|---|---|
| 15.1 My lecturers do not integrate technology into the curriculum adequately | | | | | |
| 15.2 My lecturers do not plan and prepare learning activities with technology adequately | | | | | |
| 15.3 My lecturers do not consider learning enhancement and student engagement when incorporating technology into the curriculum | | | | | |

16. Learners who are not trained in using technological devices will not experience the full benefits of the e-learning environment. Indicate your level of agreement/disagreement on the following statements as to whether DUT has assisted in enhancing your skills for the purposes of e-learning:

| TRAINING/WORKSHOPS/ORIENTATION | **Strongly Disagree** | **Disagree** | **Neutral** | **Agree** | **Strongly Agree** |
|---|---|---|---|---|---|
| 16.1 The institution does not provide training and workshops to enable my use of e-learning | | | | | |
| 16.2 The institution does not provide orientation courses for e-learning, to improve understanding of course material | | | | | |

17. It is challenging for you to complete your work because of the lack of technical support for e-learning activities.

| TECHNICAL SUPPORT | **Strongly Disagree** | **Disagree** | **Neutral** | **Agree** | **Strongly Agree** |
|---|---|---|---|---|---|
| 17.1 My institution does not provide adequate online technical support for my e-learning activities. | | | | | |
| 17.2 My institution does not provide a reliable LMS (Learning Management System) | | | | | |
| 17.3 My institution does not provide a Help Desk for technical support (phone/email/chat) | | | | | |

18. Apart from the challenges listed above, please list any other challenges you may be experiencing with e-learning at DUT

________________________________________

________________________________________

________________________________________

________________________________________

**SECTION 4: BEST PRACTICES**

19. The following statements focus on the best practices of **other institutions** and relate to how learners enjoy technological advancements in education to enhance their learning activities. Rate your level of agreement/disagreement on each of the following, which you believe would be a good practice for DUT.

| BEST PRACTICES | **Strongly Disagree** | **Disagree** | **Neutral** | **Agree** | **Strongly Agree** |
|---|---|---|---|---|---|
| 19.1 In classes with large groups, tools such as social networking, micro blogging, other applications should be made available | | | | | |
| 19.2 Learning will be more interactive if lecturers deliver online courses via social media, lecture recordings, online educational games and other similar technologies | | | | | |
| 19.3 The feelings of isolation in online classes can be overcome by online peer tutoring, discussion boards and group videoconferences | | | | | |
| 19.4 Having online access to remote tutors will assist in my studies via e-learning | | | | | |
| 19.5 Training programmes and orientation will improve pass rates in the e-learning environment | | | | | |
| 19.6 Flexible online technical support is important for a user-friendly environment for e-learning success | | | | | |

20. Apart from the best practices listed above, please list any other best practices you think may be beneficial to learning with technology at DUT.

**THANK YOU FOR YOUR TIME**

**Annexure 7: Turnitin Report** **(Prof. K. Reddy - Date: 30/05/21)**

Navitha Ramroop amended full PhD thesis 26 05 2021

ORIGINALITY REPORT

| 15% | 13% | 5% | 6% |
|---|---|---|---|
| SIMILARITY INDEX | INTERNET SOURCES | PUBLICATIONS | STUDENT PAPERS |

PRIMARY SOURCES

| | | |
|---|---|---|
| 1 | Submitted to University of KwaZulu-Natal<br>Student Paper | 1 % |
| 2 | Submitted to Mancosa<br>Student Paper | 1 % |
| 3 | Submitted to Durban University of Technology<br>Student Paper | 1 % |
| 4 | ir.dut.ac.za<br>Internet Source | 1 % |
| 5 | openscholar.dut.ac.za<br>Internet Source | 1 % |
| 6 | www.mobt3ath.com<br>Internet Source | <1 % |
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| 9 | hdl.handle.net<br>Internet Source | <1 % |

# Appendix A: Correlation Analysis: Staff

Correlations

| | | | Personal Computer (PC) | Smart Phone | Tablet | Laptop | Wearables (Smart Watches) | I am often distracted by social media and other entertaining content when using technology for learning | I am often distracted when using technology for learning, as lessons with technology lack innovation | because I cannot afford the technology for online courses | because of insufficient time to study | because of lack of experience in online learning | E-learning takes up more of my time as I need to retrieve information from the LMS | I do not have the time to engage in live e-learnings sessions due to family and work commitments | With e-learning, I do not get to interact personally with my peers | With e-learning, I do not get to interact personally with my lecturers | I find it difficult to engage with e-learning material as it is not interactive |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Spearman's | Personal Computer (PC) | Correlation Coefficient | 1,000 | .280** | .471** | .361** | .250** | -0,039 | -0,095 | -0,053 | -.124* | -.170** | -.123* | -.134* | -0,019 | -0,005 | -0,068 |
| | | Sig. (2-tailed) | | 0,000 | 0,000 | 0,000 | 0,000 | 0,530 | 0,129 | 0,401 | 0,047 | 0,006 | 0,049 | 0,032 | 0,761 | 0,935 | 0,278 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 |
| | Smart Phone | Correlation Coefficient | .280** | 1,000 | .172** | .328** | 0,035 | .137* | 0,028 | -0,020 | -0,106 | -0,089 | -0,060 | -.148* | -0,059 | 0,004 | -0,076 |
| | | Sig. (2-tailed) | 0,000 | | 0,006 | 0,000 | 0,581 | 0,028 | 0,651 | 0,754 | 0,092 | 0,157 | 0,341 | 0,018 | 0,349 | 0,955 | 0,226 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 |
| | Tablet | Correlation Coefficient | .471** | .172** | 1,000 | .382** | .422** | -0,027 | -0,051 | -0,102 | -.160* | -.142* | -0,058 | -.144* | -0,065 | -.129* | -0,083 |
| | | Sig. (2-tailed) | 0,000 | 0,006 | | 0,000 | 0,000 | 0,671 | 0,416 | 0,102 | 0,010 | 0,023 | 0,352 | 0,021 | 0,299 | 0,040 | 0,184 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 |
| | Laptop | Correlation Coefficient | .361** | .328** | .382** | 1,000 | .243** | -0,022 | -0,026 | -.227** | -0,099 | -0,112 | -0,104 | -.153* | -.132* | -.127* | -.157* |
| | | Sig. (2-tailed) | 0,000 | 0,000 | 0,000 | | 0,000 | 0,724 | 0,677 | 0,000 | 0,116 | 0,073 | 0,098 | 0,015 | 0,035 | 0,043 | 0,012 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 |
| | Wearables (Smart Watches) | Correlation Coefficient | .250** | 0,035 | .422** | .243** | 1,000 | -0,051 | -0,057 | -.170** | -.128* | -0,088 | -0,073 | -0,097 | -0,069 | -0,100 | -0,078 |
| | | Sig. (2-tailed) | 0,000 | 0,581 | 0,000 | 0,000 | | 0,420 | 0,361 | 0,006 | 0,041 | 0,158 | 0,241 | 0,123 | 0,272 | 0,111 | 0,211 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 |
| | I am often distracted by social media and other entertaining content when using technology for learning | Correlation Coefficient | -0,039 | .137* | -0,027 | -0,022 | -0,051 | 1,000 | .398** | .149* | .163** | .203** | .230** | .159* | .138* | .168** | .212** |
| | | Sig. (2-tailed) | 0,530 | 0,028 | 0,671 | 0,724 | 0,420 | | 0,000 | 0,017 | 0,009 | 0,001 | 0,000 | 0,011 | 0,028 | 0,007 | 0,001 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 |
| | I am often distracted when using technology for learning, as lessons with technology lack innovation | Correlation Coefficient | -0,095 | 0,028 | -0,051 | -0,026 | -0,057 | .398** | 1,000 | .159* | .259** | .321** | .276** | .263** | .294** | .290** | .373** |
| | | Sig. (2-tailed) | 0,129 | 0,651 | 0,416 | 0,677 | 0,361 | 0,000 | | 0,011 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 |
| | because I cannot afford the technology for online courses | Correlation Coefficient | -0,053 | -0,020 | -0,102 | -.227** | -.170** | .149* | .159* | 1,000 | .248** | .419** | .189** | .295** | .197** | .253** | .251** |
| | | Sig. (2-tailed) | 0,401 | 0,754 | 0,102 | 0,000 | 0,006 | 0,017 | 0,011 | | 0,000 | 0,000 | 0,002 | 0,000 | 0,001 | 0,000 | 0,000 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 |
| | because of insufficient time to study | Correlation Coefficient | -.124* | -0,106 | -.160* | -0,099 | -.128* | .163** | .259** | .248** | 1,000 | .377** | .282** | .407** | .248** | .243** | .335** |
| | | Sig. (2-tailed) | 0,047 | 0,092 | 0,010 | 0,116 | 0,041 | 0,009 | 0,000 | 0,000 | | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 |
| | because of lack of experience in online learning | Correlation Coefficient | -.170** | -0,089 | -.142* | -0,112 | -0,088 | .203** | .321** | .419** | .377** | 1,000 | .347** | .357** | .188** | .273** | .339** |
| | | Sig. (2-tailed) | 0,006 | 0,157 | 0,023 | 0,073 | 0,158 | 0,001 | 0,000 | 0,000 | 0,000 | | 0,000 | 0,000 | 0,003 | 0,000 | 0,000 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 |
| | E-learning takes up more of my time as I need to retrieve information from the LMS | Correlation Coefficient | -.123* | -0,060 | -0,058 | -0,104 | -0,073 | .230** | .276** | .189** | .282** | .347** | 1,000 | .454** | .306** | .244** | .329** |
| | | Sig. (2-tailed) | 0,049 | 0,341 | 0,352 | 0,098 | 0,241 | 0,000 | 0,000 | 0,002 | 0,000 | 0,000 | | 0,000 | 0,000 | 0,000 | 0,000 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 |
| | I do not have the time to engage in live e-learnings sessions due to family and work commitments | Correlation Coefficient | -.134* | -.148* | -.144* | -.153* | -0,097 | .159* | .263** | .295** | .407** | .357** | .454** | 1,000 | .305** | .204** | .365** |
| | | Sig. (2-tailed) | 0,032 | 0,018 | 0,021 | 0,015 | 0,123 | 0,011 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | | 0,000 | 0,001 | 0,000 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 |
| | With e-learning, I do not get to interact personally with my peers | Correlation Coefficient | -0,019 | -0,059 | -0,065 | -.132* | -0,069 | .138* | .294** | .197** | .248** | .188** | .306** | .305** | 1,000 | .503** | .430** |
| | | Sig. (2-tailed) | 0,761 | 0,349 | 0,299 | 0,035 | 0,272 | 0,028 | 0,000 | 0,001 | 0,000 | 0,003 | 0,000 | 0,000 | | 0,000 | 0,000 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 |
| | With e-learning, I do not get to interact personally with my lecturers | Correlation Coefficient | -0,005 | 0,004 | -.129* | -.127* | -0,100 | .168** | .290** | .253** | .243** | .273** | .244** | .204** | .503** | 1,000 | .528** |
| | | Sig. (2-tailed) | 0,935 | 0,955 | 0,040 | 0,043 | 0,111 | 0,007 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,001 | 0,000 | | 0,000 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 |
| | I find it difficult to engage with e- learning material as it is not interactive | Correlation Coefficient | -0,068 | -0,076 | -0,083 | -.157* | -0,078 | .212** | .373** | .251** | .335** | .339** | .329** | .365** | .430** | .528** | 1,000 |
| | | Sig. (2-tailed) | 0,278 | 0,226 | 0,184 | 0,012 | 0,211 | 0,001 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 |
| | E-learning is concerned with digital learning material only, and does not provide me with interactive learning activities. | Correlation Coefficient | -0,075 | -0,024 | -0,080 | -0,086 | -0,098 | .176** | .313** | .238** | .167** | .332** | .393** | .300** | .363** | .413** | .592** |
| | | Sig. (2-tailed) | 0,229 | 0,698 | 0,203 | 0,171 | 0,118 | 0,005 | 0,000 | 0,000 | 0,007 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 |
| | E-learning does not provide me with the opportunity to problem solve with my peers | Correlation Coefficient | -0,053 | 0,005 | -0,044 | -0,009 | -0,107 | .263** | .310** | .242** | .271** | .325** | .349** | .290** | .495** | .462** | .500** |
| | | Sig. (2-tailed) | 0,401 | 0,937 | 0,485 | 0,885 | 0,089 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 |
| | e-learning does not give me the opportunity to interact with my fellow students and lecturers | Correlation Coefficient | 0,070 | 0,072 | -0,008 | 0,075 | -0,062 | .126* | .126* | .202** | .189** | .202** | .280** | .240** | .451** | .511** | .452** |
| | | Sig. (2-tailed) | 0,262 | 0,250 | 0,902 | 0,232 | 0,321 | 0,044 | 0,044 | 0,001 | 0,002 | 0,001 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 |
| | e-learning does not give me the opportunity to get feedback immediately from my lecturers | Correlation Coefficient | 0,007 | -0,044 | 0,004 | 0,046 | -0,017 | 0,122 | .156* | 0,082 | .145* | .141* | .222** | .242** | .330** | .381** | .380** |
| | | Sig. (2-tailed) | 0,907 | 0,487 | 0,953 | 0,467 | 0,785 | 0,051 | 0,012 | 0,193 | 0,020 | 0,025 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 |
| | e-learning does not allow me to express my thoughts and ideas | Correlation Coefficient | -0,007 | -0,004 | -0,070 | -0,093 | -0,057 | .210** | .243** | 0,108 | .176** | .205** | .284** | .274** | .309** | .413** | .418** |
| | | Sig. (2-tailed) | 0,911 | 0,946 | 0,266 | 0,140 | 0,364 | 0,001 | 0,000 | 0,086 | 0,005 | 0,001 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 |
| | I cannot afford technological devices to study via e-learning | Correlation Coefficient | -.195** | -.154* | -.248** | -.409** | -.249** | 0,017 | .151* | .476** | .130* | .274** | .247** | .296** | .291** | .196** | .319** |
| | | Sig. (2-tailed) | 0,002 | 0,013 | 0,000 | 0,000 | 0,000 | 0,787 | 0,016 | 0,000 | 0,037 | 0,000 | 0,000 | 0,000 | 0,000 | 0,002 | 0,000 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 |
| | There are poor computer facilities in my institution for e-learning purposes | Correlation Coefficient | -0,066 | -0,084 | -0,104 | -.195** | -0,050 | 0,025 | 0,087 | .205** | .146* | .135* | .125* | .258** | 0,110 | 0,083 | .176** |
| | | Sig. (2-tailed) | 0,290 | 0,179 | 0,096 | 0,002 | 0,430 | 0,685 | 0,167 | 0,001 | 0,019 | 0,031 | 0,046 | 0,000 | 0,079 | 0,186 | 0,005 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 |
| | There is poor network connectivity in my institution for e-learning | Correlation Coefficient | -.126* | -0,060 | -0,100 | -.126* | -0,030 | 0,091 | .201** | .179** | .348** | .174** | .156* | .285** | .262** | .137* | .264** |
| | | Sig. (2-tailed) | 0,044 | 0,336 | 0,110 | 0,043 | 0,628 | 0,146 | 0,001 | 0,004 | 0,000 | 0,005 | 0,012 | 0,000 | 0,000 | 0,029 | 0,000 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 |
| | There is poor Wi-Fi access in my institution for e-learning purposes. | Correlation Coefficient | -0,038 | -0,030 | -0,006 | -0,039 | 0,062 | 0,053 | 0,108 | 0,078 | .161** | 0,094 | 0,111 | 0,115 | .187** | 0,027 | .157* |
| | | Sig. (2-tailed) | 0,542 | 0,636 | 0,923 | 0,534 | 0,325 | 0,398 | 0,085 | 0,215 | 0,010 | 0,134 | 0,078 | 0,065 | 0,003 | 0,673 | 0,012 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 |
| | E-learning proves difficult as I do not have the appropriate technological skills | Correlation Coefficient | -.276** | -.252** | -.287** | -.303** | -.237** | 0,100 | .193** | .288** | .272** | .399** | .258** | .326** | .160* | .146* | .227** |
| | | Sig. (2-tailed) | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,111 | 0,002 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,010 | 0,019 | 0,000 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 |
| | I am afraid to use technology for learning as I find it difficult to access course material or prepare for online assessments | Correlation Coefficient | -.193** | -0,099 | -0,121 | -.284** | -.131* | .130* | .245** | .180** | .235** | .314** | .343** | .260** | .156* | .275** | .291** |
| | | Sig. (2-tailed) | 0,002 | 0,114 | 0,052 | 0,000 | 0,036 | 0,038 | 0,000 | 0,004 | 0,000 | 0,000 | 0,000 | 0,000 | 0,012 | 0,000 | 0,000 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 |
| | Technology moves too rapidly and I cannot keep up with the advancements | Correlation Coefficient | -.245** | -.128* | -.220** | -.255** | -.253** | .220** | .292** | .313** | .304** | .363** | .320** | .326** | .167** | .141* | .253** |
| | | Sig. (2-tailed) | 0,000 | 0,041 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,007 | 0,024 | 0,000 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 |
| | I lack the confidence to use technological equipment to engage in online learning | Correlation Coefficient | -.244** | -.161* | -.193** | -.323** | -.195** | .213** | .261** | .173** | .338** | .287** | .306** | .317** | .175** | 0,111 | .262** |
| | | Sig. (2-tailed) | 0,000 | 0,010 | 0,002 | 0,000 | 0,002 | 0,001 | 0,000 | 0,005 | 0,000 | 0,000 | 0,000 | 0,000 | 0,005 | 0,076 | 0,000 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 |
| | Submitting my work via e-learning is risky as my work could be lost | Correlation Coefficient | -.189** | 0,008 | -.139* | -.123* | -.146* | .208** | .202** | .220** | .245** | .279** | .371** | .265** | .276** | .283** | .378** |
| | | Sig. (2-tailed) | 0,002 | 0,896 | 0,026 | 0,050 | 0,019 | 0,001 | 0,001 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| | | N | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 |
| | Submitting my work via e-learning is risky as sensitive information could be disclosed | Correlation Coefficient | -0,118 | -0,069 | -0,044 | -0,045 | -0,032 | .143* | .211** | .258** | .199** | .308** | .318** | .236** | .176** | .223** | .311** |
| | | Sig. (2-tailed) | 0,059 | 0,273 | 0,483 | 0,477 | 0,616 | 0,022 | 0,001 | 0,000 | 0,001 | 0,000 | 0,000 | 0,000 | 0,005 | 0,000 | 0,000 |
| | | N | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 |
| | The quality of the e-learning system in my institution is not adequate to meet my educational needs | Correlation Coefficient | -0,019 | -0,089 | -0,039 | -0,036 | -0,031 | 0,041 | .218** | .199** | .245** | .286** | .278** | .221** | .215** | .259** | .327** |
| | | Sig. (2-tailed) | 0,762 | 0,154 | 0,540 | 0,565 | 0,617 | 0,513 | 0,000 | 0,001 | 0,000 | 0,000 | 0,000 | 0,000 | 0,001 | 0,000 | 0,000 |
| | | N | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 |
| | I spend more time learning how to use the software rather than learning the contents | Correlation Coefficient | -.205** | -.143* | -.160* | -.233** | -.181** | .253** | .298** | .333** | .257** | .360** | .305** | .341** | .219** | .229** | .367** |
| | | Sig. (2-tailed) | 0,001 | 0,022 | 0,011 | 0,000 | 0,004 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| | | N | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 |
| | My lecturers do not integrate technology into the curriculum adequately | Correlation Coefficient | 0,038 | -0,024 | 0,035 | 0,023 | 0,044 | 0,059 | .162** | .188** | .153* | .229** | .147* | .244** | .205** | .207** | .318** |
| | | Sig. (2-tailed) | 0,542 | 0,703 | 0,578 | 0,718 | 0,484 | 0,350 | 0,009 | 0,003 | 0,014 | 0,000 | 0,018 | 0,000 | 0,001 | 0,001 | 0,000 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 |
| | My lecturers do not plan and prepare learning activities with technology adequately | Correlation Coefficient | 0,012 | 0,047 | 0,048 | 0,014 | 0,050 | .126* | .141* | .190** | .131* | .231** | .217** | .167** | .158* | .230** | .292** |
| | | Sig. (2-tailed) | 0,853 | 0,458 | 0,446 | 0,825 | 0,425 | 0,044 | 0,024 | 0,002 | 0,037 | 0,000 | 0,000 | 0,008 | 0,011 | 0,000 | 0,000 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 |
| | My lecturers do not consider learning enhancement and student engagement when incorporating technology into the curriculum | Correlation Coefficient | 0,005 | 0,052 | 0,042 | -0,049 | 0,051 | 0,023 | .202** | .189** | .152* | .320** | .147* | .151* | .177** | .299** | .303** |
| | | Sig. (2-tailed) | 0,930 | 0,404 | 0,507 | 0,435 | 0,416 | 0,713 | 0,001 | 0,002 | 0,015 | 0,000 | 0,018 | 0,015 | 0,005 | 0,000 | 0,000 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 |
| | The institution does not provide training and workshops to enable my use of e-learning | Correlation Coefficient | -0,073 | -0,014 | -0,098 | -.197** | 0,042 | .141* | .181** | .153* | .181** | .210** | .128* | .185** | .124* | .166** | .247** |
| | | Sig. (2-tailed) | 0,246 | 0,818 | 0,120 | 0,002 | 0,502 | 0,024 | 0,004 | 0,014 | 0,004 | 0,001 | 0,042 | 0,003 | 0,049 | 0,008 | 0,000 |
| | | N | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 |
| | The institution does not provide orientation courses for e-learning, to improve understanding of course material | Correlation Coefficient | -0,073 | -0,036 | -0,090 | -.166** | 0,010 | .127* | 0,120 | 0,074 | 0,114 | .207** | .193** | .177** | 0,101 | 0,079 | .235** |
| | | Sig. (2-tailed) | 0,245 | 0,568 | 0,152 | 0,008 | 0,871 | 0,044 | 0,055 | 0,238 | 0,069 | 0,001 | 0,002 | 0,005 | 0,108 | 0,206 | 0,000 |
| | | N | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 |
| | My institution does not provide adequate online technical support for my e-learning activities. | Correlation Coefficient | 0,001 | -0,069 | -0,046 | -0,095 | -0,011 | 0,108 | 0,073 | .231** | 0,084 | .222** | .220** | .218** | .255** | .139* | .269** |
| | | Sig. (2-tailed) | 0,992 | 0,272 | 0,462 | 0,128 | 0,863 | 0,084 | 0,243 | 0,000 | 0,180 | 0,000 | 0,000 | 0,000 | 0,000 | 0,027 | 0,000 |
| | | N | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 |
| | My institution does not provide a reliable LMS (Learning Management System) | Correlation Coefficient | -0,037 | -.174** | -0,005 | -.164** | 0,053 | 0,052 | .161** | .169** | .134* | .169** | .186** | .180** | .186** | 0,103 | .216** |
| | | Sig. (2-tailed) | 0,558 | 0,005 | 0,938 | 0,009 | 0,398 | 0,411 | 0,010 | 0,007 | 0,032 | 0,007 | 0,003 | 0,004 | 0,003 | 0,102 | 0,001 |
| | | N | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 |
| | My institution does not provide a Help Desk for technical support (phone/email/chat) | Correlation Coefficient | 0,026 | -0,055 | 0,013 | -0,013 | 0,045 | 0,089 | 0,044 | 0,055 | -0,064 | 0,041 | .145* | 0,051 | 0,096 | 0,050 | 0,121 |
| | | Sig. (2-tailed) | 0,677 | 0,384 | 0,840 | 0,838 | 0,475 | 0,156 | 0,483 | 0,380 | 0,312 | 0,517 | 0,021 | 0,420 | 0,126 | 0,423 | 0,055 |
| | | N | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 |
| | In classes with large groups, tools such as social networking, micro blogging, other applications should be made available | Correlation Coefficient | -0,059 | -0,097 | -.200** | -0,083 | -0,035 | 0,015 | 0,074 | 0,120 | .180** | .189** | 0,081 | 0,120 | .170** | .158* | 0,108 |
| | | Sig. (2-tailed) | 0,351 | 0,126 | 0,001 | 0,187 | 0,576 | 0,810 | 0,243 | 0,057 | 0,004 | 0,003 | 0,201 | 0,058 | 0,007 | 0,012 | 0,089 |
| | | N | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 |
| | Learning will be more interactive if lecturers deliver online courses via social media, lecture recordings, online educational games and other similar technologies | Correlation Coefficient | 0,040 | 0,106 | -0,030 | 0,063 | 0,038 | 0,032 | .143* | 0,067 | 0,112 | 0,119 | .139* | .132* | .161* | .135* | .142* |
| | | Sig. (2-tailed) | 0,529 | 0,092 | 0,640 | 0,323 | 0,545 | 0,609 | 0,023 | 0,289 | 0,078 | 0,060 | 0,028 | 0,036 | 0,011 | 0,033 | 0,025 |
| | | N | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 |
| | The feelings of isolation in online classes can be overcome by online peer tutoring, discussion boards and group video conferences | Correlation Coefficient | 0,020 | .146* | -0,052 | 0,034 | -0,065 | -0,005 | 0,047 | -0,014 | 0,058 | 0,003 | 0,055 | 0,038 | .210** | .126* | 0,061 |
| | | Sig. (2-tailed) | 0,748 | 0,021 | 0,413 | 0,594 | 0,305 | 0,935 | 0,455 | 0,820 | 0,363 | 0,961 | 0,381 | 0,545 | 0,001 | 0,046 | 0,336 |
| | | N | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 |
| | Having online access to remote tutors will assist in my studies via e-learning | Correlation Coefficient | -0,027 | 0,110 | -0,026 | 0,063 | -0,015 | 0,009 | 0,043 | 0,041 | 0,040 | 0,101 | 0,008 | 0,006 | 0,108 | 0,109 | 0,039 |
| | | Sig. (2-tailed) | 0,671 | 0,083 | 0,681 | 0,317 | 0,814 | 0,889 | 0,495 | 0,516 | 0,525 | 0,111 | 0,895 | 0,924 | 0,089 | 0,083 | 0,539 |
| | | N | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 |
| | Training programmes and orientation will improve pass rates in the e-learning environment | Correlation Coefficient | -0,045 | -0,011 | -0,013 | -0,025 | -0,038 | 0,039 | 0,043 | 0,009 | -0,010 | 0,073 | 0,019 | 0,006 | 0,101 | 0,011 | -0,002 |
| | | Sig. (2-tailed) | 0,474 | 0,861 | 0,833 | 0,692 | 0,546 | 0,539 | 0,494 | 0,882 | 0,871 | 0,250 | 0,763 | 0,930 | 0,110 | 0,861 | 0,973 |
| | | N | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 |
| | Flexible online technical support is important for a user-friendly environment for e-learning success | Correlation Coefficient | 0,061 | -0,003 | 0,001 | 0,102 | 0,069 | 0,023 | 0,019 | 0,038 | 0,011 | 0,035 | 0,019 | 0,011 | .157* | 0,004 | 0,003 |
| | | Sig. (2-tailed) | 0,334 | 0,967 | 0,989 | 0,107 | 0,273 | 0,714 | 0,765 | 0,548 | 0,868 | 0,583 | 0,768 | 0,857 | 0,013 | 0,946 | 0,957 |
| | | N | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 |

| | | | E-learning is concerned with digital learning material only, and does not provide me with interactive learning activities. | E-learning does not provide me with the opportunity to problem solve with my peers | e-learning does not give me the opportunity to interact with my fellow students and lecturers | e-learning does not give me the opportunity to get feedback immediately from my lecturers | e-learning does not allow me to express my thoughts and ideas | I cannot afford technological devices to study via e-learning | There are poor computer facilities in my institution for e-learning purposes | There is poor network connectivity in my institution for e-learning | There is poor Wi-Fi access in my institution for e-learning purposes. | E-learning proves difficult as I do not have the appropriate technological skills | I am afraid to use technology for learning as I find it difficult to access course material or prepare for online assessments | Technology moves too rapidly and I cannot keep up with the advancements | I lack the confidence to use technological equipment to engage in online learning | Submitting my work via e-learning is risky as my work could be lost | Submitting my work via e-learning is risky as sensitive information could be disclosed |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Spearman's | Personal Computer (PC) | Correlation Coefficient | -0,075 | -0,053 | 0,070 | 0,007 | -0,007 | -.195** | -0,066 | -.126* | -0,038 | -.276** | -.193** | -.245** | -.244** | -.189** | -0,118 |
| | | Sig. (2-tailed) | 0,229 | 0,401 | 0,262 | 0,907 | 0,911 | 0,002 | 0,290 | 0,044 | 0,542 | 0,000 | 0,002 | 0,000 | 0,000 | 0,002 | 0,059 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 255 | 255 |
| | Smart Phone | Correlation Coefficient | -0,024 | 0,005 | 0,072 | -0,044 | -0,004 | -.154* | -0,084 | -0,060 | -0,030 | -.252** | -0,099 | -.128* | -.161* | 0,008 | -0,069 |
| | | Sig. (2-tailed) | 0,698 | 0,937 | 0,250 | 0,487 | 0,946 | 0,013 | 0,179 | 0,336 | 0,636 | 0,000 | 0,114 | 0,041 | 0,010 | 0,896 | 0,273 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 255 | 255 |
| | Tablet | Correlation Coefficient | -0,080 | -0,044 | -0,008 | 0,004 | -0,070 | -.248** | -0,104 | -0,100 | -0,006 | -.287** | -0,121 | -.220** | -.193** | -.139* | -0,044 |
| | | Sig. (2-tailed) | 0,203 | 0,485 | 0,902 | 0,953 | 0,266 | 0,000 | 0,096 | 0,110 | 0,923 | 0,000 | 0,052 | 0,000 | 0,002 | 0,026 | 0,483 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 255 | 255 |
| | Laptop | Correlation Coefficient | -0,086 | -0,009 | 0,075 | 0,046 | -0,093 | -.409** | -.195** | -.126* | -0,039 | -.303** | -.284** | -.255** | -.323** | -.123* | -0,045 |
| | | Sig. (2-tailed) | 0,171 | 0,885 | 0,232 | 0,467 | 0,140 | 0,000 | 0,002 | 0,043 | 0,534 | 0,000 | 0,000 | 0,000 | 0,000 | 0,050 | 0,477 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 255 | 255 |
| | Wearables (Smart Watches) | Correlation Coefficient | -0,098 | -0,107 | -0,062 | -0,017 | -0,057 | -.249** | -0,050 | -0,030 | 0,062 | -.237** | -.131* | -.253** | -.195** | -.146* | -0,032 |
| | | Sig. (2-tailed) | 0,118 | 0,089 | 0,321 | 0,785 | 0,364 | 0,000 | 0,430 | 0,628 | 0,325 | 0,000 | 0,036 | 0,000 | 0,002 | 0,019 | 0,616 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 255 | 255 |
| | I am often distracted by social media and other entertaining content when using technology for learning | Correlation Coefficient | .176** | .263** | .126* | 0,122 | .210** | 0,017 | 0,025 | 0,091 | 0,053 | 0,100 | .130* | .220** | .213** | .208** | .143* |
| | | Sig. (2-tailed) | 0,005 | 0,000 | 0,044 | 0,051 | 0,001 | 0,787 | 0,685 | 0,146 | 0,398 | 0,111 | 0,038 | 0,000 | 0,001 | 0,001 | 0,022 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 255 | 255 |
| | I am often distracted when using technology for learning, as lessons with technology lack innovation | Correlation Coefficient | .313** | .310** | .126* | .156* | .243** | .151* | 0,087 | .201** | 0,108 | .193** | .245** | .292** | .261** | .202** | .211** |
| | | Sig. (2-tailed) | 0,000 | 0,000 | 0,044 | 0,012 | 0,000 | 0,016 | 0,167 | 0,001 | 0,085 | 0,002 | 0,000 | 0,000 | 0,000 | 0,001 | 0,001 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 255 | 255 |
| | because I cannot afford the technology for online courses | Correlation Coefficient | .238** | .242** | .202** | 0,082 | 0,108 | .476** | .205** | .179** | 0,078 | .288** | .180** | .313** | .173** | .220** | .258** |
| | | Sig. (2-tailed) | 0,000 | 0,000 | 0,001 | 0,193 | 0,086 | 0,000 | 0,001 | 0,004 | 0,215 | 0,000 | 0,004 | 0,000 | 0,005 | 0,000 | 0,000 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 255 | 255 |
| | because of insufficient time to study | Correlation Coefficient | .167** | .271** | .189** | .145* | .176** | .130* | .146* | .348** | .161** | .272** | .235** | .304** | .338** | .245** | .199** |
| | | Sig. (2-tailed) | 0,007 | 0,000 | 0,002 | 0,020 | 0,005 | 0,037 | 0,019 | 0,000 | 0,010 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,001 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 255 | 255 |
| | because of lack of experience in online learning | Correlation Coefficient | .332** | .325** | .202** | .141* | .205** | .274** | .135* | .174** | 0,094 | .399** | .314** | .363** | .287** | .279** | .308** |
| | | Sig. (2-tailed) | 0,000 | 0,000 | 0,001 | 0,025 | 0,001 | 0,000 | 0,031 | 0,005 | 0,134 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 255 | 255 |
| | E-learning takes up more of my time as I need to retrieve information from the LMS | Correlation Coefficient | .393** | .349** | .280** | .222** | .284** | .247** | .125* | .156* | 0,111 | .258** | .343** | .320** | .306** | .371** | .318** |
| | | Sig. (2-tailed) | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,046 | 0,012 | 0,078 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 255 | 255 |
| | I do not have the time to engage in live e-learnings sessions due to family and work commitments | Correlation Coefficient | .300** | .290** | .240** | .242** | .274** | .296** | .258** | .285** | 0,115 | .326** | .260** | .326** | .317** | .265** | .236** |
| | | Sig. (2-tailed) | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,065 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 255 | 255 |
| | With e-learning, I do not get to interact personally with my peers | Correlation Coefficient | .363** | .495** | .451** | .330** | .309** | .291** | 0,110 | .262** | .187** | .160* | .156* | .167** | .175** | .276** | .176** |
| | | Sig. (2-tailed) | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,079 | 0,000 | 0,003 | 0,010 | 0,012 | 0,007 | 0,005 | 0,000 | 0,005 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 255 | 255 |
| | With e-learning, I do not get to interact personally with my lecturers | Correlation Coefficient | .413** | .462** | .511** | .381** | .413** | .196** | 0,083 | .137* | 0,027 | .146* | .275** | .141* | 0,111 | .283** | .223** |
| | | Sig. (2-tailed) | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,002 | 0,186 | 0,029 | 0,673 | 0,019 | 0,000 | 0,024 | 0,076 | 0,000 | 0,000 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 255 | 255 |
| | I find it difficult to engage with e- learning material as it is not interactive | Correlation Coefficient | .592** | .500** | .452** | .380** | .418** | .319** | .176** | .264** | .157* | .227** | .291** | .253** | .262** | .378** | .311** |
| | | Sig. (2-tailed) | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,005 | 0,000 | 0,012 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 255 | 255 |
| | E-learning is concerned with digital learning material only, and does not provide me with interactive learning activities. | Correlation Coefficient | 1,000 | .570** | .414** | .402** | .408** | .198** | .127* | .155* | 0,093 | .273** | .347** | .298** | .282** | .320** | .285** |
| | | Sig. (2-tailed) | | 0,000 | 0,000 | 0,000 | 0,000 | 0,001 | 0,043 | 0,013 | 0,137 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 255 | 255 |
| | E-learning does not provide me with the opportunity to problem solve with my peers | Correlation Coefficient | .570** | 1,000 | .526** | .467** | .524** | .166** | 0,104 | 0,119 | 0,063 | .209** | .255** | .223** | .206** | .312** | .225** |
| | | Sig. (2-tailed) | 0,000 | | 0,000 | 0,000 | 0,000 | 0,008 | 0,095 | 0,058 | 0,318 | 0,001 | 0,000 | 0,000 | 0,001 | 0,000 | 0,000 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 255 | 255 |
| | e-learning does not give me the opportunity to interact with my fellow students and lecturers | Correlation Coefficient | .414** | .526** | 1,000 | .508** | .452** | .224** | .171** | .228** | 0,113 | .151* | .244** | .157* | .138* | .303** | .222** |
| | | Sig. (2-tailed) | 0,000 | 0,000 | | 0,000 | 0,000 | 0,000 | 0,006 | 0,000 | 0,071 | 0,016 | 0,000 | 0,012 | 0,028 | 0,000 | 0,000 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 255 | 255 |
| | e-learning does not give me the opportunity to get feedback immediately from my lecturers | Correlation Coefficient | .402** | .467** | .508** | 1,000 | .574** | .223** | 0,091 | .135* | .160* | 0,106 | .207** | 0,105 | 0,093 | .288** | .255** |
| | | Sig. (2-tailed) | 0,000 | 0,000 | 0,000 | | 0,000 | 0,000 | 0,148 | 0,031 | 0,011 | 0,091 | 0,001 | 0,092 | 0,137 | 0,000 | 0,000 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 255 | 255 |
| | e-learning does not allow me to express my thoughts and ideas | Correlation Coefficient | .408** | .524** | .452** | .574** | 1,000 | .209** | .225** | .203** | .181** | .135* | .270** | .191** | .248** | .199** | .205** |
| | | Sig. (2-tailed) | 0,000 | 0,000 | 0,000 | 0,000 | | 0,001 | 0,000 | 0,001 | 0,004 | 0,031 | 0,000 | 0,002 | 0,000 | 0,001 | 0,001 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 255 | 255 |
| | I cannot afford technological devices to study via e-learning | Correlation Coefficient | .198** | .166** | .224** | .223** | .209** | 1,000 | .381** | .170** | .127* | .337** | .218** | .307** | .254** | .175** | .172** |
| | | Sig. (2-tailed) | 0,001 | 0,008 | 0,000 | 0,000 | 0,001 | | 0,000 | 0,006 | 0,043 | 0,000 | 0,000 | 0,000 | 0,000 | 0,005 | 0,006 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 255 | 255 |
| | There are poor computer facilities in my institution for e-learning purposes | Correlation Coefficient | .127* | 0,104 | .171** | 0,091 | .225** | .381** | 1,000 | .470** | .332** | .188** | .168** | .175** | .178** | .129* | .130* |
| | | Sig. (2-tailed) | 0,043 | 0,095 | 0,006 | 0,148 | 0,000 | 0,000 | | 0,000 | 0,000 | 0,002 | 0,007 | 0,005 | 0,004 | 0,039 | 0,038 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 255 | 255 |
| | There is poor network connectivity in my institution for e-learning | Correlation Coefficient | .155* | 0,119 | .228** | .135* | .203** | .170** | .470** | 1,000 | .634** | .128* | .141* | .166** | .206** | .134* | 0,119 |
| | | Sig. (2-tailed) | 0,013 | 0,058 | 0,000 | 0,031 | 0,001 | 0,006 | 0,000 | | 0,000 | 0,040 | 0,024 | 0,008 | 0,001 | 0,032 | 0,057 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 255 | 255 |
| | There is poor Wi-Fi access in my institution for e-learning purposes. | Correlation Coefficient | 0,093 | 0,063 | 0,113 | .160* | .181** | .127* | .332** | .634** | 1,000 | -0,032 | 0,002 | -0,043 | 0,007 | 0,121 | 0,113 |
| | | Sig. (2-tailed) | 0,137 | 0,318 | 0,071 | 0,011 | 0,004 | 0,043 | 0,000 | 0,000 | | 0,608 | 0,981 | 0,497 | 0,915 | 0,053 | 0,072 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 255 | 255 |
| | E-learning proves difficult as I do not have the appropriate technological skills | Correlation Coefficient | .273** | .209** | .151* | 0,106 | .135* | .337** | .188** | .128* | -0,032 | 1,000 | .491** | .668** | .518** | .341** | .295** |
| | | Sig. (2-tailed) | 0,000 | 0,001 | 0,016 | 0,091 | 0,031 | 0,000 | 0,002 | 0,040 | 0,608 | | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 255 | 255 |
| | I am afraid to use technology for learning as I find it difficult to access course material or prepare for online assessments | Correlation Coefficient | .347** | .255** | .244** | .207** | .270** | .218** | .168** | .141* | 0,002 | .491** | 1,000 | .569** | .669** | .358** | .292** |
| | | Sig. (2-tailed) | 0,000 | 0,000 | 0,000 | 0,001 | 0,000 | 0,000 | 0,007 | 0,024 | 0,981 | 0,000 | | 0,000 | 0,000 | 0,000 | 0,000 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 255 | 255 |
| | Technology moves too rapidly and I cannot keep up with the advancements | Correlation Coefficient | .298** | .223** | .157* | 0,105 | .191** | .307** | .175** | .166** | -0,043 | .668** | .569** | 1,000 | .668** | .328** | .302** |
| | | Sig. (2-tailed) | 0,000 | 0,000 | 0,012 | 0,092 | 0,002 | 0,000 | 0,005 | 0,008 | 0,497 | 0,000 | 0,000 | | 0,000 | 0,000 | 0,000 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 255 | 255 |
| | I lack the confidence to use technological equipment to engage in online learning | Correlation Coefficient | .282** | .206** | .138* | 0,093 | .248** | .254** | .178** | .206** | 0,007 | .518** | .669** | .668** | 1,000 | .361** | .288** |
| | | Sig. (2-tailed) | 0,000 | 0,001 | 0,028 | 0,137 | 0,000 | 0,000 | 0,004 | 0,001 | 0,915 | 0,000 | 0,000 | 0,000 | | 0,000 | 0,000 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 255 | 255 |
| | Submitting my work via e-learning is risky as my work could be lost | Correlation Coefficient | .320** | .312** | .303** | .288** | .199** | .175** | .129* | .134* | 0,121 | .341** | .358** | .328** | .361** | 1,000 | .693** |
| | | Sig. (2-tailed) | 0,000 | 0,000 | 0,000 | 0,000 | 0,001 | 0,005 | 0,039 | 0,032 | 0,053 | 0,000 | 0,000 | 0,000 | 0,000 | | 0,000 |
| | | N | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 |
| | Submitting my work via e-learning is risky as sensitive information could be disclosed | Correlation Coefficient | .285** | .225** | .222** | .255** | .205** | .172** | .130* | 0,119 | 0,113 | .295** | .292** | .302** | .288** | .693** | 1,000 |
| | | Sig. (2-tailed) | 0,000 | 0,000 | 0,000 | 0,000 | 0,001 | 0,006 | 0,038 | 0,057 | 0,072 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | |
| | | N | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 |
| | The quality of the e-learning system in my institution is not adequate to meet my educational needs | Correlation Coefficient | .349** | .394** | .305** | .304** | .396** | .147* | .249** | .175** | .143* | .300** | .265** | .241** | .229** | .259** | .298** |
| | | Sig. (2-tailed) | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,019 | 0,000 | 0,005 | 0,022 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| | | N | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 |
| | I spend more time learning how to use the software rather than learning the contents | Correlation Coefficient | .348** | .285** | .255** | .177** | .240** | .307** | .223** | .162** | 0,045 | .502** | .454** | .469** | .442** | .436** | .448** |
| | | Sig. (2-tailed) | 0,000 | 0,000 | 0,000 | 0,005 | 0,000 | 0,000 | 0,000 | 0,010 | 0,474 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| | | N | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 |
| | My lecturers do not integrate technology into the curriculum adequately | Correlation Coefficient | .336** | .300** | .311** | .320** | .369** | .175** | .350** | .192** | .202** | 0,107 | .198** | .175** | 0,105 | .243** | .326** |
| | | Sig. (2-tailed) | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,005 | 0,000 | 0,002 | 0,001 | 0,086 | 0,001 | 0,005 | 0,094 | 0,000 | 0,000 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 255 | 255 |
| | My lecturers do not plan and prepare learning activities with technology adequately | Correlation Coefficient | .336** | .273** | .308** | .304** | .351** | 0,121 | .269** | .242** | .195** | 0,107 | .261** | .167** | .167** | .219** | .253** |
| | | Sig. (2-tailed) | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,053 | 0,000 | 0,000 | 0,002 | 0,088 | 0,000 | 0,007 | 0,007 | 0,000 | 0,000 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 255 | 255 |
| | My lecturers do not consider learning enhancement and student engagement when incorporating technology into the curriculum | Correlation Coefficient | .374** | .312** | .295** | .326** | .403** | .137* | .196** | .218** | .160* | .158* | .304** | .216** | .146* | .165** | .265** |
| | | Sig. (2-tailed) | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,028 | 0,002 | 0,000 | 0,010 | 0,012 | 0,000 | 0,000 | 0,020 | 0,008 | 0,000 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 255 | 255 |
| | The institution does not provide training and workshops to enable my use of e-learning | Correlation Coefficient | .254** | .281** | .189** | .170** | .259** | .217** | .287** | .241** | .143* | .166** | .291** | .161* | .259** | 0,077 | 0,065 |
| | | Sig. (2-tailed) | 0,000 | 0,000 | 0,002 | 0,006 | 0,000 | 0,000 | 0,000 | 0,000 | 0,022 | 0,008 | 0,000 | 0,010 | 0,000 | 0,223 | 0,306 |
| | | N | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 254 | 254 |
| | The institution does not provide orientation courses for e-learning, to improve understanding of course material | Correlation Coefficient | .338** | .248** | .132* | .231** | .261** | .161** | .191** | .168** | .189** | .133* | .271** | 0,104 | .251** | 0,092 | 0,087 |
| | | Sig. (2-tailed) | 0,000 | 0,000 | 0,035 | 0,000 | 0,000 | 0,010 | 0,002 | 0,007 | 0,002 | 0,033 | 0,000 | 0,096 | 0,000 | 0,142 | 0,165 |
| | | N | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 254 | 254 |
| | My institution does not provide adequate online technical support for my e-learning activities. | Correlation Coefficient | .416** | .301** | .240** | .212** | .273** | .273** | .293** | .207** | .215** | .213** | .278** | .191** | .249** | .207** | .236** |
| | | Sig. (2-tailed) | 0,000 | 0,000 | 0,000 | 0,001 | 0,000 | 0,000 | 0,000 | 0,001 | 0,001 | 0,001 | 0,000 | 0,002 | 0,000 | 0,001 | 0,000 |
| | | N | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 254 | 254 |
| | My institution does not provide a reliable LMS (Learning Management System) | Correlation Coefficient | .297** | .250** | .130* | .166** | .213** | .160* | .252** | .201** | .188** | 0,062 | .260** | 0,074 | .219** | .190** | .234** |
| | | Sig. (2-tailed) | 0,000 | 0,000 | 0,038 | 0,008 | 0,001 | 0,010 | 0,000 | 0,001 | 0,003 | 0,322 | 0,000 | 0,237 | 0,000 | 0,002 | 0,000 |
| | | N | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 254 | 254 |
| | My institution does not provide a Help Desk for technical support (phone/email/chat) | Correlation Coefficient | .224** | .179** | .156* | 0,047 | .172** | 0,072 | .154* | .164** | .155* | -0,081 | .170** | -0,029 | .146* | 0,087 | 0,100 |
| | | Sig. (2-tailed) | 0,000 | 0,004 | 0,013 | 0,456 | 0,006 | 0,253 | 0,014 | 0,009 | 0,013 | 0,196 | 0,006 | 0,641 | 0,019 | 0,165 | 0,110 |
| | | N | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 254 | 254 |
| | In classes with large groups, tools such as social networking, micro blogging, other applications should be made available | Correlation Coefficient | .127* | 0,095 | .148* | .154* | 0,093 | .199** | 0,056 | 0,030 | 0,032 | .211** | 0,088 | 0,107 | 0,059 | 0,094 | 0,067 |
| | | Sig. (2-tailed) | 0,044 | 0,133 | 0,019 | 0,015 | 0,142 | 0,002 | 0,374 | 0,636 | 0,619 | 0,001 | 0,162 | 0,089 | 0,352 | 0,139 | 0,291 |
| | | N | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 250 | 250 |
| | Learning will be more interactive if lecturers deliver online courses via social media, lecture recordings, online educational games and other similar technologies | Correlation Coefficient | .190** | .160* | 0,115 | .181** | .170** | 0,085 | 0,078 | 0,071 | .147* | 0,025 | 0,073 | -0,003 | 0,051 | .205** | .202** |
| | | Sig. (2-tailed) | 0,002 | 0,011 | 0,069 | 0,004 | 0,007 | 0,180 | 0,217 | 0,265 | 0,020 | 0,697 | 0,252 | 0,957 | 0,424 | 0,001 | 0,001 |
| | | N | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 250 | 250 |
| | The feelings of isolation in online classes can be overcome by online peer tutoring, discussion boards and group video conferences | Correlation Coefficient | .154* | .233** | .129* | .207** | 0,115 | 0,066 | -0,068 | 0,076 | 0,058 | 0,021 | 0,078 | -0,017 | 0,026 | 0,119 | 0,062 |
| | | Sig. (2-tailed) | 0,015 | 0,000 | 0,040 | 0,001 | 0,069 | 0,297 | 0,286 | 0,229 | 0,356 | 0,739 | 0,218 | 0,786 | 0,677 | 0,060 | 0,330 |
| | | N | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 250 | 250 |
| | Having online access to remote tutors will assist in my studies via e-learning | Correlation Coefficient | .144* | 0,105 | 0,068 | .149* | 0,054 | 0,084 | -0,113 | -0,020 | -0,013 | 0,017 | 0,005 | -0,071 | -0,063 | 0,033 | 0,099 |
| | | Sig. (2-tailed) | 0,022 | 0,096 | 0,281 | 0,018 | 0,393 | 0,186 | 0,074 | 0,757 | 0,842 | 0,792 | 0,940 | 0,260 | 0,321 | 0,600 | 0,119 |
| | | N | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 250 | 250 |
| | Training programmes and orientation will improve pass rates in the e-learning environment | Correlation Coefficient | 0,094 | 0,038 | -0,038 | 0,061 | -0,033 | 0,059 | -0,055 | 0,002 | 0,047 | 0,062 | 0,017 | -0,103 | -0,022 | 0,124 | 0,110 |
| | | Sig. (2-tailed) | 0,138 | 0,544 | 0,553 | 0,333 | 0,607 | 0,351 | 0,386 | 0,972 | 0,461 | 0,328 | 0,790 | 0,102 | 0,730 | 0,051 | 0,084 |
| | | N | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 250 | 250 |
| | Flexible online technical support is important for a user-friendly environment for e-learning success | Correlation Coefficient | 0,060 | 0,074 | 0,067 | .161* | 0,035 | -0,002 | -0,076 | 0,093 | .221** | -0,068 | -0,112 | -.196** | -.152* | 0,088 | 0,102 |
| | | Sig. (2-tailed) | 0,347 | 0,242 | 0,289 | 0,011 | 0,581 | 0,978 | 0,232 | 0,140 | 0,000 | 0,284 | 0,076 | 0,002 | 0,016 | 0,164 | 0,108 |
| | | N | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 250 | 250 |

| | | | The quality of the e-learning system in my institution is not adequate to meet my educational needs | I spend more time learning how to use the software rather than learning the contents | My lecturers do not integrate technology into the curriculum adequately | My lecturers do not plan and prepare learning activities with technology adequately | My lecturers do not consider learning enhancement and student engagement when incorporating technology into the curriculum | The institution does not provide training and workshops to enable my use of e-learning | The institution does not provide orientation courses for e-learning, to improve understanding of course material | My institution does not provide adequate online technical support for my e-learning activities. | My institution does not provide a reliable LMS (Learning Management System) | My institution does not provide a Help Desk for technical support (phone/email/chat) | In classes with large groups, tools such as social networking, micro blogging, other applications should be made available | Learning will be more interactive if lecturers deliver online courses via social media, lecture recordings, online educational games and other similar technologies | The feelings of isolation in online classes can be overcome by online peer tutoring, discussion boards and group video conferences | Having online access to remote tutors will assist in my studies via e-learning | Training programmes and orientation will improve pass rates in the e-learning environment | Flexible online technical support is important for a user-friendly environment for e-learning success |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Spearman's | Personal Computer (PC) | Correlation Coefficient | -0,019 | -.205** | 0,038 | 0,012 | 0,005 | -0,073 | -0,073 | 0,001 | -0,037 | 0,026 | -0,059 | 0,040 | 0,020 | -0,027 | -0,045 | 0,061 |
| | | Sig. (2-tailed) | 0,762 | 0,001 | 0,542 | 0,853 | 0,930 | 0,246 | 0,245 | 0,992 | 0,558 | 0,677 | 0,351 | 0,529 | 0,748 | 0,671 | 0,474 | 0,334 |
| | | N | 255 | 255 | 256 | 256 | 256 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| | Smart Phone | Correlation Coefficient | -0,089 | -.143* | -0,024 | 0,047 | 0,052 | -0,014 | -0,036 | -0,069 | -.174** | -0,055 | -0,097 | 0,106 | .146* | 0,110 | -0,011 | -0,003 |
| | | Sig. (2-tailed) | 0,154 | 0,022 | 0,703 | 0,458 | 0,404 | 0,818 | 0,568 | 0,272 | 0,005 | 0,384 | 0,126 | 0,092 | 0,021 | 0,083 | 0,861 | 0,967 |
| | | N | 255 | 255 | 256 | 256 | 256 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| | Tablet | Correlation Coefficient | -0,039 | -.160* | 0,035 | 0,048 | 0,042 | -0,098 | -0,090 | -0,046 | -0,005 | 0,013 | -.200** | -0,030 | -0,052 | -0,026 | -0,013 | 0,001 |
| | | Sig. (2-tailed) | 0,540 | 0,011 | 0,578 | 0,446 | 0,507 | 0,120 | 0,152 | 0,462 | 0,938 | 0,840 | 0,001 | 0,640 | 0,413 | 0,681 | 0,833 | 0,989 |
| | | N | 255 | 255 | 256 | 256 | 256 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| | Laptop | Correlation Coefficient | -0,036 | -.233** | 0,023 | 0,014 | -0,049 | -.197** | -.166** | -0,095 | -.164** | -0,013 | -0,083 | 0,063 | 0,034 | 0,063 | -0,025 | 0,102 |
| | | Sig. (2-tailed) | 0,565 | 0,000 | 0,718 | 0,825 | 0,435 | 0,002 | 0,008 | 0,128 | 0,009 | 0,838 | 0,187 | 0,323 | 0,594 | 0,317 | 0,692 | 0,107 |
| | | N | 255 | 255 | 256 | 256 | 256 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| | Wearables (Smart Watches) | Correlation Coefficient | -0,031 | -.181** | 0,044 | 0,050 | 0,051 | 0,042 | 0,010 | -0,011 | 0,053 | 0,045 | -0,035 | 0,038 | -0,065 | -0,015 | -0,038 | 0,069 |
| | | Sig. (2-tailed) | 0,617 | 0,004 | 0,484 | 0,425 | 0,416 | 0,502 | 0,871 | 0,863 | 0,398 | 0,475 | 0,576 | 0,545 | 0,305 | 0,814 | 0,546 | 0,273 |
| | | N | 255 | 255 | 256 | 256 | 256 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| | I am often distracted by social media and other entertaining content when using technology for learning | Correlation Coefficient | 0,041 | .253** | 0,059 | .126* | 0,023 | .141* | .127* | 0,108 | 0,052 | 0,089 | 0,015 | 0,032 | -0,005 | 0,009 | 0,039 | 0,023 |
| | | Sig. (2-tailed) | 0,513 | 0,000 | 0,350 | 0,044 | 0,713 | 0,024 | 0,044 | 0,084 | 0,411 | 0,156 | 0,810 | 0,609 | 0,935 | 0,889 | 0,539 | 0,714 |
| | | N | 255 | 255 | 256 | 256 | 256 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| | I am often distracted when using technology for learning, as lessons with technology lack innovation | Correlation Coefficient | .218** | .298** | .162** | .141* | .202** | .181** | 0,120 | 0,073 | .161** | 0,044 | 0,074 | .143* | 0,047 | 0,043 | 0,043 | 0,019 |
| | | Sig. (2-tailed) | 0,000 | 0,000 | 0,009 | 0,024 | 0,001 | 0,004 | 0,055 | 0,243 | 0,010 | 0,483 | 0,243 | 0,023 | 0,455 | 0,495 | 0,494 | 0,765 |
| | | N | 255 | 255 | 256 | 256 | 256 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| | because I cannot afford the technology for online courses | Correlation Coefficient | .199** | .333** | .188** | .190** | .189** | .153* | 0,074 | .231** | .169** | 0,055 | 0,120 | 0,067 | -0,014 | 0,041 | 0,009 | 0,038 |
| | | Sig. (2-tailed) | 0,001 | 0,000 | 0,003 | 0,002 | 0,002 | 0,014 | 0,238 | 0,000 | 0,007 | 0,380 | 0,057 | 0,289 | 0,820 | 0,516 | 0,882 | 0,548 |
| | | N | 255 | 255 | 256 | 256 | 256 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| | because of insufficient time to study | Correlation Coefficient | .245** | .257** | .153* | .131* | .152* | .181** | 0,114 | 0,084 | .134* | -0,064 | .180** | 0,112 | 0,058 | 0,040 | -0,010 | 0,011 |
| | | Sig. (2-tailed) | 0,000 | 0,000 | 0,014 | 0,037 | 0,015 | 0,004 | 0,069 | 0,180 | 0,032 | 0,312 | 0,004 | 0,078 | 0,363 | 0,525 | 0,871 | 0,868 |
| | | N | 255 | 255 | 256 | 256 | 256 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| | because of lack of experience in online learning | Correlation Coefficient | .286** | .360** | .229** | .231** | .320** | .210** | .207** | .222** | .169** | 0,041 | .189** | 0,119 | 0,003 | 0,101 | 0,073 | 0,035 |
| | | Sig. (2-tailed) | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,001 | 0,001 | 0,000 | 0,007 | 0,517 | 0,003 | 0,060 | 0,961 | 0,111 | 0,250 | 0,583 |
| | | N | 255 | 255 | 256 | 256 | 256 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| | E-learning takes up more of my time as I need to retrieve information from the LMS | Correlation Coefficient | .278** | .305** | .147* | .217** | .147* | .128* | .193** | .220** | .186** | .145* | 0,081 | .139* | 0,055 | 0,008 | 0,019 | 0,019 |
| | | Sig. (2-tailed) | 0,000 | 0,000 | 0,018 | 0,000 | 0,018 | 0,042 | 0,002 | 0,000 | 0,003 | 0,021 | 0,201 | 0,028 | 0,381 | 0,895 | 0,763 | 0,768 |
| | | N | 255 | 255 | 256 | 256 | 256 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| | I do not have the time to engage in live e-learnings sessions due to family and work commitments | Correlation Coefficient | .221** | .341** | .244** | .167** | .151* | .185** | .177** | .218** | .180** | 0,051 | 0,120 | .132* | 0,038 | 0,006 | 0,006 | 0,011 |
| | | Sig. (2-tailed) | 0,000 | 0,000 | 0,000 | 0,008 | 0,015 | 0,003 | 0,005 | 0,000 | 0,004 | 0,420 | 0,058 | 0,036 | 0,545 | 0,924 | 0,930 | 0,857 |
| | | N | 255 | 255 | 256 | 256 | 256 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| | With e-learning, I do not get to interact personally with my peers | Correlation Coefficient | .215** | .219** | .205** | .158* | .177** | .124* | 0,101 | .255** | .186** | 0,096 | .170** | .161* | .210** | 0,108 | 0,101 | .157* |
| | | Sig. (2-tailed) | 0,001 | 0,000 | 0,001 | 0,011 | 0,005 | 0,049 | 0,108 | 0,000 | 0,003 | 0,126 | 0,007 | 0,011 | 0,001 | 0,089 | 0,110 | 0,013 |
| | | N | 255 | 255 | 256 | 256 | 256 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| | With e-learning, I do not get to interact personally with my lecturers | Correlation Coefficient | .259** | .229** | .207** | .230** | .299** | .166** | 0,079 | .139* | 0,103 | 0,050 | .158* | .135* | .126* | 0,109 | 0,011 | 0,004 |
| | | Sig. (2-tailed) | 0,000 | 0,000 | 0,001 | 0,000 | 0,000 | 0,008 | 0,206 | 0,027 | 0,102 | 0,423 | 0,012 | 0,033 | 0,046 | 0,083 | 0,861 | 0,946 |
| | | N | 255 | 255 | 256 | 256 | 256 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| | I find it difficult to engage with e- learning material as it is not interactive | Correlation Coefficient | .327** | .367** | .318** | .292** | .303** | .247** | .235** | .269** | .216** | 0,121 | 0,108 | .142* | 0,061 | 0,039 | -0,002 | 0,003 |
| | | Sig. (2-tailed) | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,001 | 0,055 | 0,089 | 0,025 | 0,336 | 0,539 | 0,973 | 0,957 |
| | | N | 255 | 255 | 256 | 256 | 256 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| | E-learning is concerned with digital learning material only, and does not provide me with interactive learning activities. | Correlation Coefficient | .349** | .348** | .336** | .336** | .374** | .254** | .338** | .416** | .297** | .224** | .127* | .190** | .154* | .144* | 0,094 | 0,060 |
| | | Sig. (2-tailed) | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,044 | 0,002 | 0,015 | 0,022 | 0,138 | 0,347 |
| | | N | 255 | 255 | 256 | 256 | 256 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| | E-learning does not provide me with the opportunity to problem solve with my peers | Correlation Coefficient | .394** | .285** | .300** | .273** | .312** | .281** | .248** | .301** | .250** | .179** | 0,095 | .160* | .233** | 0,105 | 0,038 | 0,074 |
| | | Sig. (2-tailed) | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,004 | 0,133 | 0,011 | 0,000 | 0,096 | 0,544 | 0,242 |
| | | N | 255 | 255 | 256 | 256 | 256 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| | e-learning does not give me the opportunity to interact with my fellow students and lecturers | Correlation Coefficient | .305** | .255** | .311** | .308** | .295** | .189** | .132* | .240** | .130* | .156* | .148* | 0,115 | .129* | 0,068 | -0,038 | 0,067 |
| | | Sig. (2-tailed) | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,002 | 0,035 | 0,000 | 0,038 | 0,013 | 0,019 | 0,069 | 0,040 | 0,281 | 0,553 | 0,289 |
| | | N | 255 | 255 | 256 | 256 | 256 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| | e-learning does not give me the opportunity to get feedback immediately from my lecturers | Correlation Coefficient | .304** | .177** | .320** | .304** | .326** | .170** | .231** | .212** | .166** | 0,047 | .154* | .181** | .207** | .149* | 0,061 | .161* |
| | | Sig. (2-tailed) | 0,000 | 0,005 | 0,000 | 0,000 | 0,000 | 0,006 | 0,000 | 0,001 | 0,008 | 0,456 | 0,015 | 0,004 | 0,001 | 0,018 | 0,333 | 0,011 |
| | | N | 255 | 255 | 256 | 256 | 256 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| | e-learning does not allow me to express my thoughts and ideas | Correlation Coefficient | .396** | .240** | .369** | .351** | .403** | .259** | .261** | .273** | .213** | .172** | 0,093 | .170** | 0,115 | 0,054 | -0,033 | 0,035 |
| | | Sig. (2-tailed) | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,001 | 0,006 | 0,142 | 0,007 | 0,069 | 0,393 | 0,607 | 0,581 |
| | | N | 255 | 255 | 256 | 256 | 256 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| | I cannot afford technological devices to study via e-learning | Correlation Coefficient | .147* | .307** | .175** | 0,121 | .137* | .217** | .161** | .273** | .160* | 0,072 | .199** | 0,085 | 0,066 | 0,084 | 0,059 | -0,002 |
| | | Sig. (2-tailed) | 0,019 | 0,000 | 0,005 | 0,053 | 0,028 | 0,000 | 0,010 | 0,000 | 0,010 | 0,253 | 0,002 | 0,180 | 0,297 | 0,186 | 0,351 | 0,978 |
| | | N | 255 | 255 | 256 | 256 | 256 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| | There are poor computer facilities in my institution for e-learning purposes | Correlation Coefficient | .249** | .223** | .350** | .269** | .196** | .287** | .191** | .293** | .252** | .154* | 0,056 | 0,078 | -0,068 | -0,113 | -0,055 | -0,076 |
| | | Sig. (2-tailed) | 0,000 | 0,000 | 0,000 | 0,000 | 0,002 | 0,000 | 0,002 | 0,000 | 0,000 | 0,014 | 0,374 | 0,217 | 0,286 | 0,074 | 0,386 | 0,232 |
| | | N | 255 | 255 | 256 | 256 | 256 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| | There is poor network connectivity in my institution for e-learning | Correlation Coefficient | .175** | .162** | .192** | .242** | .218** | .241** | .168** | .207** | .201** | .164** | 0,030 | 0,071 | 0,076 | -0,020 | 0,002 | 0,093 |
| | | Sig. (2-tailed) | 0,005 | 0,010 | 0,002 | 0,000 | 0,000 | 0,000 | 0,007 | 0,001 | 0,001 | 0,009 | 0,636 | 0,265 | 0,229 | 0,757 | 0,972 | 0,140 |
| | | N | 255 | 255 | 256 | 256 | 256 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| | There is poor Wi-Fi access in my institution for e-learning purposes. | Correlation Coefficient | .143* | 0,045 | .202** | .195** | .160* | .143* | .189** | .215** | .188** | .155* | 0,032 | .147* | 0,058 | -0,013 | 0,047 | .221** |
| | | Sig. (2-tailed) | 0,022 | 0,474 | 0,001 | 0,002 | 0,010 | 0,022 | 0,002 | 0,001 | 0,003 | 0,013 | 0,619 | 0,020 | 0,356 | 0,842 | 0,461 | 0,000 |
| | | N | 255 | 255 | 256 | 256 | 256 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| | E-learning proves difficult as I do not have the appropriate technological skills | Correlation Coefficient | .300** | .502** | 0,107 | 0,107 | .158* | .166** | .133* | .213** | 0,062 | -0,081 | .211** | 0,025 | 0,021 | 0,017 | 0,062 | -0,068 |
| | | Sig. (2-tailed) | 0,000 | 0,000 | 0,086 | 0,088 | 0,012 | 0,008 | 0,033 | 0,001 | 0,322 | 0,196 | 0,001 | 0,697 | 0,739 | 0,792 | 0,328 | 0,284 |
| | | N | 255 | 255 | 256 | 256 | 256 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| | I am afraid to use technology for learning as I find it difficult to access course material or prepare for online assessments | Correlation Coefficient | .265** | .454** | .198** | .261** | .304** | .291** | .271** | .278** | .260** | .170** | 0,088 | 0,073 | 0,078 | 0,005 | 0,017 | -0,112 |
| | | Sig. (2-tailed) | 0,000 | 0,000 | 0,001 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,006 | 0,162 | 0,252 | 0,218 | 0,940 | 0,790 | 0,076 |
| | | N | 255 | 255 | 256 | 256 | 256 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| | Technology moves too rapidly and I cannot keep up with the advancements | Correlation Coefficient | .241** | .469** | .175** | .167** | .216** | .161* | 0,104 | .191** | 0,074 | -0,029 | 0,107 | -0,003 | -0,017 | -0,071 | -0,103 | -.196** |
| | | Sig. (2-tailed) | 0,000 | 0,000 | 0,005 | 0,007 | 0,000 | 0,010 | 0,096 | 0,002 | 0,237 | 0,641 | 0,089 | 0,957 | 0,786 | 0,260 | 0,102 | 0,002 |
| | | N | 255 | 255 | 256 | 256 | 256 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| | I lack the confidence to use technological equipment to engage in online learning | Correlation Coefficient | .229** | .442** | 0,105 | .167** | .146* | .259** | .251** | .249** | .219** | .146* | 0,059 | 0,051 | 0,026 | -0,063 | -0,022 | -.152* |
| | | Sig. (2-tailed) | 0,000 | 0,000 | 0,094 | 0,007 | 0,020 | 0,000 | 0,000 | 0,000 | 0,000 | 0,019 | 0,352 | 0,424 | 0,677 | 0,321 | 0,730 | 0,016 |
| | | N | 255 | 255 | 256 | 256 | 256 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| | Submitting my work via e-learning is risky as my work could be lost | Correlation Coefficient | .259** | .436** | .243** | .219** | .165** | 0,077 | 0,092 | .207** | .190** | 0,087 | 0,094 | .205** | 0,119 | 0,033 | 0,124 | 0,088 |
| | | Sig. (2-tailed) | 0,000 | 0,000 | 0,000 | 0,000 | 0,008 | 0,223 | 0,142 | 0,001 | 0,002 | 0,165 | 0,139 | 0,001 | 0,060 | 0,600 | 0,051 | 0,164 |
| | | N | 255 | 255 | 255 | 255 | 255 | 254 | 254 | 254 | 254 | 254 | 250 | 250 | 250 | 250 | 250 | 250 |
| | Submitting my work via e-learning is risky as sensitive information could be disclosed | Correlation Coefficient | .298** | .448** | .326** | .253** | .265** | 0,065 | 0,087 | .236** | .234** | 0,100 | 0,067 | .202** | 0,062 | 0,099 | 0,110 | 0,102 |
| | | Sig. (2-tailed) | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,306 | 0,165 | 0,000 | 0,000 | 0,110 | 0,291 | 0,001 | 0,330 | 0,119 | 0,084 | 0,108 |
| | | N | 255 | 255 | 255 | 255 | 255 | 254 | 254 | 254 | 254 | 254 | 250 | 250 | 250 | 250 | 250 | 250 |
| | The quality of the e-learning system in my institution is not adequate to meet my educational needs | Correlation Coefficient | 1,000 | .339** | .411** | .445** | .500** | .249** | .289** | .291** | .319** | .163** | 0,064 | 0,061 | -0,046 | -0,051 | -0,113 | -0,049 |
| | | Sig. (2-tailed) | | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,009 | 0,312 | 0,340 | 0,472 | 0,419 | 0,075 | 0,438 |
| | | N | 255 | 255 | 255 | 255 | 255 | 254 | 254 | 254 | 254 | 254 | 250 | 250 | 250 | 250 | 250 | 250 |
| | I spend more time learning how to use the software rather than learning the contents | Correlation Coefficient | .339** | 1,000 | .328** | .305** | .292** | .263** | .234** | .306** | .320** | .135* | 0,111 | 0,114 | -0,016 | 0,023 | 0,050 | -0,038 |
| | | Sig. (2-tailed) | 0,000 | | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,031 | 0,080 | 0,071 | 0,798 | 0,721 | 0,436 | 0,551 |
| | | N | 255 | 255 | 255 | 255 | 255 | 254 | 254 | 254 | 254 | 254 | 250 | 250 | 250 | 250 | 250 | 250 |
| | My lecturers do not integrate technology into the curriculum adequately | Correlation Coefficient | .411** | .328** | 1,000 | .653** | .616** | .265** | .320** | .351** | .283** | .220** | .125* | .127* | -0,008 | 0,085 | -0,039 | 0,079 |
| | | Sig. (2-tailed) | 0,000 | 0,000 | | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,047 | 0,044 | 0,900 | 0,178 | 0,543 | 0,213 |
| | | N | 255 | 255 | 256 | 256 | 256 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| | My lecturers do not plan and prepare learning activities with technology adequately | Correlation Coefficient | .445** | .305** | .653** | 1,000 | .689** | .319** | .418** | .370** | .287** | .342** | 0,046 | .124* | -0,052 | 0,039 | -0,016 | 0,011 |
| | | Sig. (2-tailed) | 0,000 | 0,000 | 0,000 | | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,463 | 0,050 | 0,409 | 0,542 | 0,803 | 0,857 |
| | | N | 255 | 255 | 256 | 256 | 256 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| | My lecturers do not consider learning enhancement and student engagement when incorporating technology into the curriculum | Correlation Coefficient | .500** | .292** | .616** | .689** | 1,000 | .321** | .417** | .323** | .250** | .197** | 0,015 | 0,086 | -0,053 | 0,063 | -0,036 | -0,039 |
| | | Sig. (2-tailed) | 0,000 | 0,000 | 0,000 | 0,000 | | 0,000 | 0,000 | 0,000 | 0,000 | 0,002 | 0,815 | 0,176 | 0,407 | 0,318 | 0,575 | 0,543 |
| | | N | 255 | 255 | 256 | 256 | 256 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| | The institution does not provide training and workshops to enable my use of e-learning | Correlation Coefficient | .249** | .263** | .265** | .319** | .321** | 1,000 | .662** | .449** | .392** | .313** | 0,052 | 0,043 | -0,043 | -0,045 | -0,017 | 0,013 |
| | | Sig. (2-tailed) | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | | 0,000 | 0,000 | 0,000 | 0,000 | 0,412 | 0,502 | 0,502 | 0,480 | 0,783 | 0,837 |
| | | N | 254 | 254 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| | The institution does not provide orientation courses for e-learning, to improve understanding of course material | Correlation Coefficient | .289** | .234** | .320** | .418** | .417** | .662** | 1,000 | .539** | .465** | .361** | 0,052 | .172** | -0,057 | 0,013 | 0,007 | 0,041 |
| | | Sig. (2-tailed) | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | | 0,000 | 0,000 | 0,000 | 0,415 | 0,006 | 0,369 | 0,840 | 0,915 | 0,519 |
| | | N | 254 | 254 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| | My institution does not provide adequate online technical support for my e-learning activities. | Correlation Coefficient | .291** | .306** | .351** | .370** | .323** | .449** | .539** | 1,000 | .573** | .439** | 0,076 | .210** | 0,062 | 0,023 | 0,020 | 0,110 |
| | | Sig. (2-tailed) | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | | 0,000 | 0,000 | 0,228 | 0,001 | 0,330 | 0,718 | 0,758 | 0,083 |
| | | N | 254 | 254 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| | My institution does not provide a reliable LMS (Learning Management System) | Correlation Coefficient | .319** | .320** | .283** | .287** | .250** | .392** | .465** | .573** | 1,000 | .535** | 0,015 | .159* | -0,045 | -0,037 | 0,024 | 0,072 |
| | | Sig. (2-tailed) | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | | 0,000 | 0,813 | 0,012 | 0,474 | 0,555 | 0,708 | 0,256 |
| | | N | 254 | 254 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| | My institution does not provide a Help Desk for technical support (phone/email/chat) | Correlation Coefficient | .163** | .135* | .220** | .342** | .197** | .313** | .361** | .439** | .535** | 1,000 | -0,082 | 0,041 | -0,069 | -0,095 | -0,098 | -0,013 |
| | | Sig. (2-tailed) | 0,009 | 0,031 | 0,000 | 0,000 | 0,002 | 0,000 | 0,000 | 0,000 | 0,000 | | 0,196 | 0,520 | 0,274 | 0,134 | 0,120 | 0,843 |
| | | N | 254 | 254 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| | In classes with large groups, tools such as social networking, micro blogging, other applications should be made available | Correlation Coefficient | 0,064 | 0,111 | .125* | 0,046 | 0,015 | 0,052 | 0,052 | 0,076 | 0,015 | -0,082 | 1,000 | .378** | .339** | .390** | .277** | .302** |
| | | Sig. (2-tailed) | 0,312 | 0,080 | 0,047 | 0,463 | 0,815 | 0,412 | 0,415 | 0,228 | 0,813 | 0,196 | | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| | | N | 250 | 250 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 |
| | Learning will be more interactive if lecturers deliver online courses via social media, lecture recordings, online educational games and other similar technologies | Correlation Coefficient | 0,061 | 0,114 | .127* | .124* | 0,086 | 0,043 | .172** | .210** | .159* | 0,041 | .378** | 1,000 | .384** | .389** | .341** | .378** |
| | | Sig. (2-tailed) | 0,340 | 0,071 | 0,044 | 0,050 | 0,176 | 0,502 | 0,006 | 0,001 | 0,012 | 0,520 | 0,000 | | 0,000 | 0,000 | 0,000 | 0,000 |
| | | N | 250 | 250 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 |
| | The feelings of isolation in online classes can be overcome by online peer tutoring, discussion boards and group video conferences | Correlation Coefficient | -0,046 | -0,016 | -0,008 | -0,052 | -0,053 | -0,043 | -0,057 | 0,062 | -0,045 | -0,069 | .339** | .384** | 1,000 | .633** | .481** | .451** |
| | | Sig. (2-tailed) | 0,472 | 0,798 | 0,900 | 0,409 | 0,407 | 0,502 | 0,369 | 0,330 | 0,474 | 0,274 | 0,000 | 0,000 | | 0,000 | 0,000 | 0,000 |
| | | N | 250 | 250 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 |
| | Having online access to remote tutors will assist in my studies via e-learning | Correlation Coefficient | -0,051 | 0,023 | 0,085 | 0,039 | 0,063 | -0,045 | 0,013 | 0,023 | -0,037 | -0,095 | .390** | .389** | .633** | 1,000 | .576** | .538** |
| | | Sig. (2-tailed) | 0,419 | 0,721 | 0,178 | 0,542 | 0,318 | 0,480 | 0,840 | 0,718 | 0,555 | 0,134 | 0,000 | 0,000 | 0,000 | | 0,000 | 0,000 |
| | | N | 250 | 250 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 |
| | Training programmes and orientation will improve pass rates in the e-learning environment | Correlation Coefficient | -0,113 | 0,050 | -0,039 | -0,016 | -0,036 | -0,017 | 0,007 | 0,020 | 0,024 | -0,098 | .277** | .341** | .481** | .576** | 1,000 | .613** |
| | | Sig. (2-tailed) | 0,075 | 0,436 | 0,543 | 0,803 | 0,575 | 0,783 | 0,915 | 0,758 | 0,708 | 0,120 | 0,000 | 0,000 | 0,000 | 0,000 | | 0,000 |
| | | N | 250 | 250 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 |
| | Flexible online technical support is important for a user-friendly environment for e-learning success | Correlation Coefficient | -0,049 | -0,038 | 0,079 | 0,011 | -0,039 | 0,013 | 0,041 | 0,110 | 0,072 | -0,013 | .302** | .378** | .451** | .538** | .613** | 1,000 |
| | | Sig. (2-tailed) | 0,438 | 0,551 | 0,213 | 0,857 | 0,543 | 0,837 | 0,519 | 0,083 | 0,256 | 0,843 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | |
| | | N | 250 | 250 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 |

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

# Appendix B: Correlation Analysis: Students

**Correlations**

| | | | Personal Computer (PC) | Smart Phone | Tablet | Laptop | Wearables (Smart Watches) | I am often distracted by social media and other entertaining content when using technology for learning | I am often distracted when using technology for learning, as lessons with technology lack innovation | because I cannot afford the technology for online courses | because of insufficient time to study | because of lack of experience in online learning | E-learning takes up more of my time as I need to retrieve information from the LMS | I do not have the time to engage in live e-learnings sessions due to family and work commitments | With e-learning, I do not get to interact personally with my peers | With e-learning, I do not get to interact personally with my lecturers | I find it difficult to engage with e-learning material as it is not interactive |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Spearman's | Personal Computer (PC) | Correlation Coefficient | 1,000 | .280** | .471** | .361** | .250** | -0,039 | -0,095 | -0,053 | -.124* | -.170** | -.123* | -.134* | -0,019 | -0,005 | -0,068 |
| | | Sig. (2-tailed) | | 0,000 | 0,000 | 0,000 | 0,000 | 0,530 | 0,129 | 0,401 | 0,047 | 0,006 | 0,049 | 0,032 | 0,761 | 0,935 | 0,278 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 |
| | Smart Phone | Correlation Coefficient | .280** | 1,000 | .172** | .328** | 0,035 | .137* | 0,028 | -0,020 | -0,106 | -0,089 | -0,060 | -.148* | -0,059 | 0,004 | -0,076 |
| | | Sig. (2-tailed) | 0,000 | | 0,006 | 0,000 | 0,581 | 0,028 | 0,651 | 0,754 | 0,092 | 0,157 | 0,341 | 0,018 | 0,349 | 0,955 | 0,226 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 |
| | Tablet | Correlation Coefficient | .471** | .172** | 1,000 | .382** | .422** | -0,027 | -0,051 | -0,102 | -.160* | -.142* | -0,058 | -.144* | -0,065 | -.129* | -0,083 |
| | | Sig. (2-tailed) | 0,000 | 0,006 | | 0,000 | 0,000 | 0,671 | 0,416 | 0,102 | 0,010 | 0,023 | 0,352 | 0,021 | 0,299 | 0,040 | 0,184 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 |
| | Laptop | Correlation Coefficient | .361** | .328** | .382** | 1,000 | .243** | -0,022 | -0,026 | -.227** | -0,099 | -0,112 | -0,104 | -.153* | -.132* | -.127* | -.157* |
| | | Sig. (2-tailed) | 0,000 | 0,000 | 0,000 | | 0,000 | 0,724 | 0,677 | 0,000 | 0,116 | 0,073 | 0,098 | 0,015 | 0,035 | 0,043 | 0,012 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 |
| | Wearables (Smart Watches) | Correlation Coefficient | .250** | 0,035 | .422** | .243** | 1,000 | -0,051 | -0,057 | -.170** | -.128* | -0,088 | -0,073 | -0,097 | -0,069 | -0,100 | -0,078 |
| | | Sig. (2-tailed) | 0,000 | 0,581 | 0,000 | 0,000 | | 0,420 | 0,361 | 0,006 | 0,041 | 0,158 | 0,241 | 0,123 | 0,272 | 0,111 | 0,211 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 |
| | I am often distracted by social media and other entertaining content when using technology for learning | Correlation Coefficient | -0,039 | .137* | -0,027 | -0,022 | -0,051 | 1,000 | .398** | .149* | .163** | .203** | .230** | .159* | .138* | .168** | .212** |
| | | Sig. (2-tailed) | 0,530 | 0,028 | 0,671 | 0,724 | 0,420 | | 0,000 | 0,017 | 0,009 | 0,001 | 0,000 | 0,011 | 0,028 | 0,007 | 0,001 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 |
| | I am often distracted when using technology for learning, as lessons with technology lack innovation | Correlation Coefficient | -0,095 | 0,028 | -0,051 | -0,026 | -0,057 | .398** | 1,000 | .159* | .259** | .321** | .276** | .263** | .294** | .290** | .373** |
| | | Sig. (2-tailed) | 0,129 | 0,651 | 0,416 | 0,677 | 0,361 | 0,000 | | 0,011 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 |
| | because I cannot afford the technology for online courses | Correlation Coefficient | -0,053 | -0,020 | -0,102 | -.227** | -.170** | .149* | .159* | 1,000 | .248** | .419** | .189** | .295** | .197** | .253** | .251** |
| | | Sig. (2-tailed) | 0,401 | 0,754 | 0,102 | 0,000 | 0,006 | 0,017 | 0,011 | | 0,000 | 0,000 | 0,002 | 0,000 | 0,001 | 0,000 | 0,000 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 |
| | because of insufficient time to study | Correlation Coefficient | -.124* | -0,106 | -.160* | -0,099 | -.128* | .163** | .259** | .248** | 1,000 | .377** | .282** | .407** | .248** | .243** | .335** |
| | | Sig. (2-tailed) | 0,047 | 0,092 | 0,010 | 0,116 | 0,041 | 0,009 | 0,000 | 0,000 | | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 |
| | because of lack of experience in online learning | Correlation Coefficient | -.170** | -0,089 | -.142* | -0,112 | -0,088 | .203** | .321** | .419** | .377** | 1,000 | .347** | .357** | .188** | .273** | .339** |
| | | Sig. (2-tailed) | 0,006 | 0,157 | 0,023 | 0,073 | 0,158 | 0,001 | 0,000 | 0,000 | 0,000 | | 0,000 | 0,000 | 0,003 | 0,000 | 0,000 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 |
| | E-learning takes up more of my time as I need to retrieve information from the LMS | Correlation Coefficient | -.123* | -0,060 | -0,058 | -0,104 | -0,073 | .230** | .276** | .189** | .282** | .347** | 1,000 | .454** | .306** | .244** | .329** |
| | | Sig. (2-tailed) | 0,049 | 0,341 | 0,352 | 0,098 | 0,241 | 0,000 | 0,000 | 0,002 | 0,000 | 0,000 | | 0,000 | 0,000 | 0,000 | 0,000 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 |
| | I do not have the time to engage in live e-learnings sessions due to family and work commitments | Correlation Coefficient | -.134* | -.148* | -.144* | -.153* | -0,097 | .159* | .263** | .295** | .407** | .357** | .454** | 1,000 | .305** | .204** | .365** |
| | | Sig. (2-tailed) | 0,032 | 0,018 | 0,021 | 0,015 | 0,123 | 0,011 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | | 0,000 | 0,001 | 0,000 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 |
| | With e-learning, I do not get to interact personally with my peers | Correlation Coefficient | -0,019 | -0,059 | -0,065 | -.132* | -0,069 | .138* | .294** | .197** | .248** | .188** | .306** | .305** | 1,000 | .503** | .430** |
| | | Sig. (2-tailed) | 0,761 | 0,349 | 0,299 | 0,035 | 0,272 | 0,028 | 0,000 | 0,001 | 0,000 | 0,003 | 0,000 | 0,000 | | 0,000 | 0,000 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 |
| | With e-learning, I do not get to interact personally with my lecturers | Correlation Coefficient | -0,005 | 0,004 | -.129* | -.127* | -0,100 | .168** | .290** | .253** | .243** | .273** | .244** | .204** | .503** | 1,000 | .528** |
| | | Sig. (2-tailed) | 0,935 | 0,955 | 0,040 | 0,043 | 0,111 | 0,007 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,001 | 0,000 | | 0,000 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 |
| | I find it difficult to engage with e- learning material as it is not interactive | Correlation Coefficient | -0,068 | -0,076 | -0,083 | -.157* | -0,078 | .212** | .373** | .251** | .335** | .339** | .329** | .365** | .430** | .528** | 1,000 |
| | | Sig. (2-tailed) | 0,278 | 0,226 | 0,184 | 0,012 | 0,211 | 0,001 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 |
| | E-learning is concerned with digital learning material only, and does not provide me with interactive learning activities. | Correlation Coefficient | -0,075 | -0,024 | -0,080 | -0,086 | -0,098 | .176** | .313** | .238** | .167** | .332** | .393** | .300** | .363** | .413** | .592** |
| | | Sig. (2-tailed) | 0,229 | 0,698 | 0,203 | 0,171 | 0,118 | 0,005 | 0,000 | 0,000 | 0,007 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 |
| | E-learning does not provide me with the opportunity to problem solve with my peers | Correlation Coefficient | -0,053 | 0,005 | -0,044 | -0,009 | -0,107 | .263** | .310** | .242** | .271** | .325** | .349** | .290** | .495** | .462** | .500** |
| | | Sig. (2-tailed) | 0,401 | 0,937 | 0,485 | 0,885 | 0,089 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 |
| | e-learning does not give me the opportunity to interact with my fellow students and lecturers | Correlation Coefficient | 0,070 | 0,072 | -0,008 | 0,075 | -0,062 | .126* | .126* | .202** | .189** | .202** | .280** | .240** | .451** | .511** | .452** |
| | | Sig. (2-tailed) | 0,262 | 0,250 | 0,902 | 0,232 | 0,321 | 0,044 | 0,044 | 0,001 | 0,002 | 0,001 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 |
| | e-learning does not give me the opportunity to get feedback immediately from my lecturers | Correlation Coefficient | 0,007 | -0,044 | 0,004 | 0,046 | -0,017 | 0,122 | .156* | 0,082 | .145* | .141* | .222** | .242** | .330** | .381** | .380** |
| | | Sig. (2-tailed) | 0,907 | 0,487 | 0,953 | 0,467 | 0,785 | 0,051 | 0,012 | 0,193 | 0,020 | 0,025 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 |
| | e-learning does not allow me to express my thoughts and ideas | Correlation Coefficient | -0,007 | -0,004 | -0,070 | -0,093 | -0,057 | .210** | .243** | 0,108 | .176** | .205** | .284** | .274** | .309** | .413** | .418** |
| | | Sig. (2-tailed) | 0,911 | 0,946 | 0,266 | 0,140 | 0,364 | 0,001 | 0,000 | 0,086 | 0,005 | 0,001 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 |
| | I cannot afford technological devices to study via e-learning | Correlation Coefficient | -.195** | -.154* | -.248** | -.409** | -.249** | 0,017 | .151* | .476** | .130* | .274** | .247** | .296** | .291** | .196** | .319** |
| | | Sig. (2-tailed) | 0,002 | 0,013 | 0,000 | 0,000 | 0,000 | 0,787 | 0,016 | 0,000 | 0,037 | 0,000 | 0,000 | 0,000 | 0,000 | 0,002 | 0,000 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 |
| | There are poor computer facilities in my institution for e-learning purposes | Correlation Coefficient | -0,066 | -0,084 | -0,104 | -.195** | -0,050 | 0,025 | 0,087 | .205** | .146* | .135* | .125* | .258** | 0,110 | 0,083 | .176** |
| | | Sig. (2-tailed) | 0,290 | 0,179 | 0,096 | 0,002 | 0,430 | 0,685 | 0,167 | 0,001 | 0,019 | 0,031 | 0,046 | 0,000 | 0,079 | 0,186 | 0,005 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 |
| | There is poor network connectivity in my institution for e-learning | Correlation Coefficient | -.126* | -0,060 | -0,100 | -.126* | -0,030 | 0,091 | .201** | .179** | .348** | .174** | .156* | .285** | .262** | .137* | .264** |
| | | Sig. (2-tailed) | 0,044 | 0,336 | 0,110 | 0,043 | 0,628 | 0,146 | 0,001 | 0,004 | 0,000 | 0,005 | 0,012 | 0,000 | 0,000 | 0,029 | 0,000 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 |
| | There is poor Wi-Fi access in my institution for e-learning purposes. | Correlation Coefficient | -0,038 | -0,030 | -0,006 | -0,039 | 0,062 | 0,053 | 0,108 | 0,078 | .161** | 0,094 | 0,111 | 0,115 | .187** | 0,027 | .157* |
| | | Sig. (2-tailed) | 0,542 | 0,636 | 0,923 | 0,534 | 0,325 | 0,398 | 0,085 | 0,215 | 0,010 | 0,134 | 0,078 | 0,065 | 0,003 | 0,673 | 0,012 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 |
| | E-learning proves difficult as I do not have the appropriate technological skills | Correlation Coefficient | -.276** | -.252** | -.287** | -.303** | -.237** | 0,100 | .193** | .288** | .272** | .399** | .258** | .326** | .160* | .146* | .227** |
| | | Sig. (2-tailed) | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,111 | 0,002 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,010 | 0,019 | 0,000 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 |
| | I am afraid to use technology for learning as I find it difficult to access course material or prepare for online assessments | Correlation Coefficient | -.193** | -0,099 | -0,121 | -.284** | -.131* | .130* | .245** | .180** | .235** | .314** | .343** | .260** | .156* | .275** | .291** |
| | | Sig. (2-tailed) | 0,002 | 0,114 | 0,052 | 0,000 | 0,036 | 0,038 | 0,000 | 0,004 | 0,000 | 0,000 | 0,000 | 0,000 | 0,012 | 0,000 | 0,000 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 |
| | Technology moves too rapidly and I cannot keep up with the advancements | Correlation Coefficient | -.245** | -.128* | -.220** | -.255** | -.253** | .220** | .292** | .313** | .304** | .363** | .320** | .326** | .167** | .141* | .253** |
| | | Sig. (2-tailed) | 0,000 | 0,041 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,007 | 0,024 | 0,000 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 |
| | I lack the confidence to use technological equipment to engage in online learning | Correlation Coefficient | -.244** | -.161* | -.193** | -.323** | -.195** | .213** | .261** | .173** | .338** | .287** | .306** | .317** | .175** | 0,111 | .262** |
| | | Sig. (2-tailed) | 0,000 | 0,010 | 0,002 | 0,000 | 0,002 | 0,001 | 0,000 | 0,005 | 0,000 | 0,000 | 0,000 | 0,000 | 0,005 | 0,076 | 0,000 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 |
| | Submitting my work via e-learning is risky as my work could be lost | Correlation Coefficient | -.189** | 0,008 | -.139* | -.123* | -.146* | .208** | .202** | .220** | .245** | .279** | .371** | .265** | .276** | .283** | .378** |
| | | Sig. (2-tailed) | 0,002 | 0,896 | 0,026 | 0,050 | 0,019 | 0,001 | 0,001 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| | | N | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 |
| | Submitting my work via e-learning is risky as sensitive information could be disclosed | Correlation Coefficient | -0,118 | -0,069 | -0,044 | -0,045 | -0,032 | .143* | .211** | .258** | .199** | .308** | .318** | .236** | .176** | .223** | .311** |
| | | Sig. (2-tailed) | 0,059 | 0,273 | 0,483 | 0,477 | 0,616 | 0,022 | 0,001 | 0,000 | 0,001 | 0,000 | 0,000 | 0,000 | 0,005 | 0,000 | 0,000 |
| | | N | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 |
| | The quality of the e-learning system in my institution is not adequate to meet my educational needs | Correlation Coefficient | -0,019 | -0,089 | -0,039 | -0,036 | -0,031 | 0,041 | .218** | .199** | .245** | .286** | .278** | .221** | .215** | .259** | .327** |
| | | Sig. (2-tailed) | 0,762 | 0,154 | 0,540 | 0,565 | 0,617 | 0,513 | 0,000 | 0,001 | 0,000 | 0,000 | 0,000 | 0,000 | 0,001 | 0,000 | 0,000 |
| | | N | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 |
| | I spend more time learning how to use the software rather than learning the contents | Correlation Coefficient | -.205** | -.143* | -.160* | -.233** | -.181** | .253** | .298** | .333** | .257** | .360** | .305** | .341** | .219** | .229** | .367** |
| | | Sig. (2-tailed) | 0,001 | 0,022 | 0,011 | 0,000 | 0,004 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| | | N | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 |
| | My lecturers do not integrate technology into the curriculum adequately | Correlation Coefficient | 0,038 | -0,024 | 0,035 | 0,023 | 0,044 | 0,059 | .162** | .188** | .153* | .229** | .147* | .244** | .205** | .207** | .318** |
| | | Sig. (2-tailed) | 0,542 | 0,703 | 0,578 | 0,718 | 0,484 | 0,350 | 0,009 | 0,003 | 0,014 | 0,000 | 0,018 | 0,000 | 0,001 | 0,001 | 0,000 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 |
| | My lecturers do not plan and prepare learning activities with technology adequately | Correlation Coefficient | 0,012 | 0,047 | 0,048 | 0,014 | 0,050 | .126* | .141* | .190** | .131* | .231** | .217** | .167** | .158* | .230** | .292** |
| | | Sig. (2-tailed) | 0,853 | 0,458 | 0,446 | 0,825 | 0,425 | 0,044 | 0,024 | 0,002 | 0,037 | 0,000 | 0,000 | 0,008 | 0,011 | 0,000 | 0,000 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 |
| | My lecturers do not consider learning enhancement and student engagement when incorporating technology into the curriculum | Correlation Coefficient | 0,005 | 0,052 | 0,042 | -0,049 | 0,051 | 0,023 | .202** | .189** | .152* | .320** | .147* | .151* | .177** | .299** | .303** |
| | | Sig. (2-tailed) | 0,930 | 0,404 | 0,507 | 0,435 | 0,416 | 0,713 | 0,001 | 0,002 | 0,015 | 0,000 | 0,018 | 0,015 | 0,005 | 0,000 | 0,000 |
| | | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 |
| | The institution does not provide training and workshops to enable my use of e-learning | Correlation Coefficient | -0,073 | -0,014 | -0,098 | -.197** | 0,042 | .141* | .181** | .153* | .181** | .210** | .128* | .185** | .124* | .166** | .247** |
| | | Sig. (2-tailed) | 0,246 | 0,818 | 0,120 | 0,002 | 0,502 | 0,024 | 0,004 | 0,014 | 0,004 | 0,001 | 0,042 | 0,003 | 0,049 | 0,008 | 0,000 |
| | | N | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 |
| | The institution does not provide orientation courses for e-learning, to improve understanding of course material | Correlation Coefficient | -0,073 | -0,036 | -0,090 | -.166** | 0,010 | .127* | 0,120 | 0,074 | 0,114 | .207** | .193** | .177** | 0,101 | 0,079 | .235** |
| | | Sig. (2-tailed) | 0,245 | 0,568 | 0,152 | 0,008 | 0,871 | 0,044 | 0,055 | 0,238 | 0,069 | 0,001 | 0,002 | 0,005 | 0,108 | 0,206 | 0,000 |
| | | N | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 |
| | My institution does not provide adequate online technical support for my e-learning activities. | Correlation Coefficient | 0,001 | -0,069 | -0,046 | -0,095 | -0,011 | 0,108 | 0,073 | .231** | 0,084 | .222** | .220** | .218** | .255** | .139* | .269** |
| | | Sig. (2-tailed) | 0,992 | 0,272 | 0,462 | 0,128 | 0,863 | 0,084 | 0,243 | 0,000 | 0,180 | 0,000 | 0,000 | 0,000 | 0,000 | 0,027 | 0,000 |
| | | N | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 |
| | My institution does not provide a reliable LMS (Learning Management System) | Correlation Coefficient | -0,037 | -.174** | -0,005 | -.164** | 0,053 | 0,052 | .161** | .169** | .134* | .169** | .186** | .180** | .186** | 0,103 | .216** |
| | | Sig. (2-tailed) | 0,558 | 0,005 | 0,938 | 0,009 | 0,398 | 0,411 | 0,010 | 0,007 | 0,032 | 0,007 | 0,003 | 0,004 | 0,003 | 0,102 | 0,001 |
| | | N | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 |
| | My institution does not provide a Help Desk for technical support (phone/email/chat) | Correlation Coefficient | 0,026 | -0,055 | 0,013 | -0,013 | 0,045 | 0,089 | 0,044 | 0,055 | -0,064 | 0,041 | .145* | 0,051 | 0,096 | 0,050 | 0,121 |
| | | Sig. (2-tailed) | 0,677 | 0,384 | 0,840 | 0,838 | 0,475 | 0,156 | 0,483 | 0,380 | 0,312 | 0,517 | 0,021 | 0,420 | 0,126 | 0,423 | 0,055 |
| | | N | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 |
| | In classes with large groups, tools such as social networking, micro blogging, other applications should be made available | Correlation Coefficient | -0,059 | -0,097 | -.200** | -0,083 | -0,035 | 0,015 | 0,074 | 0,120 | .180** | .189** | 0,081 | 0,120 | .170** | .158* | 0,108 |
| | | Sig. (2-tailed) | 0,351 | 0,126 | 0,001 | 0,187 | 0,576 | 0,810 | 0,243 | 0,057 | 0,004 | 0,003 | 0,201 | 0,058 | 0,007 | 0,012 | 0,089 |
| | | N | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 |
| | Learning will be more interactive if lecturers deliver online courses via social media, lecture recordings, online educational games and other similar technologies | Correlation Coefficient | 0,040 | 0,106 | -0,030 | 0,063 | 0,038 | 0,032 | .143* | 0,067 | 0,112 | 0,119 | .139* | .132* | .161* | .135* | .142* |
| | | Sig. (2-tailed) | 0,529 | 0,092 | 0,640 | 0,323 | 0,545 | 0,609 | 0,023 | 0,289 | 0,078 | 0,060 | 0,028 | 0,036 | 0,011 | 0,033 | 0,025 |
| | | N | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 |
| | The feelings of isolation in online classes can be overcome by online peer tutoring, discussion boards and group video conferences | Correlation Coefficient | 0,020 | .146* | -0,052 | 0,034 | -0,065 | -0,005 | 0,047 | -0,014 | 0,058 | 0,003 | 0,055 | 0,038 | .210** | .126* | 0,061 |
| | | Sig. (2-tailed) | 0,748 | 0,021 | 0,413 | 0,594 | 0,305 | 0,935 | 0,455 | 0,820 | 0,363 | 0,961 | 0,381 | 0,545 | 0,001 | 0,046 | 0,336 |
| | | N | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 |
| | Having online access to remote tutors will assist in my studies via e-learning | Correlation Coefficient | -0,027 | 0,110 | -0,026 | 0,063 | -0,015 | 0,009 | 0,043 | 0,041 | 0,040 | 0,101 | 0,008 | 0,006 | 0,108 | 0,109 | 0,039 |
| | | Sig. (2-tailed) | 0,671 | 0,083 | 0,681 | 0,317 | 0,814 | 0,889 | 0,495 | 0,516 | 0,525 | 0,111 | 0,895 | 0,924 | 0,089 | 0,083 | 0,539 |
| | | N | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 |
| | Training programmes and orientation will improve pass rates in the e-learning environment | Correlation Coefficient | -0,045 | -0,011 | -0,013 | -0,025 | -0,038 | 0,039 | 0,043 | 0,009 | -0,010 | 0,073 | 0,019 | 0,006 | 0,101 | 0,011 | -0,002 |
| | | Sig. (2-tailed) | 0,474 | 0,861 | 0,833 | 0,692 | 0,546 | 0,539 | 0,494 | 0,882 | 0,871 | 0,250 | 0,763 | 0,930 | 0,110 | 0,861 | 0,973 |
| | | N | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 |
| | Flexible online technical support is important for a user-friendly environment for e-learning success | Correlation Coefficient | 0,061 | -0,003 | 0,001 | 0,102 | 0,069 | 0,023 | 0,019 | 0,038 | 0,011 | 0,035 | 0,019 | 0,011 | .157* | 0,004 | 0,003 |
| | | Sig. (2-tailed) | 0,334 | 0,967 | 0,989 | 0,107 | 0,273 | 0,714 | 0,765 | 0,548 | 0,868 | 0,583 | 0,768 | 0,857 | 0,013 | 0,946 | 0,957 |
| | | N | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 |

| | | E-learning is concerned with digital learning material only, and does not provide me with interactive learning activities. | E-learning does not provide me with the opportunity to problem solve with my peers | e-learning does not give me the opportunity to interact with my fellow students and lecturers | e-learning does not give me the opportunity to get feedback immediately from my lecturers | e-learning does not allow me to express my thoughts and ideas | I cannot afford technological devices to study via e-learning | There are poor computer facilities in my institution for e-learning purposes | There is poor network connectivity in my institution for e-learning | There is poor Wi-Fi access in my institution for e-learning purposes. | E-learning proves difficult as I do not have the appropriate technological skills | I am afraid to use technology for learning as I find it difficult to access course material or prepare for online assessments | Technology moves too rapidly and I cannot keep up with the advancements | I lack the confidence to use technological equipment to engage in online learning | Submitting my work via e-learning is risky as my work could be lost | Submitting my work via e-learning is risky as sensitive information could be disclosed | The quality of the e-learning system in my institution is not adequate to meet my educational needs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Personal Computer (PC) | Correlation Coefficient | -0,075 | -0,053 | 0,070 | 0,007 | -0,007 | -.195** | -0,066 | -.126* | -0,038 | -.276** | -.193** | -.245** | -.244** | -.189** | -0,118 | -0,019 |
| | Sig. (2-tailed) | 0,229 | 0,401 | 0,262 | 0,907 | 0,911 | 0,002 | 0,290 | 0,044 | 0,542 | 0,000 | 0,002 | 0,000 | 0,000 | 0,002 | 0,059 | 0,762 |
| | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 255 | 255 | 255 |
| Smart Phone | Correlation Coefficient | -0,024 | 0,005 | 0,072 | -0,044 | -0,004 | -.154* | -0,084 | -0,060 | -0,030 | -.252** | -0,099 | -.128* | -.161* | 0,008 | -0,069 | -0,089 |
| | Sig. (2-tailed) | 0,698 | 0,937 | 0,250 | 0,487 | 0,946 | 0,013 | 0,179 | 0,336 | 0,636 | 0,000 | 0,114 | 0,041 | 0,010 | 0,896 | 0,273 | 0,154 |
| | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 255 | 255 | 255 |
| Tablet | Correlation Coefficient | -0,080 | -0,044 | -0,008 | 0,004 | -0,070 | -.248** | -0,104 | -0,100 | -0,006 | -.287** | -0,121 | -.220** | -.193** | -.139* | -0,044 | -0,039 |
| | Sig. (2-tailed) | 0,203 | 0,485 | 0,902 | 0,953 | 0,266 | 0,000 | 0,096 | 0,110 | 0,923 | 0,000 | 0,052 | 0,000 | 0,002 | 0,026 | 0,483 | 0,540 |
| | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 255 | 255 | 255 |
| Laptop | Correlation Coefficient | -0,086 | -0,009 | 0,075 | 0,046 | -0,093 | -.409** | -.195** | -.126* | -0,039 | -.303** | -.284** | -.255** | -.323** | -.123* | -0,045 | -0,036 |
| | Sig. (2-tailed) | 0,171 | 0,885 | 0,232 | 0,467 | 0,140 | 0,000 | 0,002 | 0,043 | 0,534 | 0,000 | 0,000 | 0,000 | 0,000 | 0,050 | 0,477 | 0,565 |
| | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 255 | 255 | 255 |
| Wearables (Smart Watches) | Correlation Coefficient | -0,098 | -0,107 | -0,062 | -0,017 | -0,057 | -.249** | -0,050 | -0,030 | 0,062 | -.237** | -.131* | -.253** | -.195** | -.146* | -0,032 | -0,031 |
| | Sig. (2-tailed) | 0,118 | 0,089 | 0,321 | 0,785 | 0,364 | 0,000 | 0,430 | 0,628 | 0,325 | 0,000 | 0,036 | 0,000 | 0,002 | 0,019 | 0,616 | 0,617 |
| | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 255 | 255 | 255 |
| I am often distracted by social media and other entertaining content when using technology for learning | Correlation Coefficient | .176** | .263** | .126* | 0,122 | .210** | 0,017 | 0,025 | 0,091 | 0,053 | 0,100 | .130* | .220** | .213** | .208** | .143* | 0,041 |
| | Sig. (2-tailed) | 0,005 | 0,000 | 0,044 | 0,051 | 0,001 | 0,787 | 0,685 | 0,146 | 0,398 | 0,111 | 0,038 | 0,000 | 0,001 | 0,001 | 0,022 | 0,513 |
| | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 255 | 255 | 255 |
| I am often distracted when using technology for learning, as lessons with technology lack innovation | Correlation Coefficient | .313** | .310** | .126* | .156* | .243** | .151* | 0,087 | .201** | 0,108 | .193** | .245** | .292** | .261** | .202** | .211** | .218** |
| | Sig. (2-tailed) | 0,000 | 0,000 | 0,044 | 0,012 | 0,000 | 0,016 | 0,167 | 0,001 | 0,085 | 0,002 | 0,000 | 0,000 | 0,000 | 0,001 | 0,001 | 0,000 |
| | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 255 | 255 | 255 |
| because I cannot afford the technology for online courses | Correlation Coefficient | .238** | .242** | .202** | 0,082 | 0,108 | .476** | .205** | .179** | 0,078 | .288** | .180** | .313** | .173** | .220** | .258** | .199** |
| | Sig. (2-tailed) | 0,000 | 0,000 | 0,001 | 0,193 | 0,086 | 0,000 | 0,001 | 0,004 | 0,215 | 0,000 | 0,004 | 0,000 | 0,005 | 0,000 | 0,000 | 0,001 |
| | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 255 | 255 | 255 |
| because of insufficient time to study | Correlation Coefficient | .167** | .271** | .189** | .145* | .176** | .130* | .146* | .348** | .161** | .272** | .235** | .304** | .338** | .245** | .199** | .245** |
| | Sig. (2-tailed) | 0,007 | 0,000 | 0,002 | 0,020 | 0,005 | 0,037 | 0,019 | 0,000 | 0,010 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,001 | 0,000 |
| | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 255 | 255 | 255 |
| because of lack of experience in online learning | Correlation Coefficient | .332** | .325** | .202** | .141* | .205** | .274** | .135* | .174** | 0,094 | .399** | .314** | .363** | .287** | .279** | .308** | .286** |
| | Sig. (2-tailed) | 0,000 | 0,000 | 0,001 | 0,025 | 0,001 | 0,000 | 0,031 | 0,005 | 0,134 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 255 | 255 | 255 |
| E-learning takes up more of my time as I need to retrieve information from the LMS | Correlation Coefficient | .393** | .349** | .280** | .222** | .284** | .247** | .125* | .156* | 0,111 | .258** | .343** | .320** | .306** | .371** | .318** | .278** |
| | Sig. (2-tailed) | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,046 | 0,012 | 0,078 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 255 | 255 | 255 |
| I do not have the time to engage in live e-learnings sessions due to family and work commitments | Correlation Coefficient | .300** | .290** | .240** | .242** | .274** | .296** | .258** | .285** | 0,115 | .326** | .260** | .326** | .317** | .265** | .236** | .221** |
| | Sig. (2-tailed) | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,065 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 255 | 255 | 255 |
| With e-learning, I do not get to interact personally with my peers | Correlation Coefficient | .363** | .495** | .451** | .330** | .309** | .291** | 0,110 | .262** | .187** | .160* | .156* | .167** | .175** | .276** | .176** | .215** |
| | Sig. (2-tailed) | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,079 | 0,000 | 0,003 | 0,010 | 0,012 | 0,007 | 0,005 | 0,000 | 0,005 | 0,001 |
| | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 255 | 255 | 255 |
| With e-learning, I do not get to interact personally with my lecturers | Correlation Coefficient | .413** | .462** | .511** | .381** | .413** | .196** | 0,083 | .137* | 0,027 | .146* | .275** | .141* | 0,111 | .283** | .223** | .259** |
| | Sig. (2-tailed) | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,002 | 0,186 | 0,029 | 0,673 | 0,019 | 0,000 | 0,024 | 0,076 | 0,000 | 0,000 | 0,000 |
| | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 255 | 255 | 255 |
| I find it difficult to engage with e- learning material as it is not interactive | Correlation Coefficient | .592** | .500** | .452** | .380** | .418** | .319** | .176** | .264** | .157* | .227** | .291** | .253** | .262** | .378** | .311** | .327** |
| | Sig. (2-tailed) | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,005 | 0,000 | 0,012 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 255 | 255 | 255 |
| E-learning is concerned with digital learning material only, and does not provide me with interactive learning activities. | Correlation Coefficient | 1,000 | .570** | .414** | .402** | .408** | .198** | .127* | .155* | 0,093 | .273** | .347** | .298** | .282** | .320** | .285** | .349** |
| | Sig. (2-tailed) | | 0,000 | 0,000 | 0,000 | 0,000 | 0,001 | 0,043 | 0,013 | 0,137 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 255 | 255 | 255 |
| E-learning does not provide me with the opportunity to problem solve with my peers | Correlation Coefficient | .570** | 1,000 | .526** | .467** | .524** | .166** | 0,104 | 0,119 | 0,063 | .209** | .255** | .223** | .206** | .312** | .225** | .394** |
| | Sig. (2-tailed) | 0,000 | | 0,000 | 0,000 | 0,000 | 0,008 | 0,095 | 0,058 | 0,318 | 0,001 | 0,000 | 0,000 | 0,001 | 0,000 | 0,000 | 0,000 |
| | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 255 | 255 | 255 |
| e-learning does not give me the opportunity to interact with my fellow students and lecturers | Correlation Coefficient | .414** | .526** | 1,000 | .508** | .452** | .224** | .171** | .228** | 0,113 | .151* | .244** | .157* | .138* | .303** | .222** | .305** |
| | Sig. (2-tailed) | 0,000 | 0,000 | | 0,000 | 0,000 | 0,000 | 0,006 | 0,000 | 0,071 | 0,016 | 0,000 | 0,012 | 0,028 | 0,000 | 0,000 | 0,000 |
| | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 255 | 255 | 255 |
| e-learning does not give me the opportunity to get feedback immediately from my lecturers | Correlation Coefficient | .402** | .467** | .508** | 1,000 | .574** | .223** | 0,091 | .135* | .160* | 0,106 | .207** | 0,105 | 0,093 | .288** | .255** | .304** |
| | Sig. (2-tailed) | 0,000 | 0,000 | 0,000 | | 0,000 | 0,000 | 0,148 | 0,031 | 0,011 | 0,091 | 0,001 | 0,092 | 0,137 | 0,000 | 0,000 | 0,000 |
| | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 255 | 255 | 255 |
| e-learning does not allow me to express my thoughts and ideas | Correlation Coefficient | .408** | .524** | .452** | .574** | 1,000 | .209** | .225** | .203** | .181** | .135* | .270** | .191** | .248** | .199** | .205** | .396** |
| | Sig. (2-tailed) | 0,000 | 0,000 | 0,000 | 0,000 | | 0,001 | 0,000 | 0,001 | 0,004 | 0,031 | 0,000 | 0,002 | 0,000 | 0,001 | 0,001 | 0,000 |
| | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 255 | 255 | 255 |
| I cannot afford technological devices to study via e-learning | Correlation Coefficient | .198** | .166** | .224** | .223** | .209** | 1,000 | .381** | .170** | .127* | .337** | .218** | .307** | .254** | .175** | .172** | .147* |
| | Sig. (2-tailed) | 0,001 | 0,008 | 0,000 | 0,000 | 0,001 | | 0,000 | 0,006 | 0,043 | 0,000 | 0,000 | 0,000 | 0,000 | 0,005 | 0,006 | 0,019 |
| | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 255 | 255 | 255 |
| There are poor computer facilities in my institution for e-learning purposes | Correlation Coefficient | .127* | 0,104 | .171** | 0,091 | .225** | .381** | 1,000 | .470** | .332** | .188** | .168** | .175** | .178** | .129* | .130* | .249** |
| | Sig. (2-tailed) | 0,043 | 0,095 | 0,006 | 0,148 | 0,000 | 0,000 | | 0,000 | 0,000 | 0,002 | 0,007 | 0,005 | 0,004 | 0,039 | 0,038 | 0,000 |
| | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 255 | 255 | 255 |
| There is poor network connectivity in my institution for e-learning | Correlation Coefficient | .155* | 0,119 | .228** | .135* | .203** | .170** | .470** | 1,000 | .634** | .128* | .141* | .166** | .206** | .134* | 0,119 | .175** |
| | Sig. (2-tailed) | 0,013 | 0,058 | 0,000 | 0,031 | 0,001 | 0,006 | 0,000 | | 0,000 | 0,040 | 0,024 | 0,008 | 0,001 | 0,032 | 0,057 | 0,005 |
| | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 255 | 255 | 255 |
| There is poor Wi-Fi access in my institution for e-learning purposes. | Correlation Coefficient | 0,093 | 0,063 | 0,113 | .160* | .181** | .127* | .332** | .634** | 1,000 | -0,032 | 0,002 | -0,043 | 0,007 | 0,121 | 0,113 | .143* |
| | Sig. (2-tailed) | 0,137 | 0,318 | 0,071 | 0,011 | 0,004 | 0,043 | 0,000 | 0,000 | | 0,608 | 0,981 | 0,497 | 0,915 | 0,053 | 0,072 | 0,022 |
| | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 255 | 255 | 255 |
| E-learning proves difficult as I do not have the appropriate technological skills | Correlation Coefficient | .273** | .209** | .151* | 0,106 | .135* | .337** | .188** | .128* | -0,032 | 1,000 | .491** | .668** | .518** | .341** | .295** | .300** |
| | Sig. (2-tailed) | 0,000 | 0,001 | 0,016 | 0,091 | 0,031 | 0,000 | 0,002 | 0,040 | 0,608 | | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 255 | 255 | 255 |
| I am afraid to use technology for learning as I find it difficult to access course material or prepare for online assessments | Correlation Coefficient | .347** | .255** | .244** | .207** | .270** | .218** | .168** | .141* | 0,002 | .491** | 1,000 | .569** | .669** | .358** | .292** | .265** |
| | Sig. (2-tailed) | 0,000 | 0,000 | 0,000 | 0,001 | 0,000 | 0,000 | 0,007 | 0,024 | 0,981 | 0,000 | | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 255 | 255 | 255 |
| Technology moves too rapidly and I cannot keep up with the advancements | Correlation Coefficient | .298** | .223** | .157* | 0,105 | .191** | .307** | .175** | .166** | -0,043 | .668** | .569** | 1,000 | .668** | .328** | .302** | .241** |
| | Sig. (2-tailed) | 0,000 | 0,000 | 0,012 | 0,092 | 0,002 | 0,000 | 0,005 | 0,008 | 0,497 | 0,000 | 0,000 | | 0,000 | 0,000 | 0,000 | 0,000 |
| | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 255 | 255 | 255 |
| I lack the confidence to use technological equipment to engage in online learning | Correlation Coefficient | .282** | .206** | .138* | 0,093 | .248** | .254** | .178** | .206** | 0,007 | .518** | .669** | .668** | 1,000 | .361** | .288** | .229** |
| | Sig. (2-tailed) | 0,000 | 0,001 | 0,028 | 0,137 | 0,000 | 0,000 | 0,004 | 0,001 | 0,915 | 0,000 | 0,000 | 0,000 | | 0,000 | 0,000 | 0,000 |
| | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 255 | 255 | 255 |
| Submitting my work via e-learning is risky as my work could be lost | Correlation Coefficient | .320** | .312** | .303** | .288** | .199** | .175** | .129* | .134* | 0,121 | .341** | .358** | .328** | .361** | 1,000 | .693** | .259** |
| | Sig. (2-tailed) | 0,000 | 0,000 | 0,000 | 0,000 | 0,001 | 0,005 | 0,039 | 0,032 | 0,053 | 0,000 | 0,000 | 0,000 | 0,000 | | 0,000 | 0,000 |
| | N | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 |
| Submitting my work via e-learning is risky as sensitive information could be disclosed | Correlation Coefficient | .285** | .225** | .222** | .255** | .205** | .172** | .130* | 0,119 | 0,113 | .295** | .292** | .302** | .288** | .693** | 1,000 | .298** |
| | Sig. (2-tailed) | 0,000 | 0,000 | 0,000 | 0,000 | 0,001 | 0,006 | 0,038 | 0,057 | 0,072 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | | 0,000 |
| | N | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 |
| The quality of the e-learning system in my institution is not adequate to meet my educational needs | Correlation Coefficient | .349** | .394** | .305** | .304** | .396** | .147* | .249** | .175** | .143* | .300** | .265** | .241** | .229** | .259** | .298** | 1,000 |
| | Sig. (2-tailed) | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,019 | 0,000 | 0,005 | 0,022 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | |
| | N | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 |
| I spend more time learning how to use the software rather than learning the contents | Correlation Coefficient | .348** | .285** | .255** | .177** | .240** | .307** | .223** | .162** | 0,045 | .502** | .454** | .469** | .442** | .436** | .448** | .339** |
| | Sig. (2-tailed) | 0,000 | 0,000 | 0,000 | 0,005 | 0,000 | 0,000 | 0,000 | 0,010 | 0,474 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| | N | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 |
| My lecturers do not integrate technology into the curriculum adequately | Correlation Coefficient | .336** | .300** | .311** | .320** | .369** | .175** | .350** | .192** | .202** | 0,107 | .198** | .175** | 0,105 | .243** | .326** | .411** |
| | Sig. (2-tailed) | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,005 | 0,000 | 0,002 | 0,001 | 0,086 | 0,001 | 0,005 | 0,094 | 0,000 | 0,000 | 0,000 |
| | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 255 | 255 | 255 |
| My lecturers do not plan and prepare learning activities with technology adequately | Correlation Coefficient | .336** | .273** | .308** | .304** | .351** | 0,121 | .269** | .242** | .195** | 0,107 | .261** | .167** | .167** | .219** | .253** | .445** |
| | Sig. (2-tailed) | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,053 | 0,000 | 0,000 | 0,002 | 0,088 | 0,000 | 0,007 | 0,007 | 0,000 | 0,000 | 0,000 |
| | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 255 | 255 | 255 |
| My lecturers do not consider learning enhancement and student engagement when incorporating technology into the curriculum | Correlation Coefficient | .374** | .312** | .295** | .326** | .403** | .137* | .196** | .218** | .160* | .158* | .304** | .216** | .146* | .165** | .265** | .500** |
| | Sig. (2-tailed) | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,028 | 0,002 | 0,000 | 0,010 | 0,012 | 0,000 | 0,000 | 0,020 | 0,008 | 0,000 | 0,000 |
| | N | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 255 | 255 | 255 |
| The institution does not provide training and workshops to enable my use of e-learning | Correlation Coefficient | .254** | .281** | .189** | .170** | .259** | .217** | .287** | .241** | .143* | .166** | .291** | .161* | .259** | 0,077 | 0,065 | .249** |
| | Sig. (2-tailed) | 0,000 | 0,000 | 0,002 | 0,006 | 0,000 | 0,000 | 0,000 | 0,000 | 0,022 | 0,008 | 0,000 | 0,010 | 0,000 | 0,223 | 0,306 | 0,000 |
| | N | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 254 | 254 | 254 |
| The institution does not provide orientation courses for e-learning, to improve understanding of course material | Correlation Coefficient | .338** | .248** | .132* | .231** | .261** | .161** | .191** | .168** | .189** | .133* | .271** | 0,104 | .251** | 0,092 | 0,087 | .289** |
| | Sig. (2-tailed) | 0,000 | 0,000 | 0,035 | 0,000 | 0,000 | 0,010 | 0,002 | 0,007 | 0,002 | 0,033 | 0,000 | 0,096 | 0,000 | 0,142 | 0,165 | 0,000 |
| | N | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 254 | 254 | 254 |
| My institution does not provide adequate online technical support for my e-learning activities. | Correlation Coefficient | .416** | .301** | .240** | .212** | .273** | .273** | .293** | .207** | .215** | .213** | .278** | .191** | .249** | .207** | .236** | .291** |
| | Sig. (2-tailed) | 0,000 | 0,000 | 0,000 | 0,001 | 0,000 | 0,000 | 0,000 | 0,001 | 0,001 | 0,001 | 0,000 | 0,002 | 0,000 | 0,001 | 0,000 | 0,000 |
| | N | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 254 | 254 | 254 |
| My institution does not provide a reliable LMS (Learning Management System) | Correlation Coefficient | .297** | .250** | .130* | .166** | .213** | .160* | .252** | .201** | .188** | 0,062 | .260** | 0,074 | .219** | .190** | .234** | .319** |
| | Sig. (2-tailed) | 0,000 | 0,000 | 0,038 | 0,008 | 0,001 | 0,010 | 0,000 | 0,001 | 0,003 | 0,322 | 0,000 | 0,237 | 0,000 | 0,002 | 0,000 | 0,000 |
| | N | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 254 | 254 | 254 |
| My institution does not provide a Help Desk for technical support (phone/email/chat) | Correlation Coefficient | .224** | .179** | .156* | 0,047 | .172** | 0,072 | .154* | .164** | .155* | -0,081 | .170** | -0,029 | .146* | 0,087 | 0,100 | .163** |
| | Sig. (2-tailed) | 0,000 | 0,004 | 0,013 | 0,456 | 0,006 | 0,253 | 0,014 | 0,009 | 0,013 | 0,196 | 0,006 | 0,641 | 0,019 | 0,165 | 0,110 | 0,009 |
| | N | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 254 | 254 | 254 |
| In classes with large groups, tools such as social networking, micro blogging, other applications should be made available | Correlation Coefficient | .127* | 0,095 | .148* | .154* | 0,093 | .199** | 0,056 | 0,030 | 0,032 | .211** | 0,088 | 0,107 | 0,059 | 0,094 | 0,067 | 0,064 |
| | Sig. (2-tailed) | 0,044 | 0,133 | 0,019 | 0,015 | 0,142 | 0,002 | 0,374 | 0,636 | 0,619 | 0,001 | 0,162 | 0,089 | 0,352 | 0,139 | 0,291 | 0,312 |
| | N | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 250 | 250 | 250 |
| Learning will be more interactive if lecturers deliver online courses via social media, lecture recordings, online educational games and other similar technologies | Correlation Coefficient | .190** | .160* | 0,115 | .181** | .170** | 0,085 | 0,078 | 0,071 | .147* | 0,025 | 0,073 | -0,003 | 0,051 | .205** | .202** | 0,061 |
| | Sig. (2-tailed) | 0,002 | 0,011 | 0,069 | 0,004 | 0,007 | 0,180 | 0,217 | 0,265 | 0,020 | 0,697 | 0,252 | 0,957 | 0,424 | 0,001 | 0,001 | 0,340 |
| | N | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 250 | 250 | 250 |
| The feelings of isolation in online classes can be overcome by online peer tutoring, discussion boards and group video conferences | Correlation Coefficient | .154* | .233** | .129* | .207** | 0,115 | 0,066 | -0,068 | 0,076 | 0,058 | 0,021 | 0,078 | -0,017 | 0,026 | 0,119 | 0,062 | -0,046 |
| | Sig. (2-tailed) | 0,015 | 0,000 | 0,040 | 0,001 | 0,069 | 0,297 | 0,286 | 0,229 | 0,356 | 0,739 | 0,218 | 0,786 | 0,677 | 0,060 | 0,330 | 0,472 |
| | N | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 250 | 250 | 250 |
| Having online access to remote tutors will assist in my studies via e-learning | Correlation Coefficient | .144* | 0,105 | 0,068 | .149* | 0,054 | 0,084 | -0,113 | -0,020 | -0,013 | 0,017 | 0,005 | -0,071 | -0,063 | 0,033 | 0,099 | -0,051 |
| | Sig. (2-tailed) | 0,022 | 0,096 | 0,281 | 0,018 | 0,393 | 0,186 | 0,074 | 0,757 | 0,842 | 0,792 | 0,940 | 0,260 | 0,321 | 0,600 | 0,119 | 0,419 |
| | N | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 250 | 250 | 250 |
| Training programmes and orientation will improve pass rates in the e-learning environment | Correlation Coefficient | 0,094 | 0,038 | -0,038 | 0,061 | -0,033 | 0,059 | -0,055 | 0,002 | 0,047 | 0,062 | 0,017 | -0,103 | -0,022 | 0,124 | 0,110 | -0,113 |
| | Sig. (2-tailed) | 0,138 | 0,544 | 0,553 | 0,333 | 0,607 | 0,351 | 0,386 | 0,972 | 0,461 | 0,328 | 0,790 | 0,102 | 0,730 | 0,051 | 0,084 | 0,075 |
| | N | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 250 | 250 | 250 |
| Flexible online technical support is important for a user-friendly environment for e-learning success | Correlation Coefficient | 0,060 | 0,074 | 0,067 | .161* | 0,035 | -0,002 | -0,076 | 0,093 | .221** | -0,068 | -0,112 | -.196** | -.152* | 0,088 | 0,102 | -0,049 |
| | Sig. (2-tailed) | 0,347 | 0,242 | 0,289 | 0,011 | 0,581 | 0,978 | 0,232 | 0,140 | 0,000 | 0,284 | 0,076 | 0,002 | 0,016 | 0,164 | 0,108 | 0,438 |
| | N | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 250 | 250 | 250 |

| | | I spend more time learning how to use the software rather than learning the contents | My lecturers do not integrate technology into the curriculum adequately | My lecturers do not plan and prepare learning activities with technology adequately | My lecturers do not consider learning enhancement and student engagement when incorporating technology into the curriculum | The institution does not provide training and workshops to enable my use of e-learning | The institution does not provide orientation courses for e-learning, to improve understanding of course material | My institution does not provide adequate online technical support for my e-learning activities. | My institution does not provide a reliable LMS (Learning Management System) | My institution does not provide a Help Desk for technical support (phone/email/chat) | In classes with large groups, tools such as social networking, micro blogging, other applications should be made available | Learning will be more interactive if lecturers deliver online courses via social media, lecture recordings, online educational games and other similar technologies | The feelings of isolation in online classes can be overcome by online peer tutoring, discussion boards and group video conferences | Having online access to remote tutors will assist in my studies via e-learning | Training programmes and orientation will improve pass rates in the e-learning environment | Flexible online technical support is important for a user-friendly environment for e-learning success |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Personal Computer (PC) | Correlation Coefficient | -.205** | 0,038 | 0,012 | 0,005 | -0,073 | -0,073 | 0,001 | -0,037 | 0,026 | -0,059 | 0,040 | 0,020 | -0,027 | -0,045 | 0,061 |
| | Sig. (2-tailed) | 0,001 | 0,542 | 0,853 | 0,930 | 0,246 | 0,245 | 0,992 | 0,558 | 0,677 | 0,351 | 0,529 | 0,748 | 0,671 | 0,474 | 0,334 |
| | N | 255 | 256 | 256 | 256 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| Smart Phone | Correlation Coefficient | -.143* | -0,024 | 0,047 | 0,052 | -0,014 | -0,036 | -0,069 | -.174** | -0,055 | -0,097 | 0,106 | .146* | 0,110 | -0,011 | -0,003 |
| | Sig. (2-tailed) | 0,022 | 0,703 | 0,458 | 0,404 | 0,818 | 0,568 | 0,272 | 0,005 | 0,384 | 0,126 | 0,092 | 0,021 | 0,083 | 0,861 | 0,967 |
| | N | 255 | 256 | 256 | 256 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| Tablet | Correlation Coefficient | -.160* | 0,035 | 0,048 | 0,042 | -0,098 | -0,090 | -0,046 | -0,005 | 0,013 | -.200** | -0,030 | -0,052 | -0,026 | -0,013 | 0,001 |
| | Sig. (2-tailed) | 0,011 | 0,578 | 0,446 | 0,507 | 0,120 | 0,152 | 0,462 | 0,938 | 0,840 | 0,001 | 0,640 | 0,413 | 0,681 | 0,833 | 0,989 |
| | N | 255 | 256 | 256 | 256 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| Laptop | Correlation Coefficient | -.233** | 0,023 | 0,014 | -0,049 | -.197** | -.166** | -0,095 | -.164** | -0,013 | -0,083 | 0,063 | 0,034 | 0,063 | -0,025 | 0,102 |
| | Sig. (2-tailed) | 0,000 | 0,718 | 0,825 | 0,435 | 0,002 | 0,008 | 0,128 | 0,009 | 0,838 | 0,187 | 0,323 | 0,594 | 0,317 | 0,692 | 0,107 |
| | N | 255 | 256 | 256 | 256 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| Wearables (Smart Watches) | Correlation Coefficient | -.181** | 0,044 | 0,050 | 0,051 | 0,042 | 0,010 | -0,011 | 0,053 | 0,045 | -0,035 | 0,038 | -0,065 | -0,015 | -0,038 | 0,069 |
| | Sig. (2-tailed) | 0,004 | 0,484 | 0,425 | 0,416 | 0,502 | 0,871 | 0,863 | 0,398 | 0,475 | 0,576 | 0,545 | 0,305 | 0,814 | 0,546 | 0,273 |
| | N | 255 | 256 | 256 | 256 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| I am often distracted by social media and other entertaining content when using technology for learning | Correlation Coefficient | .253** | 0,059 | .126* | 0,023 | .141* | .127* | 0,108 | 0,052 | 0,089 | 0,015 | 0,032 | -0,005 | 0,009 | 0,039 | 0,023 |
| | Sig. (2-tailed) | 0,000 | 0,350 | 0,044 | 0,713 | 0,024 | 0,044 | 0,084 | 0,411 | 0,156 | 0,810 | 0,609 | 0,935 | 0,889 | 0,539 | 0,714 |
| | N | 255 | 256 | 256 | 256 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| I am often distracted when using technology for learning, as lessons with technology lack innovation | Correlation Coefficient | .298** | .162** | .141* | .202** | .181** | 0,120 | 0,073 | .161** | 0,044 | 0,074 | .143* | 0,047 | 0,043 | 0,043 | 0,019 |
| | Sig. (2-tailed) | 0,000 | 0,009 | 0,024 | 0,001 | 0,004 | 0,055 | 0,243 | 0,010 | 0,483 | 0,243 | 0,023 | 0,455 | 0,495 | 0,494 | 0,765 |
| | N | 255 | 256 | 256 | 256 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| because I cannot afford the technology for online courses | Correlation Coefficient | .333** | .188** | .190** | .189** | .153* | 0,074 | .231** | .169** | 0,055 | 0,120 | 0,067 | -0,014 | 0,041 | 0,009 | 0,038 |
| | Sig. (2-tailed) | 0,000 | 0,003 | 0,002 | 0,002 | 0,014 | 0,238 | 0,000 | 0,007 | 0,380 | 0,057 | 0,289 | 0,820 | 0,516 | 0,882 | 0,548 |
| | N | 255 | 256 | 256 | 256 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| because of insufficient time to study | Correlation Coefficient | .257** | .153* | .131* | .152* | .181** | 0,114 | 0,084 | .134* | -0,064 | .180** | 0,112 | 0,058 | 0,040 | -0,010 | 0,011 |
| | Sig. (2-tailed) | 0,000 | 0,014 | 0,037 | 0,015 | 0,004 | 0,069 | 0,180 | 0,032 | 0,312 | 0,004 | 0,078 | 0,363 | 0,525 | 0,871 | 0,868 |
| | N | 255 | 256 | 256 | 256 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| because of lack of experience in online learning | Correlation Coefficient | .360** | .229** | .231** | .320** | .210** | .207** | .222** | .169** | 0,041 | .189** | 0,119 | 0,003 | 0,101 | 0,073 | 0,035 |
| | Sig. (2-tailed) | 0,000 | 0,000 | 0,000 | 0,000 | 0,001 | 0,001 | 0,000 | 0,007 | 0,517 | 0,003 | 0,060 | 0,961 | 0,111 | 0,250 | 0,583 |
| | N | 255 | 256 | 256 | 256 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| E-learning takes up more of my time as I need to retrieve information from the LMS | Correlation Coefficient | .305** | .147* | .217** | .147* | .128* | .193** | .220** | .186** | .145* | 0,081 | .139* | 0,055 | 0,008 | 0,019 | 0,019 |
| | Sig. (2-tailed) | 0,000 | 0,018 | 0,000 | 0,018 | 0,042 | 0,002 | 0,000 | 0,003 | 0,021 | 0,201 | 0,028 | 0,381 | 0,895 | 0,763 | 0,768 |
| | N | 255 | 256 | 256 | 256 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| I do not have the time to engage in live e-learnings sessions due to family and work commitments | Correlation Coefficient | .341** | .244** | .167** | .151* | .185** | .177** | .218** | .180** | 0,051 | 0,120 | .132* | 0,038 | 0,006 | 0,006 | 0,011 |
| | Sig. (2-tailed) | 0,000 | 0,000 | 0,008 | 0,015 | 0,003 | 0,005 | 0,000 | 0,004 | 0,420 | 0,058 | 0,036 | 0,545 | 0,924 | 0,930 | 0,857 |
| | N | 255 | 256 | 256 | 256 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| With e-learning, I do not get to interact personally with my peers | Correlation Coefficient | .219** | .205** | .158* | .177** | .124* | 0,101 | .255** | .186** | 0,096 | .170** | .161* | .210** | 0,108 | 0,101 | .157* |
| | Sig. (2-tailed) | 0,000 | 0,001 | 0,011 | 0,005 | 0,049 | 0,108 | 0,000 | 0,003 | 0,126 | 0,007 | 0,011 | 0,001 | 0,089 | 0,110 | 0,013 |
| | N | 255 | 256 | 256 | 256 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| With e-learning, I do not get to interact personally with my lecturers | Correlation Coefficient | .229** | .207** | .230** | .299** | .166** | 0,079 | .139* | 0,103 | 0,050 | .158* | .135* | .126* | 0,109 | 0,011 | 0,004 |
| | Sig. (2-tailed) | 0,000 | 0,001 | 0,000 | 0,000 | 0,008 | 0,206 | 0,027 | 0,102 | 0,423 | 0,012 | 0,033 | 0,046 | 0,083 | 0,861 | 0,946 |
| | N | 255 | 256 | 256 | 256 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| I find it difficult to engage with e- learning material as it is not interactive | Correlation Coefficient | .367** | .318** | .292** | .303** | .247** | .235** | .269** | .216** | 0,121 | 0,108 | .142* | 0,061 | 0,039 | -0,002 | 0,003 |
| | Sig. (2-tailed) | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,001 | 0,055 | 0,089 | 0,025 | 0,336 | 0,539 | 0,973 | 0,957 |
| | N | 255 | 256 | 256 | 256 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| E-learning is concerned with digital learning material only, and does not provide me with interactive learning activities. | Correlation Coefficient | .348** | .336** | .336** | .374** | .254** | .338** | .416** | .297** | .224** | .127* | .190** | .154* | .144* | 0,094 | 0,060 |
| | Sig. (2-tailed) | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,044 | 0,002 | 0,015 | 0,022 | 0,138 | 0,347 |
| | N | 255 | 256 | 256 | 256 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| E-learning does not provide me with the opportunity to problem solve with my peers | Correlation Coefficient | .285** | .300** | .273** | .312** | .281** | .248** | .301** | .250** | .179** | 0,095 | .160* | .233** | 0,105 | 0,038 | 0,074 |
| | Sig. (2-tailed) | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,004 | 0,133 | 0,011 | 0,000 | 0,096 | 0,544 | 0,242 |
| | N | 255 | 256 | 256 | 256 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| e-learning does not give me the opportunity to interact with my fellow students and lecturers | Correlation Coefficient | .255** | .311** | .308** | .295** | .189** | .132* | .240** | .130* | .156* | .148* | 0,115 | .129* | 0,068 | -0,038 | 0,067 |
| | Sig. (2-tailed) | 0,000 | 0,000 | 0,000 | 0,000 | 0,002 | 0,035 | 0,000 | 0,038 | 0,013 | 0,019 | 0,069 | 0,040 | 0,281 | 0,553 | 0,289 |
| | N | 255 | 256 | 256 | 256 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| e-learning does not give me the opportunity to get feedback immediately from my lecturers | Correlation Coefficient | .177** | .320** | .304** | .326** | .170** | .231** | .212** | .166** | 0,047 | .154* | .181** | .207** | .149* | 0,061 | .161* |
| | Sig. (2-tailed) | 0,005 | 0,000 | 0,000 | 0,000 | 0,006 | 0,000 | 0,001 | 0,008 | 0,456 | 0,015 | 0,004 | 0,001 | 0,018 | 0,333 | 0,011 |
| | N | 255 | 256 | 256 | 256 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| e-learning does not allow me to express my thoughts and ideas | Correlation Coefficient | .240** | .369** | .351** | .403** | .259** | .261** | .273** | .213** | .172** | 0,093 | .170** | 0,115 | 0,054 | -0,033 | 0,035 |
| | Sig. (2-tailed) | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,001 | 0,006 | 0,142 | 0,007 | 0,069 | 0,393 | 0,607 | 0,581 |
| | N | 255 | 256 | 256 | 256 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| I cannot afford technological devices to study via e-learning | Correlation Coefficient | .307** | .175** | 0,121 | .137* | .217** | .161** | .273** | .160* | 0,072 | .199** | 0,085 | 0,066 | 0,084 | 0,059 | -0,002 |
| | Sig. (2-tailed) | 0,000 | 0,005 | 0,053 | 0,028 | 0,000 | 0,010 | 0,000 | 0,010 | 0,253 | 0,002 | 0,180 | 0,297 | 0,186 | 0,351 | 0,978 |
| | N | 255 | 256 | 256 | 256 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| There are poor computer facilities in my institution for e-learning purposes | Correlation Coefficient | .223** | .350** | .269** | .196** | .287** | .191** | .293** | .252** | .154* | 0,056 | 0,078 | -0,068 | -0,113 | -0,055 | -0,076 |
| | Sig. (2-tailed) | 0,000 | 0,000 | 0,000 | 0,002 | 0,000 | 0,002 | 0,000 | 0,000 | 0,014 | 0,374 | 0,217 | 0,286 | 0,074 | 0,386 | 0,232 |
| | N | 255 | 256 | 256 | 256 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| There is poor network connectivity in my institution for e-learning | Correlation Coefficient | .162** | .192** | .242** | .218** | .241** | .168** | .207** | .201** | .164** | 0,030 | 0,071 | 0,076 | -0,020 | 0,002 | 0,093 |
| | Sig. (2-tailed) | 0,010 | 0,002 | 0,000 | 0,000 | 0,000 | 0,007 | 0,001 | 0,001 | 0,009 | 0,636 | 0,265 | 0,229 | 0,757 | 0,972 | 0,140 |
| | N | 255 | 256 | 256 | 256 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| There is poor Wi-Fi access in my institution for e-learning purposes. | Correlation Coefficient | 0,045 | .202** | .195** | .160* | .143* | .189** | .215** | .188** | .155* | 0,032 | .147* | 0,058 | -0,013 | 0,047 | .221** |
| | Sig. (2-tailed) | 0,474 | 0,001 | 0,002 | 0,010 | 0,022 | 0,002 | 0,001 | 0,003 | 0,013 | 0,619 | 0,020 | 0,356 | 0,842 | 0,461 | 0,000 |
| | N | 255 | 256 | 256 | 256 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| E-learning proves difficult as I do not have the appropriate technological skills | Correlation Coefficient | .502** | 0,107 | 0,107 | .158* | .166** | .133* | .213** | 0,062 | -0,081 | .211** | 0,025 | 0,021 | 0,017 | 0,062 | -0,068 |
| | Sig. (2-tailed) | 0,000 | 0,086 | 0,088 | 0,012 | 0,008 | 0,033 | 0,001 | 0,322 | 0,196 | 0,001 | 0,697 | 0,739 | 0,792 | 0,328 | 0,284 |
| | N | 255 | 256 | 256 | 256 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| I am afraid to use technology for learning as I find it difficult to access course material or prepare for online assessments | Correlation Coefficient | .454** | .198** | .261** | .304** | .291** | .271** | .278** | .260** | .170** | 0,088 | 0,073 | 0,078 | 0,005 | 0,017 | -0,112 |
| | Sig. (2-tailed) | 0,000 | 0,001 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,006 | 0,162 | 0,252 | 0,218 | 0,940 | 0,790 | 0,076 |
| | N | 255 | 256 | 256 | 256 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| Technology moves too rapidly and I cannot keep up with the advancements | Correlation Coefficient | .469** | .175** | .167** | .216** | .161* | 0,104 | .191** | 0,074 | -0,029 | 0,107 | -0,003 | -0,017 | -0,071 | -0,103 | -.196** |
| | Sig. (2-tailed) | 0,000 | 0,005 | 0,007 | 0,000 | 0,010 | 0,096 | 0,002 | 0,237 | 0,641 | 0,089 | 0,957 | 0,786 | 0,260 | 0,102 | 0,002 |
| | N | 255 | 256 | 256 | 256 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| I lack the confidence to use technological equipment to engage in online learning | Correlation Coefficient | .442** | 0,105 | .167** | .146* | .259** | .251** | .249** | .219** | .146* | 0,059 | 0,051 | 0,026 | -0,063 | -0,022 | -.152* |
| | Sig. (2-tailed) | 0,000 | 0,094 | 0,007 | 0,020 | 0,000 | 0,000 | 0,000 | 0,000 | 0,019 | 0,352 | 0,424 | 0,677 | 0,321 | 0,730 | 0,016 |
| | N | 255 | 256 | 256 | 256 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| Submitting my work via e-learning is risky as my work could be lost | Correlation Coefficient | .436** | .243** | .219** | .165** | 0,077 | 0,092 | .207** | .190** | 0,087 | 0,094 | .205** | 0,119 | 0,033 | 0,124 | 0,088 |
| | Sig. (2-tailed) | 0,000 | 0,000 | 0,000 | 0,008 | 0,223 | 0,142 | 0,001 | 0,002 | 0,165 | 0,139 | 0,001 | 0,060 | 0,600 | 0,051 | 0,164 |
| | N | 255 | 255 | 255 | 255 | 254 | 254 | 254 | 254 | 254 | 250 | 250 | 250 | 250 | 250 | 250 |
| Submitting my work via e-learning is risky as sensitive information could be disclosed | Correlation Coefficient | .448** | .326** | .253** | .265** | 0,065 | 0,087 | .236** | .234** | 0,100 | 0,067 | .202** | 0,062 | 0,099 | 0,110 | 0,102 |
| | Sig. (2-tailed) | 0,000 | 0,000 | 0,000 | 0,000 | 0,306 | 0,165 | 0,000 | 0,000 | 0,110 | 0,291 | 0,001 | 0,330 | 0,119 | 0,084 | 0,108 |
| | N | 255 | 255 | 255 | 255 | 254 | 254 | 254 | 254 | 254 | 250 | 250 | 250 | 250 | 250 | 250 |
| The quality of the e-learning system in my institution is not adequate to meet my educational needs | Correlation Coefficient | .339** | .411** | .445** | .500** | .249** | .289** | .291** | .319** | .163** | 0,064 | 0,061 | -0,046 | -0,051 | -0,113 | -0,049 |
| | Sig. (2-tailed) | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,009 | 0,312 | 0,340 | 0,472 | 0,419 | 0,075 | 0,438 |
| | N | 255 | 255 | 255 | 255 | 254 | 254 | 254 | 254 | 254 | 250 | 250 | 250 | 250 | 250 | 250 |
| I spend more time learning how to use the software rather than learning the contents | Correlation Coefficient | 1,000 | .328** | .305** | .292** | .263** | .234** | .306** | .320** | .135* | 0,111 | 0,114 | -0,016 | 0,023 | 0,050 | -0,038 |
| | Sig. (2-tailed) | | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,031 | 0,080 | 0,071 | 0,798 | 0,721 | 0,436 | 0,551 |
| | N | 255 | 255 | 255 | 255 | 254 | 254 | 254 | 254 | 254 | 250 | 250 | 250 | 250 | 250 | 250 |
| My lecturers do not integrate technology into the curriculum adequately | Correlation Coefficient | .328** | 1,000 | .653** | .616** | .265** | .320** | .351** | .283** | .220** | .125* | .127* | -0,008 | 0,085 | -0,039 | 0,079 |
| | Sig. (2-tailed) | 0,000 | | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,047 | 0,044 | 0,900 | 0,178 | 0,543 | 0,213 |
| | N | 255 | 256 | 256 | 256 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| My lecturers do not plan and prepare learning activities with technology adequately | Correlation Coefficient | .305** | .653** | 1,000 | .689** | .319** | .418** | .370** | .287** | .342** | 0,046 | .124* | -0,052 | 0,039 | -0,016 | 0,011 |
| | Sig. (2-tailed) | 0,000 | 0,000 | | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,463 | 0,050 | 0,409 | 0,542 | 0,803 | 0,857 |
| | N | 255 | 256 | 256 | 256 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| My lecturers do not consider learning enhancement and student engagement when incorporating technology into the curriculum | Correlation Coefficient | .292** | .616** | .689** | 1,000 | .321** | .417** | .323** | .250** | .197** | 0,015 | 0,086 | -0,053 | 0,063 | -0,036 | -0,039 |
| | Sig. (2-tailed) | 0,000 | 0,000 | 0,000 | | 0,000 | 0,000 | 0,000 | 0,000 | 0,002 | 0,815 | 0,176 | 0,407 | 0,318 | 0,575 | 0,543 |
| | N | 255 | 256 | 256 | 256 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| The institution does not provide training and workshops to enable my use of e-learning | Correlation Coefficient | .263** | .265** | .319** | .321** | 1,000 | .662** | .449** | .392** | .313** | 0,052 | 0,043 | -0,043 | -0,045 | -0,017 | 0,013 |
| | Sig. (2-tailed) | 0,000 | 0,000 | 0,000 | 0,000 | | 0,000 | 0,000 | 0,000 | 0,000 | 0,412 | 0,502 | 0,502 | 0,480 | 0,783 | 0,837 |
| | N | 254 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| The institution does not provide orientation courses for e-learning, to improve understanding of course material | Correlation Coefficient | .234** | .320** | .418** | .417** | .662** | 1,000 | .539** | .465** | .361** | 0,052 | .172** | -0,057 | 0,013 | 0,007 | 0,041 |
| | Sig. (2-tailed) | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | | 0,000 | 0,000 | 0,000 | 0,415 | 0,006 | 0,369 | 0,840 | 0,915 | 0,519 |
| | N | 254 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| My institution does not provide adequate online technical support for my e-learning activities. | Correlation Coefficient | .306** | .351** | .370** | .323** | .449** | .539** | 1,000 | .573** | .439** | 0,076 | .210** | 0,062 | 0,023 | 0,020 | 0,110 |
| | Sig. (2-tailed) | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | | 0,000 | 0,000 | 0,228 | 0,001 | 0,330 | 0,718 | 0,758 | 0,083 |
| | N | 254 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| My institution does not provide a reliable LMS (Learning Management System) | Correlation Coefficient | .320** | .283** | .287** | .250** | .392** | .465** | .573** | 1,000 | .535** | 0,015 | .159* | -0,045 | -0,037 | 0,024 | 0,072 |
| | Sig. (2-tailed) | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | | 0,000 | 0,813 | 0,012 | 0,474 | 0,555 | 0,708 | 0,256 |
| | N | 254 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| My institution does not provide a Help Desk for technical support (phone/email/chat) | Correlation Coefficient | .135* | .220** | .342** | .197** | .313** | .361** | .439** | .535** | 1,000 | -0,082 | 0,041 | -0,069 | -0,095 | -0,098 | -0,013 |
| | Sig. (2-tailed) | 0,031 | 0,000 | 0,000 | 0,002 | 0,000 | 0,000 | 0,000 | 0,000 | | 0,196 | 0,520 | 0,274 | 0,134 | 0,120 | 0,843 |
| | N | 254 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 251 | 251 | 251 | 251 | 251 | 251 |
| In classes with large groups, tools such as social networking, micro blogging, other applications should be made available | Correlation Coefficient | 0,111 | .125* | 0,046 | 0,015 | 0,052 | 0,052 | 0,076 | 0,015 | -0,082 | 1,000 | .378** | .339** | .390** | .277** | .302** |
| | Sig. (2-tailed) | 0,080 | 0,047 | 0,463 | 0,815 | 0,412 | 0,415 | 0,228 | 0,813 | 0,196 | | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| | N | 250 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 |
| Learning will be more interactive if lecturers deliver online courses via social media, lecture recordings, online educational games and other similar technologies | Correlation Coefficient | 0,114 | .127* | .124* | 0,086 | 0,043 | .172** | .210** | .159* | 0,041 | .378** | 1,000 | .384** | .389** | .341** | .378** |
| | Sig. (2-tailed) | 0,071 | 0,044 | 0,050 | 0,176 | 0,502 | 0,006 | 0,001 | 0,012 | 0,520 | 0,000 | | 0,000 | 0,000 | 0,000 | 0,000 |
| | N | 250 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 |
| The feelings of isolation in online classes can be overcome by online peer tutoring, discussion boards and group video conferences | Correlation Coefficient | -0,016 | -0,008 | -0,052 | -0,053 | -0,043 | -0,057 | 0,062 | -0,045 | -0,069 | .339** | .384** | 1,000 | .633** | .481** | .451** |
| | Sig. (2-tailed) | 0,798 | 0,900 | 0,409 | 0,407 | 0,502 | 0,369 | 0,330 | 0,474 | 0,274 | 0,000 | 0,000 | | 0,000 | 0,000 | 0,000 |
| | N | 250 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 |
| Having online access to remote tutors will assist in my studies via e-learning | Correlation Coefficient | 0,023 | 0,085 | 0,039 | 0,063 | -0,045 | 0,013 | 0,023 | -0,037 | -0,095 | .390** | .389** | .633** | 1,000 | .576** | .538** |
| | Sig. (2-tailed) | 0,721 | 0,178 | 0,542 | 0,318 | 0,480 | 0,840 | 0,718 | 0,555 | 0,134 | 0,000 | 0,000 | 0,000 | | 0,000 | 0,000 |
| | N | 250 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 |
| Training programmes and orientation will improve pass rates in the e-learning environment | Correlation Coefficient | 0,050 | -0,039 | -0,016 | -0,036 | -0,017 | 0,007 | 0,020 | 0,024 | -0,098 | .277** | .341** | .481** | .576** | 1,000 | .613** |
| | Sig. (2-tailed) | 0,436 | 0,543 | 0,803 | 0,575 | 0,783 | 0,915 | 0,758 | 0,708 | 0,120 | 0,000 | 0,000 | 0,000 | 0,000 | | 0,000 |
| | N | 250 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 |
| Flexible online technical support is important for a user-friendly environment for e-learning success | Correlation Coefficient | -0,038 | 0,079 | 0,011 | -0,039 | 0,013 | 0,041 | 0,110 | 0,072 | -0,013 | .302** | .378** | .451** | .538** | .613** | 1,000 |
| | Sig. (2-tailed) | 0,551 | 0,213 | 0,857 | 0,543 | 0,837 | 0,519 | 0,083 | 0,256 | 0,843 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | |
| | N | 250 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 | 251 |

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).