Cape Peninsula University of Technology

A VIRTUAL REALITY LEARNING FRAMEWORK FOR IMPROVING STUDENT ENGAGEMENT AT A SELECTED TERTIARY INSTITUTION, CAPE TOWN, SOUTH AFRICA

By

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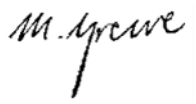
I, Martha Hendrika (Maritsa) Grewe declare that the contents of this thesis represent my own unaided work, and that the thesis has not previously been submitted for academic examination towards any qualification. Furthermore, it represents my own opinions and not necessarily those of the Cape Peninsula University of Technology.



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ABSTRACT

The use of virtual reality (VR) in education has attracted the interest of Higher Education Institutions (HEIs) and introduced the opportunity for a renewed method of teaching and learning. Furthermore, the advancement of VR has enabled academics to create immersive experiences themselves and observe how students become more engaged in their learning as a result thereof.

The research problem states that due to a lack of using emerging technology such as VR in teaching and learning, a decrease in student engagement levels is noted. As a result, a drop in pass rates was also noted at a selected tertiary institution in Cape Town, South Africa (University X). The research questions focused on the extent to which VR technology can be incorporated into teaching and learning to improve the level of Human Resources (HR) student engagement and pass rates. Further research questions focused on the relevance of current teaching and learning methods used by University X and their academic staff's preparedness to utilise VR.

This study investigated the impact of a VR-learning framework on HR student engagement at University X. A VR-learning platform was deployed to facilitate immersive learning experiences for higher education students.

A qualitative research methodology was adopted, utilising descriptive case study design. A purposive sampling technique was employed to select 38 participants from various groups, including 20 HR students, 15 academics, and three VR specialists. Data were collected using open-ended questionnaires, semi-structured interviews, and a true experiment. The independent variable, *virtual reality*, was introduced to the experimental group but not to the control group. The effects of the independent variable were then compared for two groups (a control and experimental group) to determine the difference (if any) in student engagement levels and pass rates.

The study introduced a new VR-learning framework (to be embedded into teaching, learning, and assessments) towards enhancing student/learner engagement. The VR-learning framework will support HR students with developing their South African Board of People Practices (SABPP) competencies of *citizenship for the future: innovation, technology, sustainability*.

The study found that the VR-learning framework has a positive impact on student engagement, leading to improved pass rates. The study further contributes to the growing body of Human

Resource Management research on the use of VR in higher education (HE) and provides practical recommendations for the implementation of VR-learning frameworks in HEIs.

The new VR-learning framework has the potential to revolutionise traditional learning practices with immersed VR-learning experiences. The study findings highlight a substantial increase of 180% in the engagement levels of students who learn through VR. As a result, a 23% higher pass rate in students studying through VR was noted. Additionally, teaching in VR was found to be 40% faster than distance learning online.

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DEDICATION

I dedicate this thesis to my two beautiful, energetic, and loving sons.

My parents, thank you for ‘forcing’ me to complete by continuously asking me to provide you with an update on how far I am with my studies. I am forever thankful.

To my brother, you remain an inspiration.

And to my forever person, thank you for believing in me.

I love you, all.

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ABBREVIATIONS

CHE	Council on Higher Education
DLO	Distance Learning Online
HE	Higher Education
HEIs	Higher Education Institutions
SABPP	South African Board of People Practices
VR	Virtual Reality

CHAPTER 1: INTRODUCTION AND BACKGROUND TO THE RESEARCH STUDY

1.1 Introduction and background of the research

South Africa is at the tipping point of having to prepare to adapt to a new teaching philosophy. The National Development Plan for South Africa's vision for 2030 places significant emphasis on high-quality education in HEIs (Brand South Africa, 2014) and describes the challenges faced by the educational environment.

Challenges such as policies to widen access to higher education (HE) have led to an influx of students and as a result, HEIs have been witnessed to the increasing number of dropout rates and poor overall pass rates (Meyer, 2014:7). The South African Minister of Higher Education and Training, Dr Blade Nzimande, has alerted to this fact and raised his concerns about the high dropout rate and poor pass rates among students. It has been found that between 50% and 60% of students will drop out during their first year of studies (Dyomfana, 2022:1). HEIs are criticised for their low throughput rates (Meyer, 2014:7).

As HEIs are increasingly urged by government to improve their quality of teaching and learning and enrol more students, the importance of student engagement and the unique role it plays in the students' learning journey are often neglected. Dropout rates and throughput rates are empirically linked to student engagement (Parsons & Taylor, 2011:6; Schreiber & Yu, 2016:158). Literature confirms that because of disengage students, HEIs experience high dropout rates and throughput rates. Student engagement reflects on the student's participation during teaching and learning and can include how connected students are with their institution (Meyer, 2014:37). By understanding the phenomenon of a student's engagement during teaching and learning, HEIS can build on reducing dropout rates and improve student pass rates. Steps should be taken to reduce dropout rates and improve student pass rates.

The Education and Training Quality Assurance (ETQA) body for human resource learning provision, and the South African Board for People Practices (SABPP), which is recognised by the South African Qualifications Authority (SAQA) as an HR professional body, developed the SABPP Human Resource (HR) Competency Model to set the benchmark for HR professionalism (Gie, 2021:54). This model provides a reference point for continuous professional development (CPD), specifying five core competencies that should be included in all HR learning programmes not only to develop HR professionals, but also to improve student engagement, academic success, and employability. One of these core competencies is described as "citizenship for future: innovation, technology and sustainability" (Meyer,

2012:23-24). This competency refers to the ability of HR students or practitioners to think critically and creatively about how innovation and technology can be used to promote sustainability and address environmental challenges. This competency emphasises that HR students and professionals must have a sound knowledge of Human Resource Management so that these students can become strategic HR partners within an organisation (SABPP, 2022:1). Developing this competency requires HR students and practitioners to engage with real-world issues related to sustainability and technology and working collaboratively to develop innovative solutions. As part of fostering innovation, technology, and sustainability within the HR profession, this study focuses on the role virtual reality (VR) learning can play in increasing student engagement.

In literature, student engagement is associated with three dimensions, namely behavioural, cognitive, and emotional engagement (Trowler, 2010:7), which are central focus points in this study. As HR students engage with VR, they are changing behaviourally, cognitively, and emotionally as a future HR practitioner. VR has a significant impact on the students' behavioural, cognitive, and emotional development as future HR practitioners. Chipchase et al. (2017:3) inform the study that disengagement in students is affecting students' cognitive development and is thus a predictor of students dropping out more likely. In the ongoing changing nature of teaching and learning in HE, understanding the dimensions of student engagement is crucial as it increases the potential for students to perform better in their studies. VR-learning therefore has the potential to play a transformative role in the teaching and learning of future HR students and practitioners.

The adoption of educational technologies (edtech), specifically virtual reality (VR), is equally important to the concept of student engagement in HEIs (Bardi, 2019:1). By deploying VR-learning, students may have the opportunity to engage with immersive and interactive learning experiences that go beyond traditional classroom-based learning. This may increase student motivation and engagement levels, and as a result thereof, improve pass rates.

Most HEIs start with VR gaming applications to assist with teaching and learning. A small number of institutions are moving from the purview of gaming to adopting VR as an educational tool (Kamińska et al., 2019:3). VR-learning is making great inroads into education (Marr, 2020:1), however to date, the adoption of VR in South Africa's HEIs has not been significant, even though the interest in VR-learning is growing. Internationally, through remote learning, VR-learning has been used successfully to increase student engagement in the last decade (Meyer, 2014:36), and therefore the interest of South African HEIs to explore the huge potential of VR-learning.

Not only are HEIs showing interest in integrating VR into their teaching and learning practices, but students also show a keen interest in this technology. As South African students become increasingly tech-savvy and accustomed to using digital tools and platforms in their daily lives, they may be more likely to embrace new technologies such as VR as part of their learning experience (Nxumalo, 2017:1).

As technology continues to advance and become more integrated into our daily lives, students are becoming increasingly interested in using technology to enhance their learning experience. This may include using digital tools and platforms to collaborate with peers, access online resources, and engage with interactive learning materials such as VR simulations.

Teaching and learning started with wooden paddles with printed lessons on in 1870 (Pearson & Foxon, 2012). Technology comprised a basic form of a slide projector, followed by the black chalkboard in 1890. In 1920, the radio ignited a brand-new method of learning; students started to listen to on-air classes being broadcast. In 1930, the overhead projector was introduced as a resource in classrooms, followed by videotapes in 1951 (ClassVR, 2018b:3). The first-ever handheld calculator was brought into classrooms in 1972. In recent years, most schools began introducing computer laboratories, e-learning, and the use of tablets in the classroom (Wade, 2018; Collins & Halverson, 2010). Johnes (2017) reports that laptops and tablets are being used the most for learning in the 21st century. Now, in the midst of the Fourth Industrial Revolution (Industry 4.0), emerging technologies such as VR receives more attention globally than ever before. It is predicted by a well-known futurist, Ray Kurzwell, that by 2030, “VR will be totally realistic and compelling, we will spend most of our time in virtual environments” (Kim, 2015:2). Students find it easier to adapt to changes, but unfortunately, HEIs are slow in embracing change. Kurzweil predicts that VR technology will become so realistic and immersive that people will choose to spend most of their time in virtual environments rather than in the physical world. This could have significant implications for the HR students in learning and interacting with each other (Kim, 2015:2).

Similar to the evolution of teaching and learning practices in education, trends in human resource development (HRD) have also changed rapidly, thus bringing traditional training under threat (Erasmus & Loedolff, 2019). In the field of HRD, traditional training methods are increasingly challenged by new technologies and approaches that offer more innovative and engaging ways to learn new insights and develop new skills. As learning and development practices change, the level of learner engagement becomes a critical factor. As a result, a snowball effect is created by low engagement levels at HEIs, and this can affect the way these students one day present themselves as HR practitioners in the workplace. The key goal of learning is to get students to engage with the course material.

As students become disengaged from traditional learning in academic programmes offered by HEIs, similarly, workplace learners could become disengaged from traditional learning in organisational learning programmes offered by HRD facilitators or training providers. This could be attributed to HRD facilitators or training providers continuing with the traditional learning styles they experienced as students, seldom changing their learning and development approach in how they engage with their learners. In keeping with the SABPP HR competency, *citizenship for future: innovation, technology and sustainability,* HR students need to become familiar with new technological teaching and learning styles during their HE studies and experience higher student engagement levels to be ready and adaptable for when they become HR practitioners, HRD facilitators, or training providers.

This research places emphasis on teaching and learning practices in higher education (HE), which could be transferred to training and development or learning and development practices via HRD/learning and development programmes/occupational skills programmes offered by organisations that require registration with the Quality Council of Trades and Occupation (QCTO). For regulatory purposes, the Council on Higher Education (CHE) programme accreditation criteria were contextualised in this study, as the student research participants were registered with an HEI at the time of this study and their qualification was pitched at National Qualification Framework (NQF) level 5. In addition, the QCTO was included for future VR-learning transference into occupational skills programmes.

In practice, HR students who engage with emerging technologies (such as VR-learning) as part of their tertiary education and professional development are more prone to engage with emerging technologies in their own practices as HR professional practitioner. VR assists HR students to increase their student engagement during their HR studies (embedded into the HR curriculum) while influencing their future HRD practices in learning and development.

Academia in HEIs need to be determined to embrace emerging technologies in order to address the challenges identified in the National Development Plan for 2030. To adequately prepare students for the future world of work, it is important for academia to accept, adopt and support emerging technologies (Wu et al., 2013:42; Alhija, 2017:1)

The SABPP's strategic vision to culminate "citizenship for future: innovation, technology and sustainability" supports the need of HEIs to prepare themselves to become enablers of VR-learning in the HR curriculum. VR holds many benefits for both lecturers and students, but specifically for the users (i.e., the students after graduation), as they are being developed as future citizens in a digital knowledge economy, which relates to the SABPP HR Competency Model. HR practitioners need to know the future is already presenting itself, confronting HEIs and HR students with the opportunities to use VR in teaching and learning. The SABPP HR

Competency Model anchors itself significantly in Industry 4.0, particularly in terms of the effect and impact that emerging technologies such as VR have on the new world of work (Jivan, 2021:3-6).

1.2 Research problem statement

South Africa's HEIs have been rated 77th out of 138 countries in the World Economic Forum's 2016–17 Global Competitiveness Report. Although the value of the rating scores 4.2 out of 7, it still calls for decisive action to be taken. Cloete (2015:1) supports this notion and states that "recent research shows that South Africa's current HE system can be described as medium knowledge producing and differentiated, with low participant and high attrition".

In addition, research conducted by the Council on Higher Education (CHE, 2018) reports that only one in four students in public HEIs (excluding UNISA) graduate within the allocated duration of the qualification. The CHE (2018) stresses that improving the student experience in HE is critical for South Africa's educational challenges (Strydom & Mentz, 2010:3). Apart from adopting online learning as a result of COVID-19, very little engagement with other edtech tools have occurred over the past years in teaching and learning. A further complication is that South Africa's HEIs (and the academic staff members) have not positioned themselves to engage with emerging technology such as VR.

It is noticeable that students today learn differently than students from the previous generation, making use of smart boards, laptops, and other digital devices. Therefore, it is important that lecturers refrain from using tiresome black and white textbooks (4-traders.com, 2018). Mainly because of the coronavirus pandemic which started in 2019, HEIs began to use an online or hybrid approach to learning (Landa et al., 2021). A study conducted in 2023, which analysed the students' preference and behaviours to e-learning or face-to-face learning, found that a complete return to fully fledged face-to-face learning may no longer be entirely possible, depending on the subject being taught. HEIs now prefer a more blended (or hybrid) learning approach. Although online learning has been in existence for several years in the private HEI (hereafter referred to as University X) selected for this study HRD practitioners have been reluctant to choose online learning as a means of learning. Following the pandemic, this has however changed to such a degree that most of the University X's corporate training is now done via online learning (Venter, 2023). HR practitioners are much more inclined to adapt to online learning or a blended approach to learning, which speaks to the significant transformation organisations had to concur following the coronavirus pandemic (Shahriar et al., 2021).

Innovation is a key factor that opens the door for the implementation of emerging technologies such as VR-learning. As the landscape of HRD continues to evolve, new technologies emerge

with the potential to transform teaching and learning. Making education relevant in the 21st century is a complex but important pursuit. HEIs will undoubtedly play an exceptional role in student engagement. As mentioned previously, if the use of VR-learning is not implemented by 2030, South Africa's education world ranking can be among the lowest in the world (National Planning Commission, 2018:3). Through VR it is possible to address the needs of theocratical thinking, reasoning, creativity, problem solving, collaboration, communication, and global citizenship as a skillset needed for the 21st century. The SABPP HR Competency Model includes a competency called "citizenship for the future", which emphasises the importance of HR professionals being aware of and responsive to global issues and trends. This includes understanding the impact of globalisation in the workplace, as well as the role HR can play in promoting social responsibility, sustainability, and ethical practices (SABPP, 2022:1).

Based on the problems identified in HE, this study interrogates students studying towards an HR qualification at University X. The study focuses on students pursuing an HR qualification, whose pass rates have revealed a downward trend over the last three years (2018–2020). The study engages with appropriate academic sources that indicate a correlation between poor pass rates and low student engagement. This trend is concerning, given that HR students are expected to uphold the practices promoted by the HR professional body, SABPP.

1.2.1 Main problem statement

Due to a lack of using VR technology in teaching and learning, the level of HR student engagement has decreased over the last three years (2018–2020) at University X, Cape Town, South Africa.

1.2.2 Sub-problem statement 1

Due to the main problem, HR students' pass rates dropped by 15% over the last three years (2018–2020) at University X, Cape Town, South Africa.

1.2.3 Sub-problem statement 2

Due to the main problem, the current teaching and learning methods of instruction over the last three years (2018–2020) have plateaued at University X, Cape Town, South Africa.

1.2.4 Sub-problem statement 3

Due to the main problem, academic staff have not been equipped to use VR technology in their teaching and learning practices over the last three years (2018–2020) at University X, Cape Town, South Africa.

1.3 Key questions pertaining to the research study

The key questions formulated to address the main and sub-problems of this research are as follows:

1. To what extent can VR technology be incorporated into teaching and learning to improve HR students' **level of engagement**?
2. To what extent can VR technology in teaching and learning increase HR students' **pass rates?**
3. What is the **relevance of current teaching and learning** methods of instruction in terms of engaging with HR students?
4. To what extent are **academic staff prepared** to use VR technology in their teaching and learning practices?
5. How can VR-learning be incorporated into the **HR curriculum** that are acceptable to regulatory bodies?
6. What **recommendations** can be proposed to the selected HEI in adopting VR-learning in teaching and learning practices to improve HR student engagement?

1.4 Research objectives

As a result of the HR student-related problems identified in the problem statement, it is proposed that University X implement VR-learning to increase HR student engagement. With a specific focus on students studying HR, the study could embed VR-learning into the HR curriculum and thus contribute towards developing the SABPP HR competency, *citizenship for the future,* to promote enhanced HR development/learning and development interventions in the future. The following research objectives were set to address the research problems:

1. To investigate the extent to which incorporating VR technology into teaching and learning **improve HR students' level of engagement**.
2. To determine the extent that VR technology in teaching and learning increased HR **students' pass rates**.
3. To investigate the relevance of **current teaching and learning methods** of instruction in terms of engaging with HR students.
4. To determine the extent to which **academic staff have been capacitated** to use VR-learning in their teaching and learning practices.
5. To develop a VR-learning **framework** that complies with regulatory bodies' criteria.
6. To propose recommendations for the **adoption of VR-learning** in teaching and learning at University X, Cape Town, South Africa.

The study aims to develop a VR-learning framework for University X to use VR in their teaching and learning practices to ultimately improve HR students' engagement.

1.5 Delimitation of the study

This research study is limited to a private HEI in the Western Cape, South Africa, where distance learning online is the mode of delivery. The research includes students who were enrolled for the National Diploma in Human Resource Management during the period 2018 to 2020 at the selected private HEI. It further included academic staff members and VR specialists.

1.6 Research practices

For this social science research study an **interpretivist paradigm** was adopted as the researcher relied on dialog between the participants to deduce a meaningful understanding of the subjects. Babbie and Mouton (2001:28, cited in De Vos et al., 2011:8) explain that the interpretive approach is also called the phenomenological approach, which relates to hermeneutics. During the hermeneutic circle, the study could deduce a "complex whole from preconceptions about the meaning of its parts and their interrelationships" (Klein & Myers, 1999:67-93).

For this research, a **qualitative research** methodology was applied. A qualitative paradigm stems from the interpretivist paradigm and aims to understand the social science (De Vos et al., 2011:65).

The ontology (how the researcher saw the reality) and epistemology (how the researcher believed the social phenomena should be studied) assisted the researcher with choosing the **descriptive case study** research design.

The target **population** comprised of students who were (and some currently are still) registered for the National Diploma in Human Resource Management, studying via distance learning online at a University X. The registrations period was from 2018 to 2020. The population further included academics employed at University X and subject matter experts in the field of VR as well as an expert in regulatory affairs in South Africa.

Applying the interpretivist approach, the researcher used (i) open-ended questionnaires, (ii) semi-structured interviews, and a (iii) true experiment to collect the data.

A **random post-test-only control group design** was used for the experiment. Although the random post-test control group design is quantitative in nature, the study adopted this approach as the focus was still to gather descriptive data stemming from the experiment. De Vos et al. (2011:400) supported the study in this decision, stating that there is no single way to perform qualitative analysis because much depends on the purpose of the research.

It is on this basis that the outcome of the experiment was to deduce the difference in the dependent variable (*student engagement*) and the independent variable (*virtual reality*) from the controlled and experimental group of participants (De Vos et al., 2011:146). This enabled the researcher to measure the effectiveness of using VR technology/VR-learning in the control versus the experimental group, and thereafter to describe how VR-learning may increase HR student engagement and throughput rates. The true experiment has further allowed the study to investigate how the proposed VR-learning framework should comply with regulatory criteria in HE.

The study is underpinned by **ethical practices**. All participants were well-informed of the background of the research and how data would be collected. As part of the consent form, participants have been assured of their anonymity. In addition, the researcher signed a declaration stating that this study is her own work. Finally, ethical clearance has been obtained from the Cape Peninsula University of Technology (CPUT), where the researcher is a registered student.

After collecting the data, the study used **computer-assisted qualitative data analysis software (CAQDAS)**, named ATLAS.ti, to automate the data and present a more complex way of looking for relationships in the data and assist with developing conceptual and theoretical thinking about the data (Butler-Kisber, 2018:39).

The most used criterion for qualitative research are trustworthiness. Several criteria resort under trustworthiness, however, the best-known are credibility, transferability, dependability, confirmability, and reflexivity (Korstjens & Moser, 2018:120). It has been suggested that quantitative language should not be confused with quantitative language, therefore the use of the word ', would not be part of this section's discussion as it relates to quantitative research (Holloway & Wheeler, 1996, cited in Slevin & Sines, 2000:79).

1.7 Clarification of key concepts

For this research study, the following key concepts are clarified.

1.7.1 Curriculum

The Council on Higher Education (CHE, 2014:3) describes the term *curriculum* as "primarily [referring] to the formal curriculum, that is, the planned learning experiences that students are exposed to with a view to achieving desired outcomes in terms of knowledge, competencies and attributes".

The term *curriculum* encompasses:

- Knowledge, such as list of subjects, topics, and resources included in a course of study
- Ways of knowing, skills, values, and practices
- Teaching methodologies
- Assessment practices

1.7.2 The Council on Higher Education (CHE)

The Council on Higher Education (CHE), as the Quality Council for HE, is, among others, responsible for the quality assurance of the qualifications on its sub-framework, the Higher Education Qualifications Sub-Framework (HEQSF), which is governed and released by the Higher Education Quality Committee (HEQC) (CHE, 2023a).

1.7.3 Dropout rate

For this study, the term *dropout rate* refers to measuring the proportion of students who have not completed a module within a qualification and who are not enrolled at one point in time for any other modules within the qualification regardless of when they dropped out.

1.7.4 Educational technology (Edtech)

The term *edtech* refers to educational technology, which is the combined use of education and technology (Techterms, 2018).

1.7.5 National Qualifications Framework (NQF)

The CHE (2023b:3) describes the National Qualifications Framework (NQF) as a single integrated system comprising three elements:

- General and further education and training—this element incorporates schools and FET colleges
- Higher education—this element includes traditional universities and universities of technology
- Trades and occupations—this element involves workplace learning and skills development such as learnership

1.7.6 Pass rate

A pass rate is defined as the *number of test takers who pass* over the *number of test takers who attempt to do the exam*. It is designed to provide an indication of how many test takers ended up passing the exam across all the attempts they made to do the exam (Wyse et al., 2019).

1.7.7 Professional body

SAQA describes a professional body as “a body of expert practitioners in an occupation or profession resulting in learning in and for the workplace” (SAQA, 2023:1).

1.7.8 Programme accreditation

The CHE (2023a:1) describes programme accreditation as “the evaluation of HE academic programmes in accordance with the HEQC’s programme accreditation criteria, which stipulate the minimum requirements for programme input, process, output and impact, and review”.

1.7.9 Student engagement versus learner engagement

Although both terms (*student engagement* and *learner engagement*) refer to a degree of involvement and interest in a person’s own learning process, these terms can be used slightly different depending on the context and connotation. Parsons and Taylor (2011:6) explain “student engagement to be built around the hopeful goal of enhancing all students’ abilities to learn how to learn or to become lifelong learners in a knowledge-based society”. *Student engagement* often refers to students in a traditional classroom setting, whereas the term *learner engagement* has a broader connotation and is often linked to HRD where learning can take place in any learning environment. Within the organisation, learning can either be distance (self-directed) or online.

1.7.10 Virtual reality (VR)

Wenglinsky (2005:64) identifies VR as “an artificial environment that is created with software and presented to the user in such a way that the user suspends belief and accepts it as a real environment and are experienced through two of the five senses: sight and sound”.

1.8 Significance of the study

Deploying VR in the human resource (HR) field can contribute extensively to the HR body of knowledge in several ways:

i) Firstly, VR-learning can be utilised to create immersive HR learning programmes for students, enabling them to engage in realistic, yet immersive simulations of workplace scenarios. By analysing the data collected from these simulations, HR professionals in the organisation can identify skills gaps and develop targeted training and development programmes to address them.

ii) Secondly, VR-learning can further be used to create realistic simulations of job functions, enabling HR recruiters to assess employees’ job readiness and suitability. This can lead to more accurate candidate selection and improved recruitment outcomes.

iii) Finally, incorporating VR into the teaching and learning process can change the role of academic staff who lecture at an HEI, from a traditional, *teacher-centred approach*

to a more *learner-centred teaching approach* (ClassVR, 2018b:4). Academics employed at HEIs can benefit significantly from this study.

Recommendations on how to adapt a curriculum to include VR will be presented. Adapting a curriculum to the use of VR can help mitigate the challenge of students having to source organisations to conduct their workplace practicals.

Overall, this study will assist HR students in building their SABPP HR competency. It will do so by incorporating VR as a new learning and development tool, specifically targeting the future competencies of *citizenship for the future: innovation, technology, and sustainability*. This integration of VR into future HRD interventions within the organization will enable HR professionals to stay up-to-date with Industry 4.0 and its transition towards Society 5.0, emphasizing human-machine interaction in a super smart society.

The main HR doctoral contribution of this research is to create a VR-learning framework (to be embedded into teaching, learning and assessments) that will enhance HR student/learner engagement. The VR-learning framework will further support HR students to develop their SABPP competencies of *citizenship for the future: innovation, technology, sustainability*.

1.9 Summary and chapter outline

The study aims to develop a VR-learning framework for University X to use VR in their teaching and learning practices to ultimately improve HR students' engagement. The study therefore seeks to investigate the underlying causes of the low pass rates and high dropout rates by exploring how the new teaching philosophy can be implemented to increase pass rates and lower the dropout rate of HR students.

The research problem alludes to the fact that without a new framework that incorporates VR-learning into teaching and learning practices, University X will continue to see an increase in disengaged students with low pass rates. It is in the interest of HRD practitioners and HR professionals in the organisation to drive innovation, optimise technology, and contribute towards sustainability. The HRD practitioner's role is important to provide students with the opportunity to become future citizens who can practice the skills obtained during their studies.

This chapter provides the key questions and objectives pertaining to this research study. The researcher ensured that the research problem, questions, and objectives are all aligned.

To address the research problem, a qualitative interpretivist paradigm has been adopted. The study made use of three research instruments to collect the data. The descriptive data have been uploaded to ATLAS.ti for coding purposes. Themes related from the coding and data were organised according to patterns formed in the data analysis stage. The researcher

ensured that authenticity was evident throughout the study by being truthful to the qualitative data collected and by focusing specifically on the criteria of credibility, transferability, dependability, confirmability, and reflexivity.

Due to the volume of the content, the thesis comprises ten (10) chapters, categorised as follows:

Chapter 1 presents the research problem and explains the background of the study. This is followed by stating the research problem, research questions and research objectives. In addition, this chapter briefly describes the research methodology and processes used during the study, followed by the study's delimitations and key concepts pertaining to virtual reality and student engagement. The chapter concludes with the significance of this research and explains the contribution this study will make to the HR body of knowledge.

Chapter 2 investigates student engagement and the importance of adapting a new teaching methodology. The chapter describes the conceptual framework for student engagement and provides a brief description of the various types of student engagement. Equally important to note in this chapter are the factors that may influence student engagement.

Chapter 3 is the second literature chapter where the core instrumental tool in this research, VR, is discussed. As this technology is relatively new to the educational field, the chapter explains what VR is, the evolution thereof, and the advantages and disadvantages of using VR in education. The various types of hardware available are discussed to determine which VR hardware and software will be best suited for this study.

Chapter 4 explores the extent to which academic staff are prepared to use VR technology in their teaching and learning practices. The chapter commences with the status of VR in higher education. In addition, the chapter discusses the future role of academic staff. A relevant topic in this chapter is how the COVID-19 pandemic changed teaching and learning. This is followed by an in-depth look at the teacher-centred approach versus the learner-centred approach of teaching. Two learning models are discussed, namely Kolb's Experimental Model of Learning and the Honey and Mumford's Learning Model. in closing, the perspective of VR academia along with providing some advice on the successful deployment of VR in teaching and learning is discussed.

In the final literature review chapter (**Chapter 5**), the study explores literature focusing on how the current curriculum needs to be amended to incorporate the use of VR in teaching and learning.

Chapter 6 outlines the research methodology and design. The chapter presents an overview of the research approach, data collection methods, data analysis techniques, and sampling procedures, including other elements of the research process. Additionally, the chapter discussed ethical considerations and best practices for ensuring that the research is conducted in an ethical and responsible manner.

Chapter 7 presents the research results of the inductive qualitative research study using the ATLAS.ti software for data analysis. The study presents excerpts from the qualitative data to illustrate key themes or patterns that emerged from the data analysis.

In **Chapter 8**, the research results as it relates to 36 participants are discussed. Research outcomes are further presented using tables and figures to assist in the discussion of the implications of the findings. Finally, this chapter highlights the limitations of the research results and provides suggestions for further research in the field.

Chapter 9 includes recommendations to relevant stakeholders in HEIs on the use of VR within teaching and learning. Incorporated into the results is how tertiary intuitions will have to adapt their curricula and assessment plan to incorporate the use of VR in teaching and learning. A proposed model to incorporate VR in teaching and learning to increase student engagement is presented.

Finally, **chapter 10** concludes with a summary of the research outcomes achieved and indicates how the study contributes to the HR body of knowledge, specifically adding value to the SABPP HR competency: *citizenship for the future: innovation, technology, sustainability*.

CHAPTER 2: STUDENT ENGAGEMENT

2.1 Introduction

Chapters 2 to 5 comprise a discussion of literature on each dimension of the problem statement to build a conceptual framework that can assist academia in expounding on the reasons why virtual reality (VR) should be included in teaching and learning.

The independent variable for this study is *student engagement*. Realising that student engagement is crucial to the academic success of a student makes this study relevant in a time where higher education institutions (HEIs) experience high dropout rates.

Chapter 2 conceptualises the claim of many researchers who believe that students who learn using a VR platform possess enhanced student engagement levels, which will result in high academic strength. Topics such as the importance of student engagement in HEIs and the factors influencing student engagement are discussed in this chapter. It is also important to examine the different types of student engagement that exist, namely cognitive, emotional, and behavioural engagement. To further expand on this study, the chapter discusses the influence VR has on student engagement. Furthermore, the study expounds on the concept of student engagement and investigates the current state of student engagement in HEIs in South Africa and concludes by considering the international perspectives on student engagement.

2.2 The concept of student engagement

The notion of student engagement in HE has emerged over the past decade as a reliable predictor of students' academic success (Schreiber & Yu, 2016:3). Bowden et al. (2019:3) allude to the fact that as HEIs begin to measure the level of student engagement, "it offers the ability to qualify and monitor the extent to which a student's baseline expectations are being met by the institution". Student engagement is a useful framework to assist HEIs in examining students' academic success (Schreiber & Yu, 2016:2).

Students experience and engage with the world differently than their several years ago (Parsons & Taylor, 2011:6). Thirty years before this statement was made by Parsons and Taylor (2011:16), Albert Einstein, the most influential physicists, prudently stated, "The only source of knowledge is experience". It is on this premises that Kolb's experimental learning model was designed in 1984. Kolb's learning model stresses that learning is the process whereby knowledge is created through the transformation of experience (Barker et al*.,* 2012:2). Axelson and Flick (2010:38) concur with Parsons and Taylor, noting that learning about new things does not enable a student to understand and apply the concepts of learning; a student needs to *experience* the learning.

Researchers agree that student engagement is critical to academic success; however, not all share a clear definition of what student engagement is. The study shares some of the definitions sourced from literature. Student engagement refers to “the focus of a learner’s attention on the task at hand while given sufficient involvement and mental clarity that can lead to an optimal state of learning” (Gregory et al., 2016:141). Kahu and Lodge (2018:1) provide a more significant perspective on student engagement, stating that “student engagement is a complex multidimensional construct that correlates strongly with student retention”. Student retention refers to the actual completion (or throughput) rate of students. Factors such as socio-economic status might play a role in the retention rate of a student, as cautioned by Abduh et al. (2023:3).

Axelson and Flick (2010:29) note that student engagement “is an important means by which students develop feelings about other students, lecturers, and institutions that give them a sense of connectedness, affiliation, and belonging, while simultaneously offering learning opportunities for these students”. Students who are positively engaged in their learning experience success in their studies (Bowden et al., 2019:4). Schreiber and Yu (2016:158) sum up these theoretical conceptualisations of what student engagement is by stating that “it provides a rich and textured framework of student integration that supports the notion of student persistence and retention as grounded in a complex web of influences”.

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The literature further expounds on what is referred to as the *pillars of student engagement*. The first pillar refers to the academic engagement, which involves the completion of academic tasks. Important indicators underlying this pillar would be the attendance of students, how students engage with their lecturer and other students, and then finally completing the

academic tasks timeously. The second pillar refers to the intellectual engagement students demonstrate during their studies. Dealing with personal challenges and being able to sequence task to reach the goal are facts that refer to the student's intellectual engagement. The final pillar refers to the social-emotional engagement students where the student/lecturer relationships, as well as the student to student, and finally the academic partnerships (such as discussion groups and student mentors) from the student plays a vital role (Kang, 2021:1).

George Kuh (2003) further elucidates on understanding the concept of student engagement by mentioning that the institution where students study is of less importance, what matters is what and how they learn. The actual institution is not that important to students, but more the access to opportunities, learning environments, the quality of facilitators, the course design and graduate success rates (Shah et al., 2013:1). Students also prefer to have flexibility in their studies, to choose when and where they want to study. Students opt to choose learning institutions where they have a greater choice of the mode of delivery in learning (Milpark Education, 2020:1). Thus, to promote student engagement, HEIs can provide the opportunity for students to study in various 'modes of delivery' and this can lead to students begin more engaged, as students can now choose how to study (for example, face-to-face learning, blended learning, correspondence learning, or online learning).

Furthermore, it is important to note that student engagement occurs simultaneously on multiple levels and cannot be forced (talentlms.com, n.d.:6.). Student engagement is multidimensional by nature (Ciric & Jovanovic, 2016) and therefore engagement can take place on a social, academic, and intellectual level. Social engagement refers to the student wanting to belong to a study group or certain learning institution, whereas academic engagement refers to the commitment of students to be involved in academic learning throughout their studies. Finally, intellectual engagement includes the cognitive behaviour of a student (Hu et al., 2012).

Interestingly, student engagement can manifest through both positive and negative valences. Positive valences include a student being happy, enjoying his/or her studies, having pride and satisfaction during the learning phase. Opposingly, negative valences include a lack of attention, anger, anxiety, and frustration (Bowden et al., 2019:4). Ultimately, students cannot be forced to engage, they always have a choice. Students will only engage once the lesson resonates with them and they can access and understand the concepts of the subject being taught to them. Usually, students tend to lose interest when the work gets too difficult for them. Therefore, lecturers need to be cautious about putting lesson plans together that are too complex for students as they can become overwhelmed by the content and lose engagement.

In summary, to understand the conceptional framework of student engagement, the different definitions should be taken into consideration alongside the elements that make up student engagement. To take this discussion further, several educational theorists have listed the different dimensions that exist during student engagement.

2.3 The different dimensions of student engagement

In this study, the term *dimensions of student engagement* refers to the unique types of engagement that leads to differences in behaviour when students engage with their studies, namely behavioural, emotional, and cognitive behaviour. Researchers suggest that student engagement is a multidimensional construct whereby:

- Emotional engagement includes students' interests, values, and emotions. It is important for students who study towards being an HR professional, acquires the skill to recognise one's own emotions and that of others. In organisations, HR professionals need to assist employees to develop their emotional intelligence that will enhance their emotional engagement and promote a healthy work-environment. The SABPP regard this a key role of not only the HR practitioner but also the Chief Human Resource Officer (CHRO) (Jivan, 2023:4).
- Cognitive behaviour reflects on a student's motivational levels and the acquisition of knowledge and skills, obtained through learning and experience. In the context of the role of the HRD practitioner, it is important to offer training programmes which assist students to develop their cognitive behaviour. In an organisational setting, the HR professional should demonstrate their cognitive behaviour by interrogating the market and platforms especially with the use of automation through artificial intelligence (AI) and VR (Jivan, 2021:5).
- "Behavioural engagement includes the rules and directions of the study the student is undergoing" (Gesualdi, 2019:20). HRD practitioners should assist students in developing the skills and behaviours needed to perform their jobs effectively.

These three levels of engagement relate to the core competencies as mentioned in the SABPP's HR Standards and stipulate the responsibility of HR professionals to conduct high quality HR work.

The reasons why a student will choose a specific dimension of student engagement are firstly determined by the study method or approach used during teaching and learning, and secondly, studies concluded that when students receive too much information over a short time, they easily feel overwhelmed and become disengaged and bored (Babic, 2019:1). Students also tend to become depressed, which in return negatively affects not only student engagement but also student performance (Matthes et al*.,* 2020). Based on this evidence, it

is important to discuss the three different dimensions of student engagement and when each of these dimensions is applied.

2.3.1 Cognitive engagement

The first type of student engagement dimension discussed in this study is **cognitive engagement** which enables a student to master the work whilst gaining new knowledge by students seeking to go beyond what is expected by them (Trowler, 2010:7; talentlms.com, n.d.:7). Cognitive Engagement further requires perseverance from students, by having to concentrate the whole time. The student needs to be actively engaged by being willing and able to learn (Parsons et al., 2020:3).

Active engagement refers to a student being engaged throughout the learning process and therefore the *cognitive engagement* of a student is increased (Sharp et al., 2010:60). In the segment of cognitive behaviour, a student can be highly engaged or can demonstrate a low engagement level. In table 2.1 below, the two different types of cognitive engagement are illustrated.

Table 2.1: Levels of engagement
(Source: Parsons et al., 2020:31)

Level of Engagement	Explanation
High Engagement	• The student demonstrates behavioural engagement with studies (involves participating in group work and assignments) • The student asks questions • The student perseveres when challenged • The student exceeds expectations on tasks delivered
Low Engagement	• The student does not complete assigned tasks • The student demonstrates boredom • The student gives up easily

Adding to table 2.1, the characteristics of cognitive behaviour are described next. If the following behaviour is in place, engagement will follow:

- **Volition learning** (learning by choice): When a student is actively engaged in class, a high engagement is noted.
- **Investment and willingness to exert effort:** Here the student is willing to go the extra mile in his/her studies.
- **Thoughtfulness** (applying the processes of deep thinking): Critical thinking is important when assessing students.
- **Self-regulation:** Is the student able to manage his/her study progress?
- **Goal setting:** Students who set study goals automatically achieve a much higher engagement level.

- **Preference for a challenge:** Students who easily engage with a learning challenge tend to have a higher level of engagement in their studies.
- **Resiliency and persistence** are important in studies: Is the student able to proceed with his/her studies against any challenges faced? (Nayir, 2017:3).

Cognitive behaviour is closely linked to a student's brain activity. Neuroscientists have studied the anatomy and molecular biology of the brain, with a particular interest in how the brain is affected by the engagement and learning of students (Donovan et al., 1999:65). Scientists believe that using VR, the brain creates positive stimuli (Thielking, 2019). It is believed that the brain is changing when exposed to VR, as it must adapt to the high-tech information age (Sprenger, 2010:4; Bowden et al., 2019:4). Some researchers are convinced that the brain is malleable to the environmental demands and stimuli, especially to learning new processes (Firth et al*.,* 2019:1).

Adding to Donovan's studies in neuroscience, various theorists have written about how the brain operates during learning (and how cognitive behaviour in a student is affected), one of which is Edgar Dale. To allude to the theories of Edgar Dale (1960, cited in ClassVR, 2018b:1), literature notes that a human being will remember 10% of what he or she reads as opposed to 90% of what he/she experiences. Dale's experience in teaching, along with his involvement in audio-visual material, led to his conceptualisation of the *Cone of Experience* module.

As per Edgar Dale, learning experiences can be classified in various ways, including psychological classification. Dale's *Cone of Experience* has progressed through several transitions with a significant impact on how instructional materials are designed. It is important to include Dale's theories in this study, as academia need to understand its role in a student's engagement levels. Edgar Dales' module is linked to cognitive behaviour in that a student will have to demonstrate through what is learnt.

Figure 2.1 illustrates Dale's *Cone of Experience*.

Dale's theory is based on what people generally remember. People will remember:

- Ninety per cent (90%) of what they do (level 1 and 2)
- Seventy per cent (70%) of what they say and write (Level 3 and 4)
- Fifty per cent (50%) of what they hear and see (Level 5 to 10)
- Thirty per cent (30%) of what they see (Level 8)
- Twenty per cent (20%) of what they hear (level 9)
- Ten per cent (10%) of what they read (level 10)

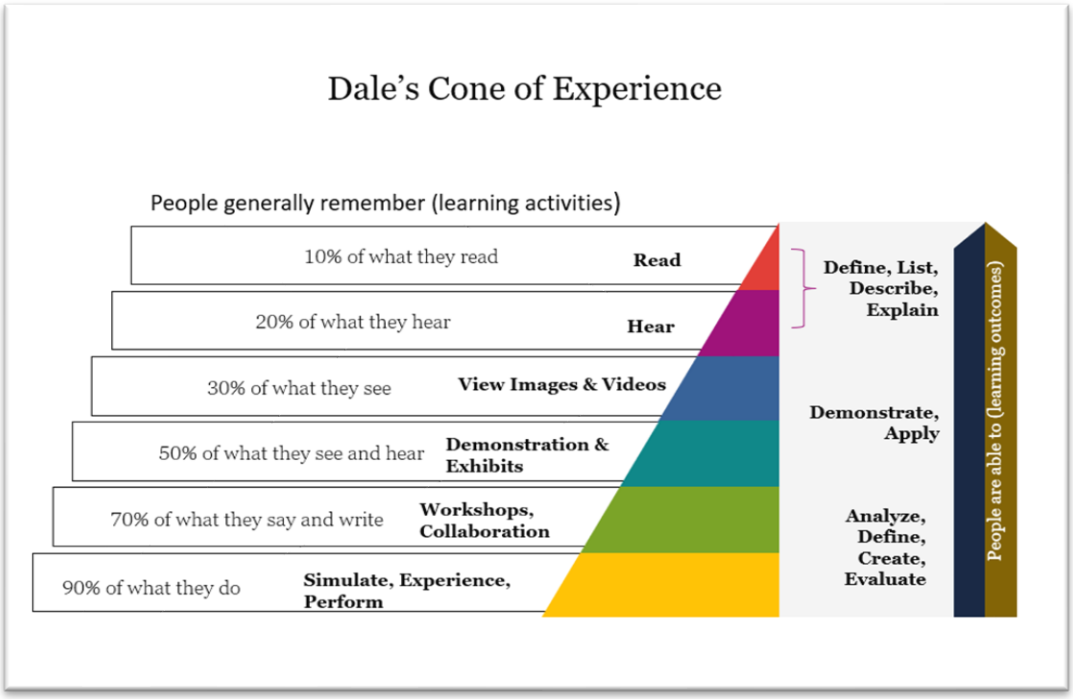

Figure 2.1: Dale's Cone of Experience
(Source: Pietroni, 2019)

Dale's theories continue to influence teaching and learning still in the 21st century (Lee & Reeves, 2018:1). Virtual reality, the essence of this study, is all about what you do, see and experience whilst operating the virtual device. Thus, a direct link can be seen between virtual reality, cognitive behaviour in a student and Dale's theory. Therefore, when lecturers design new lesson plans or assessments, it is important to refer to Dale's theory, especially when creating VR-learning plans.

To conclude, Donovan et al. (1999:41) clarified that the transfer of cognitive engagement is successful once the student has mastered (and experienced) the learning. Therefore, students are motivated by the complexity of the learning taking place and the need to solve the learning problems (Bransford et al., 2000:65). The next dimension of student engagement is discussed in the section below.

2.3.2 Emotional engagement

The second dimension of engagement is **emotional engagement.** This type of engagement involves the student connecting to either other students or the learning itself (talentlms.com, n.d.:7). Trowler (2010:7) and Mebert et al. (2020:4) believe that students who are highly emotionally engaged will demonstrate interest, enjoyment, and a sense of belonging during their studies. Interestingly, enjoyment and a sense of belonging are created when the actual learning taking place. Gutman and Schoon (2018:111) add that emotional engagement is not a static event and can change gradually throughout a learner's studies—it all depends on what the student is engaging with at that specific moment.

It is important to note that emotional engagement is set by the facilitator or other students of the actual learning outcome and can change at any time, depending on what is happening at that very moment in the learning. This change in the level of emotional engagement is visible when students react positively or negatively towards facilitators and other class members (Bowden et al., 2019:5). A student who is negatively engaged may demonstrate a decline in academic activity or a change in their attitude towards the learning. Nayir (2017:1) agrees with Trowler (2010) that when the "level of perception" of the learning value decreases the student loses interest and enjoyment in the learning.

Emotional engagement can also increase positively when students are informed beforehand what the learning outcomes are, as it prevents students from experiencing feelings of anxiety (talentlms.com, n.d.:8). Emotional engagement creates feelings of inclusiveness, belonging and purpose (Bowden et al., 2019:7). If the student enjoys the subject, the emotional engagement will increase.

2.3.3 Behavioural engagement

The behavioural dimension of engagement is defined as the "observable academic performance and participatory actions and activities and is the most frequently measured dimension within the barometers of student experience" (Bowden et al., 2019:7). Mebert et al. (2020:5) add that through behavioural engagement measurements of time, effort and the level of concentration can be used as predictors of the level of student engagement.

A students' behaviour plays an important part to determine engagement. For instance, an engaged student is most likely to always have his work completed on time and shows up for class diligently (talentlms.com, n.d.:8.) Depending on how much the student is interested in the learning, the behavioural engagement level differs from learning outcome to the next learning outcome. Students who are behaviourally engaged in their studies reach higher academic achievements (Hospel et al*.,* 2016:37).

To ensure that a student is behaviourally engaged, a deep understanding and empathy for students and their culture are required. Therefore, trust is important between the lecturer and the student. Trust is therefore important between the lecturer and the student (Gesualdi, 2019:35). When a student reacts positively to behavioural engagement it creates a positive climate and in return positively affects their success (Nguyen et al*.,* 2018:30). Figure 2.2 summarises how student engagement, together with student behaviour can have a positive influence on the student's academic success overall.

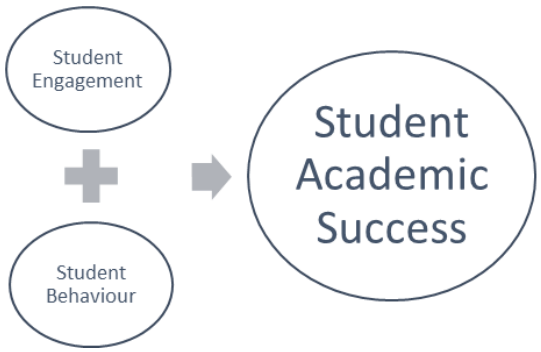

Figure 2.2: The link between student engagement and student success

Nayir (2017:2) notes that behavioural engagement can be demonstrated through the presence of the following characteristics:

- **Participation** by the student who is studying
- The **presence** of the student whilst studying
- The actual **behaviour** of the student
- **Efforts** being made by the student during his studies
- **Persistence** to succeed is demonstrated by the student
- The **concentration** level of the student during studies
- The **attention and involvement** in the actual studies by the student

Over recent years' efforts to evaluate and increase, a student's behavioural engagement has been inescapable in HE (Barnacle & Dall'Alba, 2017:1326) and needs to be addressed. Considering the characteristics of a student that demonstrates behavioural engagement, the link to students being in an immersed environment would closely relate to these characters mentioned by Nayir. Students in an immersed environment would be present in their studies, show participation by concentrating and being involved in the moment, thereby showing every effort to succeed in their studies (Schreiber & Yu, 2016:158). To provide a final overview of the three *dimensions of engagement*, Trowler (2010:7) illustrates in the table below how each student's engagement dimension can have a positive and a negative pole (Table 2.2).

Table 2.2: Examples of positive and negative engagement
(Source: Trowler, 2010:7)

	Positive Engagement	**Non-Engagement**	**Negative Engagement**
Behavioural	Attends lectures, participates with enthusiasm	Skips lectures without excuse	Boycotts, pickets, or disrupting lecturers
Emotional	Interest	Boredom	Rejection
Cognitive	Meets or exceeds assignment requirements	Assignments late, rushed, or absent	Redefines parameters for assignments

Positive engagement, during the behavioural engagement phase, is regarded as a student who attends lectures and participates in class. Through emotional engagement, the student shows interest in class activities. During the cognitive engagement dimension, the student meets or even exceeds the assignment requirements.

A student who is not engaging in his/her studies may demonstrate behaviours of skipping lectures and are often bored and tend to submit assignments late. Non-engaged students may demonstrate boredom in class and students who demonstrate cognitive behaviour tend to be late with submitting work or being absent. Any negative behavioural engagement by a student would be regarded as a student who disturbs lectures or participates in pickets and boycotts. Emotionally engaged students may reject studying while cognitive engaged students may redefine parameters for submitting assignments.

The paradox view brings perplexity to the study, as Lim et al.'s (2006:3, cited in D'Agustino, 2013) study found that although students may be engaged in the virtual environment, not all engagement might lead to engagement in the learning task. Lim et al.'s study (2006) found that often students in the virtual world show more interest in creating avatars, moving around to different virtual environments, but lack engagement with the actual learning. This emphasises the importance of designing VR-learning platforms that include compulsory assessments for the students to complete.

In closing this discussion, Mebert et al. (2020:16) and Ting et al. (2020:5) concur that student engagement is a combination of cognitive, emotional, and behavioural engagement in which students will demonstrate a willingness to participate in task given to them and collaborate with peers. Overall, a comprehensive human resource development training programme should include a focus on all three aspects of behaviour, emotion, and cognition to help employees, develop into well-rounded and productive employees. As mentioned in the research problem, the dependant variable (*student engagement*), is being oppressed due to teaching and learning practices that have plateaued over the last decade.

In the next section, the study elaborates on the challenges that HEIs experience with regards to student engagement.

2.4 Challenges experienced by HEIs

Since the first democratic elections in 1994, HEIs have dramatically changed. It is a common phenomenon that HEIs are seeking to promote student engagement. Wawrzynski et al. (2012:107) state that "after the fall of apartheid South Africa's higher education has slowly begun what was, and continuous to be, a seismic shift in the operation of its universities".

A current imperative by HEIs is to ensure that throughput (achievement) rates are well received by the Department of Higher Education and Training (DHET, 2019). Despite the efforts made by the DHET to fund students with lower-income backgrounds, the dropout and completion rates remained elusive. Dropout rates at both undergraduate and postgraduate levels remained very high, with approximately 50% of students not completing their qualifications (Schreiber & Yu, 2016:157). National reports from the Council on Higher Education further reports on these challenges experienced (CHE, 2019).

Theorists have identified that healthy student engagement positively affects student achievement. Therefore, one of the research objectives is to understand how student engagement can increase student achievement (Bowden, et al., 2019:7). Likewise, it is important for HEIs to have a sound understanding of how they can influence student engagement levels resulting in less dropouts and more graduates. HEIs have a responsible to ensure that students excel in their studies. (DHET, 2019:20).

Poor pass rates and disengaged students is not unique to South Africa, these challenges are shared among many other international HEIs. The South African Survey of Student Engagement (SASSE) investigated the differences and similarities in challenges experienced both nationally and internally. The outcome of this study is presented in table 2.3.

Table 2.3: Challenges facing HEIs
(Source: Strydom & Mentz, 2010:7; Dameron & Durand, 2017:3)

Challenges facing Higher Education	
International	**South Africa**
Low pass rates	Very low pass rates (around 15% of students graduate in time)
Low enrolment of minority group students	Participation rates of previously excluded Black African students around 12%
Low pass rates among low income, minority group students	One in three Black African students graduate in time, less than 5% of this cohort obtains a degree
Students not adequately prepared in high school	Students not adequately prepared in high school
Increased demand for graduates in the knowledge economy results in a rapidly expanding student body with unprecedented levels of diversity and large numbers of first generations students	Widening access and an increased demand for graduates in the knowledge economy led to unprecedented levels of diversity and many first-generation students
Development of online learning	Implementation of online learning during COVID-19
Sustainability of current edtech trends	Increase in the adoption of internet-related technologies/edtech
Socially acceptability of higher fees Climate change and sustainability	Cost of learning fees/Fees must fall

As a result of the challenges experienced by HEIs, the study focuses on student engagement and how with the use of VR-learning these challenges can be overcome. Using VR, disengaged students can be assisted to understand learning concepts better and by creating an enjoyable learning environment through VR, student success is positively affected.

In addition, a global survey conducted by Infrastructure in 2022 revealed that 43% of students believe that immediate feedback increases student engagement, whereas only 39% of the institutional administrators agreed to this fact. Apart from the immediate student feedback that can potentially increase student engagement, 75% of students strongly believes that a proper learner management system (LMS) increases two-way communication, and therefore increases student engagement as well.

To conclude, this section outlined the challenges experienced by HEIs of which the most current challenge is to accelerate towards the digital shift in teaching and learning with the hope to increase student engagement. A renewed focus is required from HEIs to adapt to a modern education experience for students, which includes VR. An in-depth investigation regarding VR, will be done in chapter 3 of this study. The next section will discuss the factors that influence student engagement.

2.5 Factors influencing student engagement

As mentioned earlier, HEIs are faces with the pressure to provide quality education in an ever-changing environment as directed by regulatory bodies governing qualifications in the HE fields. In this context, student engagement becomes a critical indicator of the quality in teaching and learning (Ting et al., 2020:1).

This research study focuses specifically on the following three factors that influence student engagement, namely: **(i) the student, (ii) the HE academic staff members, (iii) and the HEIs**. Notwithstanding, there are many other factors mentioned in the literature. This study examines only three categories.

2.5.1 The student

For students to fully benefit from student engagement, the investment of time and effort into academic activities need to be present (Ting et al., 2020). The factors influencing the student's engagement levels is the students own (i) motivational level, the student's (ii) area of focus, and the (iii) level of engagement demonstrated by the student during teaching and learning as well as (iv) the time the student spend on learning and finally the (5) the subject the student chooses to follow. These three factors are discussed in the sub-sections below.

Firstly, it is important for the study to determine the effect of motivation on student engagement, as motivation is considered a prerequisite for student engagement (Saeed & Zyngier, 2012:1). Panigrahi et al. (2018) and Lee and Pang (2014:2) define motivation as “a state of mind that arouses activities of human body action Learning does not take place by itself but involves the active participation from a student.

The term *motivation* can be classified (or characterised) into three groups: intrinsic motivation, extrinsic motivation, and lack of motivation. Students who are motivated intrinsic (first level) would be self-driven and view their learning as self-driven to accomplish personal satisfaction (Lee & Pang, 2014:2). Intrinsic motivation further refers to the values that are instilled in a human being (Nayir, 2017:5). Students being motivated extrinsic (second level) would engage in learning to achieve specific learning outcomes (Lee & Pang, 2014:2) and demonstrate passive compliance (Nayir, 2017:5; Saeed & Zyngier, 2012:2). During extrinsic motivation, students love to be praised and recognised in their studies. In a study done by Zyngier in 2011, it was concluded that intrinsic motivation assisted authentic student engagement, and that extrinsic motivation served to develop ritual engagement in students. However, students who had both types of motivation showed different types of engagement (Saeed & Zyngier, 2012:1). The third level, lack of motivation or ‘A-motivated’, is a condition where there is no meaning or reason for the student to be motivated (Nayir, 2017:5).

It should be known that there are many more different kinds of motivational levels. However, in this study only these three will be discussed in terms of their influence on student engagement. Nayir (2017:3) demonstrates the relationship between student motivation and student engagement levels in figure 2.3 illustrated below.

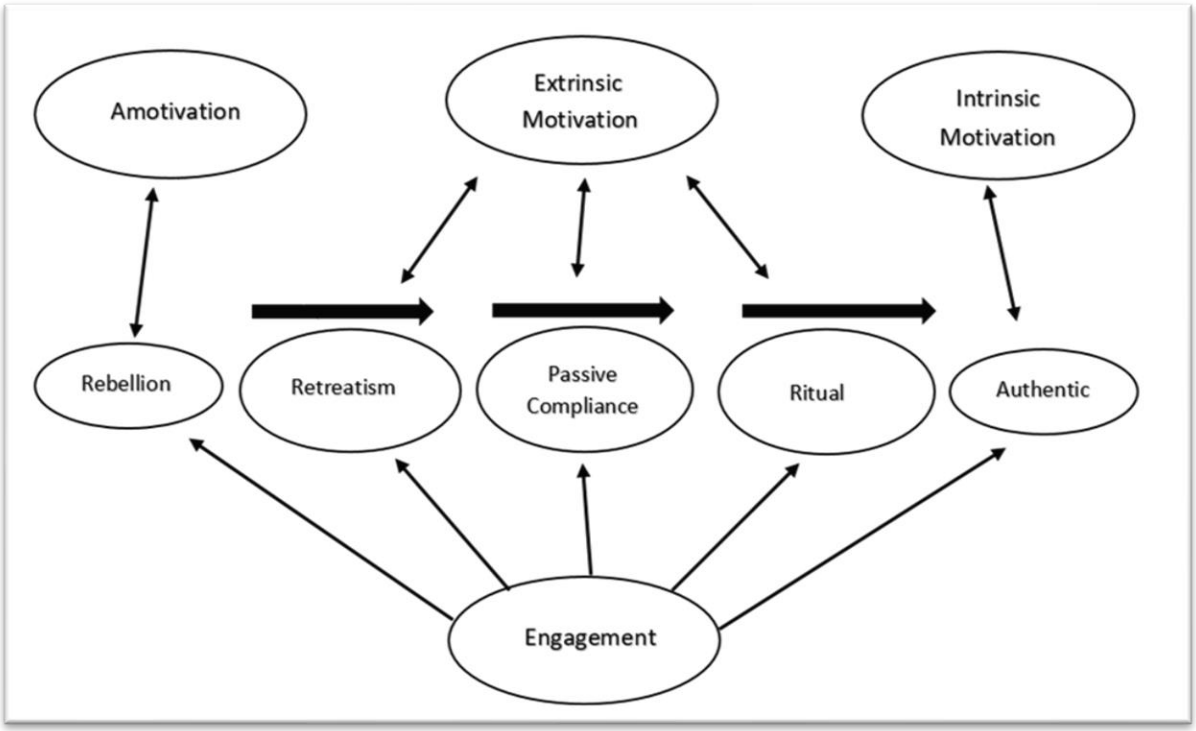

Figure 2.3: Relationship between student motivation and student engagement (Source: Nayir, 2017:6)

As seen in figure 2.3, student motivational levels are directly related to the level of student engagement. Often students who lack motivation (A-motivated) would come across as rebellious and show little interest in their studies.

Students with extrinsic motivation are engaged in class activities when surrounded by other students and can act as passive compliance, in other words, students just doing what they are supposed to do. There is no further action from these students; they do whatever needs to be done to meet the requirements. These students can also act out of ritual and demonstrating behaviour that is expected of them. Students with extrinsic motivation may also demonstrate giving up and losing interest in the study. Lastly, those students with intrinsic motivation are at an authentic engagement level (Nayir, 2017:6), which means that they are actively involved in their studies.

The **second** factor that can influence student engagement (under the *student* criterion) is the element of focus. Two focus area types regulate overall student engagement: (i) promotion focus (growth and achievements), and (ii) prevention focus (safety and security). With promotion focus, students envision success because of their hard work during their studies. Therefore, due to the student's growth in their studies and leading towards achievement, the overall student engagement of the student is positive.

On the other hand, prevention focus is based on the theory that students will be more vigilant and adhere to course requirements, as they are driven by security and protection. Students, who are 'prevention focused' in their engagement, will adhere to instructions given by the facilitator. This will have a positive knock-on effect by the student being more engaged. The table below illustrates the differences between students who are 'promotion focused' versus those who are 'prevention focused'.

Table 2.4: The difference between promotion and prevention focus (Source: Mariani et al., 2020:10)

	Promotion	**Prevention**
Needs	Growth and progress	Security and protection
Standards target	Ideal self (reflected by hopes and aspirations)	
Strategic tendencies	Approaching the desired state	Avoiding the desired state
Outcomes	Presence of positive outcomes	Absence of negative outcomes

Panigrahi et al. (2018) remarked that the two focus areas (promotion and prevention) are closely linked to Maslow's hierarchy of needs, whereby the learner will opt for safety and security by adhering to the facilitator's instruction. In Maslow's hierarchy of needs, students' motivation will increase when they feel safe in the classroom, safe with their peers and feel comfortable with the subject being taught (ThoughtCo, 2019). This is emphasised in table 2.4, where the need for a student who is promotion focused, will be growth and progress in their studies. Students will set targets for themselves to achieve these goals. These 'promotion-focused students' will have strategies in place that will assist them to get to their desired state or goal. This will result in positive outcomes for the student.

On the other hand, students who are prevention-focused also have the need to achieve their goals, but their focus is on staying safe during the achievement of their goals. When these students feel unsafe in their actions, they may choose to avoid their desired state and no longer focus on their strategy. This can lead to the absence of outcomes, or the negative outcome of goals set.

The **third** factor why a student is less engaged refers to 'class engagement', which can be defined as the level of curiosity, interest optimism and passion that a student will demonstrate in class (Great Schools Partnership, 2020). Günüç and Kuzu (2014:10) explain that students who attend class form relationships with other students, which results in students being more engaged in their studies. Equally important is the engagement that the lecturer has with the student (Günüç & Kuzu, 2014:10). If students are fond of their lecturer, they tend to be more engaged in their studies. This phenomenon also forms part of Maslow's hierarchy of needs,

namely love and belonging. Students have the need to form part of a social group where they feel they belong as opposed to feeling isolated (ThoughtCo, 2019:1). The National Survey of Student Engagement (NSSE, 2017:1) notes that when students are part of a non-discriminatory environment, they tend to feel a stronger sense of belonging, resulting in greater cognitive development. Ting et al. (2020:451) argue that the lecturer-student relationship is seen as the most important factor that influence student engagement.

Besides the students and lecturer that engage with one another, students also engage with technology in the classroom. Owing to the technological nature of this research, it is important to show the relationship that exists between technology that is used in the classroom (such as VR) and important factors influencing student engagement in class. Figure 2.4 illustrates the factors that influence student engagement and the role that technology plays in student engagement.

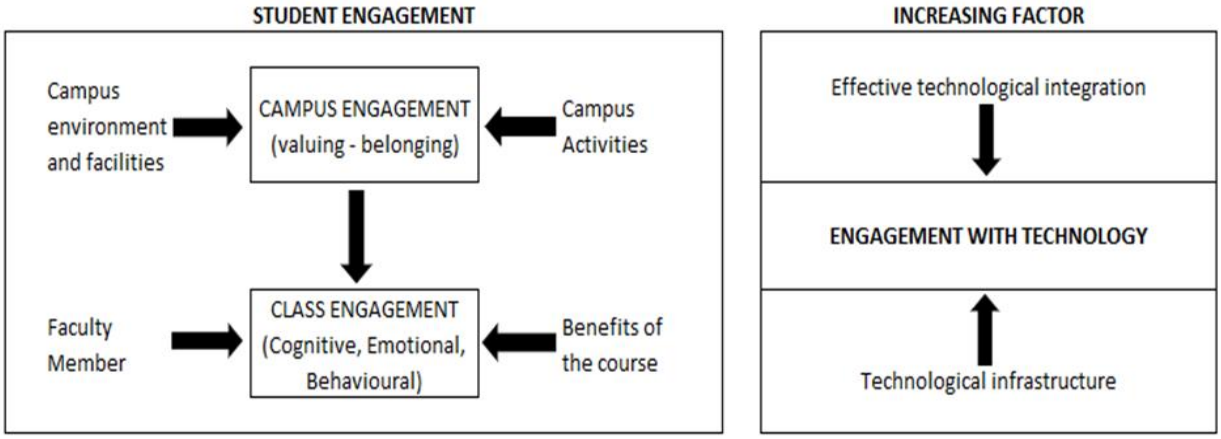

Figure 2.4: Factors influencing student engagement and the role of technology in student engagement (Source: Günüç & Kuzu, 2014:15)

Figure 2.4 demonstrates the relationship that exists between student engagement levels concerning campus engagement and class engagement. The campus environment, facilities and activities contribute to the campus engagement a student experiences. In addition, whatever the academic benefits (such as cognitive, emotional, and behavioural engagement), the academic institution enforces on the student, the higher the level of class engagement would be. Günüç and Kuzu (2014:15) believe that the increasing factor for student engagement would be the use of technology in the classroom. Therefore, it would be important to set a user-friendly technological infrastructure and integrate it with the lesson plans to enhance the learner's engagement with technology. It is important for the study to investigate the critical success factors which play a role in the increase of student engagement.

Time refers to the continued progress of events (Lexico Dictionaries, 2020). This would be the **fourth** reason why a student is not engaged. Kolari et al. (2006:9) note that for students to

reap the benefits of their studies they need to **spend time** with the subject. Students would need to spend time on activities such as analysing, debating and problem solving, which are essential to a student's development and ultimately their student engagement. The more time a student uses to analyse debate and practice problem-solving during learning, the more success will be achieved and therefore, time is regarded as a critical success factor in aiming for higher student engagement levels.

Therefore, it is important that VR content includes case studies that will support analysing, debating and problem-solving. In a study conducted by Allcoat and von Muhlenen (2018), a total of 99 participants were assigned to one of three learning conditions: (a) traditional textbook style learning, (b) virtual reality and (c) video (passive learning). A pre-and post-test were provided to the students. Participants in the VR environment studied in a shorter period and remembered more learning concepts compared to the participants in the traditional mode of learning (Allcoat & Von Muhlenen*,* 2018:1; PWC, 2019:17). This is attributed to VR allowing a student to experience and participate in the learning process at his/her own pace. Using VR, the student learns mostly by seeing computer-based simulations of the learning object, as opposed to having to read several pages regarding the learning objectives and this shortens the time of the study.

The **fifth** reason for poor student engagement, refers to the "subject" the student is being taught. There are certain subjects, which students just tend to be more interested in. These subjects (or learning topics) of choice, depend on student-to-student interest. Being interested in a subject would result in a mental resource, which enhances learning and ultimately leads to better student achievement (Harackiewicz & Hulleman, 2010:2).

Kuh (2003:1) further derives that a student needs to be practically involved in the subject to increase engagement. Students should not only hear and read the lesson but also practically get to do what is being taught.

Students, who are interested in a subject, tend to explore all aspects of the subject, master it and develop skills that will positively affect them in their studies (Harackiewicz & Hulleman, 2010:3). The challenge would be to engage students who are not interested in a subject and would need to complete it as part of the curriculum. Therefore, it is important for HR lecturers to create a VR-learning environment that is exciting and engaging for students, to enhance their interest in the subject.

2.5.2 The academic staff member

The role of HE academic staff members in promoting student engagement is arguably one the most important focus areas influencing student engagement. HEIs should create an

environment that fosters student engagement. This notion is derived from the fact that academic staff will be closely involved in the design intervention of VR training. “Design intervention” refers to how technology was designed to engage with students. The use of interactive technology, such as VR, is the key driver in student engagement (Rashid & Asghar, 2016:3).

Technological design interventions have many possibilities and have many advantages to secure motivation and engagement in students. It is important to remember, that edtech (educational technology) should be designed with the student in mind. When designing lesson plans, the facilitator should keep in mind what the learning outcomes are and what the best learning approach are to teach the subject (Yeight, 2018:2). VR is not suitable for all subjects and lecturers should decide on what mode of delivery best suits the learning outcome. Wankel et al. (2013:4) agree that technology on its own cannot guarantee student engagement, but that lecturers should use the best mode of delivery for the specific subject being taught.

Literature supports the fact that students who have experienced VR-learning feel more engage and often collaborate with other students about the learning outcome and what was observed through VR-learning (Panigrahi et al*.,* 2018). However, Günüç and Kuzu (2014:13) caution that in the case where technology has been poorly implemented by academics, it will result in students being even more disengaged from the class and their studies. Even poor tool selection or misaligned study guides on the virtual platform will lead to students being disengaged in their studies (Yeight, 2018:1). Therefore, it is important that lectures be fully trained to operate VR hardware and software, before attempting to use it in class (Günüç & Kuzu, 2014:13). Academics should be competent in designing and operating edtech.

Trowler (2010:38) notes that the manner in which the lecturers facilitate, assess, and engage with a learner is critical. With VR, lecturers can mentor and coach students during their studies. Chapter 5 of the literature review discusses the role of the academic staff member in-depth. To conclude this section, it is important to understand the significant role an academic plays in creating an environment that fosters student engagement. Academics have the ability to shape the learning environment, design effective teaching strategies, and provide support and guidance to students.

2.5.3 The higher education institution

The last factor influencing student engagement is the role that the institution plays. There are several focus areas an institution can focus on to increase student engagement, one of which is to provide students and the academic staff with the needed training to equip themselves in using modern technology (Ting et al., 2020:451). Virtual competence can be “critical capable

to work effectively within a virtual reality platform" (Wang & Haggerty, 2006:1). If a student or lecturer is unable to operate the VR device, it can influence student engagement.

HEIs should stay informed about the changes in edtech to adhere to the needs to their students and become competent in using edtech tools. Companies like Veative, provide lecturers with the resources to equip themselves with the VR resources and LMS platform. Through a self-passed course, the lecturer can complete the online training and receive a digital certificate of completion (Veative Group, 2022:1).

Apart from the actual subject being taught, Pike and Kuh (2005:187) argue that "the most important institutional factors are thought to be the **policies and practices** adopted by institutions to increase student engagement". Each institution would need to ensure that creative engagement initiatives are adopted.

Most HEIs have a student body represented on various decision-making structures. This allows for students to feel part of the institution and be more engaged. In addition to Trowler (2010), Günüç and Kuzu (2014:3) add that apart from students being on a student body, the faculty need to ensure the environment in which the students learn are conducive, enthusiastic, and ambitiously. Through VR platforms, students can be transferred from boring classrooms to exciting new spaces that are favourable for learning.

Other areas of focus can be to provide students with an online library, have interactive online classes, have digital labs and if required in a face-to-face setup, students enjoy having student lounges. These facilities promote collaboration between students and promote student engagement. The fifth concept to stimulate student engagement is class engagement, which will be discussed below.

2.6 Measuring student engagement

A study conducted by Christopoulos et al. (2018) confirms that to measure the level of student engagement when students are exposed to virtual learning experiences, , three aspects need to be considered: (i) the students' prior learning experiences, their (ii) perceptions about VR as a learning tool, and the impact of the actual (iii) VR design /and or VR lesson plan being used. These aspects are important to consider as this will have a direct effect on how the student experience and therefore engage in their studies. The SABPP Competency Model, refers to five capabilities that are required for strategic HR impact, one of which is being able to use the analytics obtained and measuring these for research purposes. An HR practitioner would need to be able to generate a systematic and integrated approach to HR analytics and measures in demonstrating HR impact on the business (Meyer, 2014).

To address the first measurement, literature suggests that a student's prior learning should be taken into consideration when measuring student engagement (Christopoulos et al., 2018). It is interesting to note that 23% of VR device owners are between 25 and 34 years of age (Generation Y). Although the device owners are from generation Y, it is the generation Alpha which are shows the biggest interest in the metaverse and VR (Gandotra, 2022:2). Therefore, it is critical for HEIs to prepare for the next generation of students entering HEIs.

Secondly, the measurement of the students' engagement is the perception of the student to use VR as a learning tool. VR is mostly used for gaming with its inception., However, with the development of VR technology, VR is being in many different industries, one of which is education. According to D'Agustino (2013:3), students need to think deeply, and they do have this opportunity when in the virtual world, as they can see, experience, and listen to the learning.

Thirdly, in order to measure student engagement, the design of the VR experience should encourage opportunities for collaboration with the learning task and/or other students in the immersive world. It should also provide opportunities for creativity and reflection on learning (D'Agustino, 2013:11).

To obtain an overall picture of the level of student engagement, it is recommended that these three factors be considered. In the next section, the study will discuss the meaningful role that VR plays in student engagement.

2.7 The significant role of virtual reality

Investigating the significant role that VR plays in student engagement is critical to HE, as VR will become and even more integral part of teaching and learning in the future. In this section, the study will discuss some of the significant ways in which VR can enhance student engagement.

Araiza-Alba et al. (2020:1) report that due to the students being in an immersive world, students are more emotionally connected to their studies and the sense of presence are often associated with increased levels of student engagements. The higher the sense of a student involvement, the **greater the recall of knowledge** will be.

Linking to the recall of knowledge, further research conducted by Harman et al. (2017:3) examined the episodic **memory recall** of given scenarios. Students were given 'faces of people' and further information about these people either given to students in VR and or on a desktop display (online learning). The memory performance of the students who made use of VR headsets, performed much better as opposed to students learning with a desktop display.

VR further **promotes real-world simulations**, which increases student engagement levels as student s will apply their learning into practice. Among the many examples, Vasarainen et al. (2021:7) explain how students can practice removing undetonated explosives and so overcome unsurpassable obstacles set by time and space, safety, and resources, through the use of VR.

Through the use of avatars and special meetings, students can now collaborate and socially interact with one another in a simulated real-world environment. This enhances student engagement as students can do group projects together, from anywhere in the world as long as they have an internet connection (Eon Reality, 2023:1).

VR can further be used by HR practitioners to measure and employee's performance through simulations and games. The VR-learning experiences can be created in such a way that valuable insights into an employee's strengthens and weaknesses, as well as areas for improvement can be identified. Furthermore, In the field of HR, VR has great potential in recruitment and onboarding (Lawton, 2021:1).

VR is an important tool for HRD practitioners as it provides a unique manner in which to train students, assess their performance and more importantly measure their student engagement levels, In conclusion, VR-learning brings a deeper sense of immersion to the user, which improves engagement levels, in both HR students and employees.

2.8 Student engagement in South African HEIs

South Africa has experienced drastic changes in HE since the first democratic election in 1994. This makes student engagement in South Africa a complex issue, that is arranged by factors such as socioeconomics, language, institutional culture, and academic preparedness (Mkhize et al., 2021:1).

Schreiber and Yu (2016:1) state that "despite policy and system reviews (such as curriculum and degree reforms, programme extension and introduction of foundation programmes, institutional mergers, changes in admission criteria, increased funding for student fees and residence), student persistence has not shifted dramatically and remains differentiated along race and gender. Academic performance poses an 'intractable challenge".

Schreiber and Yu (2016:120) conducted a study at a selected public South African university and collected information on student's participation in educationally purposeful activities, as well as the extent in which students interact with lecturers. Schreiber further collected data on how students perceive the university environment. The outcomes of the study revealed student engagement levels differs across races and this could be as a results of pre-

universities school experiences of students and the different expectations with which students enter a university. This was confirmed by another study conducted by Wawrzynski et al. (2012:2), who claim that the way students engage at HEIs can differ because of the instability and ongoing changes characterised by South Africa's HEIs. Schreiber and Yu (2016:172) further state that the "legacy of the apartheid history in South Africa is the racialized performance distribution and it seems that these also manifest at many universities, in the country".

Gender imbalances have been experienced by students. It has been observed that better performing students were also more engaged. Two important engagement indicators, namely Higher-Ordered learning and Collaborative Learning, reveals that better-performing students are more engaged in collaborative leaning.

Factors that influenced student engagement, that were beyond academic challenges, included the students' learning experience and the campus culture and climate (Schreiber & Yu 2016:18; Strydom & Mentz, 2014:8). Literature claims that students who engage themselves in cocurricular activities are more engage in their studies (Wawrzynski et al., 2012:107). In South Africa, the SABPP develops the future of the HR talent pool, by giving students recognition who are committed to the HR field. The SABPP Student Chapter was initiated by the HR professional body (SABPP) to encourage HR students to join as registered HR Student Members, which will assist and prepare them as aspirant HR professionals (Gie, 2021:68). In the Student Chapters, students have networking opportunities with other HR students across universities and access to an established HR professional community to kick start their HR career paths. Initiatives like these, keep HR students engaged, offer knowledge-based insights, and develop their professional mind-set towards becoming HR professionals in organisations.

Notably, a further study conducted on 48,981 students in HE (by the Department of Higher Education) in 2020 revealed that during the COVID pandemic students focus shifted to self-learning which encouraged student engagement. Students were comfortable engaging with lecturers via electronic platforms and with fellow classmates. In total, 70% of respondents engaged with classmates through online chats. The report indicated that students recognised the efforts made by their lecturers and appreciated the lecturers and the institutional support given during the pandemic. All these factors played an integral part in increasing student engagement.

HEIs will have to investigate and build a unique policy to increase student engagement at an institutional level. It is important for HEIs in South Africa to re-image teaching and learning by

considering the deployment of emerged technologies, such as VR to address the challenge of student engagement.

The next section addresses the international student engagement trends.

2.9 An international perspective on student engagement

The challenges that HEIs face with student engagement is not unique to South Africa, but these are challenges HEIs face around the world.

Student engagement has widely been understood to be a useful proxy for HEI students' academic success. Instructure (2022) (the CANVA Learner Management group) conducted a global study that included 23 countries and 7,572 students' administrators and faculty members, on the state of student success and engagement in HE in 2022. The results inferred that the top contributor to student success was the (i) quality of the faculty, the (ii) engagement with learning content, (iii) hands-on instruction, and the (iv) availability of technology.

The same CANVA study, requested of students to identified six key trends that they feel is of importance to their academic success and engagement. The students identified the six trends below as success factors in their engagement of their studies:

- Students demanding to have **convenience and flexibility** in their studies.
- Students feel it is important that the faculty **prepare them adequately** for career readiness.
- Students need for competency and **skills-based learning**, not necessarily a traditional degree-learning programme.
- **Tech-enhanced pedagogy** is critical for student engagement.
- The digital divide where there is a gap between those with and those without **Internet** connectivity remains to be a basic need of students globally and finally.
- The psychological **well-being of a student** is at the forefront of student success.

The consultation group, Advance Higher Education (advance-he.ac.uk, 2019), in the United Kingdom (UK) has also extensively researched 'student engagement critical success factors' and designed a conceptual framework for understanding student engagement in HE, From their research, student engagement will increase by (i) individual learning, (ii) curriculum design and delivery, (iii) discipline level of the student, (iv) the departmental level, the (v) institutional level, and finally, the (vi) policy level of the HEI. Table 2.5 illustrates the opportunities that exist to enhance student engagement.

Table 2.5: Examples to support a conceptual framework of student engagement in HE (Source: advance-he.ac.uk, 2019)

Opportunities for Student Engagement	Examples of Engagement
Individual learning	• Students engaged in their own learning through formal academic study • Self-reflection about their own learning • Participation in extra-curricular activities • Learning with and from their peers
Curriculum design and delivery	• Students to get involved in the design and delivery of their own learning • Evaluation during the course with rapid feedback and response • Students participating in research projects • Students generating materials for others to use • Postgraduate students who teach • Employability work
Discipline level	• Student membership of discipline focused student networks • Membership of professional body, subject centre, or discipline advisory groups • Subject in discipline-specific pedagogic research, focus groups and surveys • Membership of professional accreditation panels • Student surveys and focus groups
School/departmental level	• Student rep membership on school committees/faculty boards • Staff-Student Liaison Committees • Evaluation (usually questionnaires) at programme and course level • Student involvement in internal subject review
Institutional level	• Student representation on institutional bodies • Students engaged in institutional quality processes • Student union activities • Student involvement in university governing bodies
Policy level	• Student membership/consultation on cross-sector working groups or projects. • National representation • Representation on the steering committee • Liaison with student stakeholders • Student representation on Academy Board

In table 2.5, opportunities are displayed of how HEIs can ensure that students are engaged.

Firstly, it is important for students to **individually engage** with their own learning pathway and reflect on their own studies to increase student engagement. The more extra-curricular activities a student is involved with, the higher the success rate of a student. The delivery hereof should be given to students in small chunks. Additionally, peer learning is an important element for the promotion of student engagement.

Secondly, when discussing **curriculum design** and the delivery of lessons, student engagement will be promoted when students are involved in the design and delivery of their own learning. Though the use of VR, this is possible. Immediate feedback and responses are provided through the virtual platform to students and fellow students can add comments to one another's work, so that students can learn from one another.

Thirdly, student engagement can be promoted by the discipline level in the HEI, by means of students who join a **professional body** in the subject they are learning. For example, in South Africa, students who study Human Resource Management in South Africa can join the professional body for HR practitioners, namely the South African Board of People Practices (SABPP) who provides their members with valuable HR related knowledge. For HRD professionals it would be beneficial to involve themselves in internal review sessions, as means of ensuring students are engaged by keeping the study material/topic relevant and updated.

Furthermore, HEIs can invite students to become part of **student committees** to increase student commitment. Being part of student committees, they can contribute to course development discussions and subject reviews. Likewise, as in the SABPP Student Chapters, there are student bodies internationally present at several universities, one of which is the Society for Human Resource Management which provides students the opportunity to enhance their skillset, knowledge of trending HR issues, career opportunities and also the opportunity to network with business HR professionals and fellow students (SABPP, 2023).

Finally, student engagement can be increased by inviting students to be part of **policymaking**, especially to be representative in steering committees and even the institution's academic board. The importance of individual learning, curriculum design and delivery, the discipline level of the student and school/departmental and institutional level, and policy processes, are all important factors that contribute towards a student's engagement levels.

In New York, Hill's 2016 Digital Study Trends Survey, collected 3,311 students from the age 18 years and older to record their engagement with digital learning. It was reported that four out of five students prefer to study with digital learning as it increases their grades and gets maximum value out of their studies in higher education (McGraw-Hill, 2016). A further 79% of students who participated in the survey, reported that using digital learning, even the lecturers are better prepared for class (McGraw-Hill, 2016).

Interestingly an opposite view was gathered in a study conducted by PricewaterhouseCoopers (PWC) in the United States (in conjunction with the Business-Higher Education Forum). In 2018, PWC wanted to determine if HEIs are preparing students for the jobs of the future. From

the study, it was evident that lecturers are not at ease to use technology in the classroom (PWC, 2019). Hence, the educational system is failing to prepare students for the world of the future. For this study, the critical component of preparing HEI academic staff members to utilise VR-learning, will be discussed in Chapter 4 of the literature review.

In another study conducted by O'Connell and Dyment (2014) to determine if 42 journaling students are acceptive of technology in their studies, the outcome was as follows:

> "(1) students are not as technologically competent as assumed; (2) students chose to use basic/fundamental technologies (e.g., word processing) because they viewed it as the easiest way to complete the reflective journaling assignment; (3) student perceptions of what makes an assignment 'good' influenced their choice to use Web 2.0 technologies; and (4) overarching student perceptions of higher education and learning impacted their appropriation of technology".

TheCOVID-19 pandemic has led to severe global disruption especially when several countries called out lockdowns. Across the globe, HEIs had to prepare themselves for a different way of teaching and learning. Online learning solutions had to be introduced quickly. In a matter of weeks, the entire educational system had to adapt to new ways of educating students (Tam & El-Azar, 2020). Many countries preferred to rely on a blended learning approach, where some distance and/or face-to-face learning and online learning techniques were implemented. In China, a cloud-based, online learning and broadcast platform was introduced and the broadcast of live television networks, to give students access to learning material. Students also received free data to access these sites. In Hong Kong, a consortium of educational organisations came together to form a platform where educational assets (such as videos, books, assessments, and counselling) can be shared. In Lebanon, students shot and sent their videos of athletic training to their teachers. Populations across the globe are coming together to find educational solutions and innovations (Coman et al., 2020:1).

Although VR has the functionality to let students sit in a virtual classroom and attend classes hosted by the facilitator, the slow pace of change in academic institutions prohibited the use of VR in 2020 to use as a medium during the corona epidemic. This is mainly due to the accessibility of all students having access to their own personal computer at their homes in less developed countries as well as the readiness of facilitators to use (and understand) the VR software and how to create lesson plans.

2.10 Summary

There has been a significant shift in HE from a more prescriptive view of learning to an immersive environment in which student can engage, feel, and experience. Student

engagement has enjoyed much attention since more edtech tools become available (such as VR), which will fundamentally influence the way students learn and engage with their studies.

As alluded to in this chapter, student engagement is a multidimensional concept whereby emotional engagement involves interests, values, and overall emotions; cognitive engagement considers motivation, effort, and persistence, and behavioural engagement includes following rules, directions, and principles of the work.

It is evident that student engagement plays a successful role in student academic success of students enrolled in HE. The concept of student engagement being a predictor of a student's academic success provided the framework to examine how students engage with South African HEIs. An engaged learner is active in their learning, eager to participate, willing to expend effort, motivated and inspired. Students in HEIs are more likely to be engaging in their studies when they are motivated by the opportunity to explore new things. This will result in students obtaining better results and will ultimately assist the Department of Higher Education in South Africa in reaching their targets for completion rates of various levels of qualifications.

HEIs are urged to renew their focus on how to increase student engagement as disengaged students will produce poor pass rates and higher dropout rates. If educational institutions fail to change their teaching and learning pedagogy, curriculum and assessment strategies, academia will fail students and, in the process, add to the disengagement of students.

In the next literature chapter, the concept of virtual reality is discussed.

CHAPTER 3: THE CONCEPT OF VIRTUAL REALITY

3.1 Introduction

A few years ago, virtual reality (VR) was only used by a selected few and was by far too futuristic to be used in education. However, in recent times, the use of VR has rapidly evolved and a preferred learning tool in the field of education. VR provides exciting avenues for students to engage. An impressively long list exists for the areas in which VR is used in various subject fields. VR used in education proves to be remarkably successful, as supported by the studies which will be discussed in this chapter.

With the development of new technology, new demands are placed on HE to adapt to the technology available in the fourth industrial revolution. Often lecturers must deal with students who are bored and disengaged and very often fail to understand the need to learn the topic. With the use of innovative education, such as VR, content can be presented in a new way and a redesign of the way lecturers teach is now possible. VR brings a whole new dimension to education and is much needed in teaching and learning. Though VR students can take responsibility for their own learning, by being in the immersive space and interact with the learning objects.

In this chapter, the study will focus on defining VR and discussing its evolution. Due to the nature of the study, it is important to emphasise how VR can benefit the student during teaching and learning. Various advantages and disadvantages in VR will also be discussed. The study will further focus on approaches to successfully design and implement VR applications, as well as the challenges experienced by developers. Incorporating VR into teaching and learning has generated a great deal of interest in tertiary institutions and therefore, the study will further examine the laws that are set for VR in HE.

Apart from the international developments in VR, the study also focuses on the development of VR in the South African landscape. There is a lot more attraction from the South African universities to experiment with virtual learning platforms and by creating authentic VR scenarios that are too dangerous for students to experience in real life. Finally, this chapter will discuss how the use of technology in training is gaining momentum worldwide and its positive effects on student engagement.

3.2 Defining virtual reality (VR)

From storytelling to modern technology, such as VR, developers have tried to capture their audiences by making them feel present in an alternate reality that is created (Sherman & Craig, 2019). VR is defined as a tool for immersive learning, which means that it is a resource

that can take individuals to an interactive learning environment where they can have 360-degree views, physically or virtually (Savickaite et al., 2022:1; Uptale, 2020).

In support of the above view, Aczel (2017) adds that VR mostly refers to “all non-physical stimulated complex media that are generated and maintained by a computer”. The users of VR will have a sensory experience (Sherman & Craig, 2003:13, cited in Aczel, 2017:3). Educational VR can also be defined for its need to learn, extend knowledge, obtain credible information, and connect with other users (Aczel, 2017:9). In table 3.1, the characteristics of VR are illustrated when compared to traditional desktop use.

Table 3.1: Desktop paradigm versus virtual model
(Source: Aczel, 2017:3)

Desktop Model	Virtual Model
The user’s activity is symbol processing	The user’s activity is reality generation
The user views a monitor	The user wears computer gear (VR goggles)
The experience is symbolic (conventional, abstract)	The experience is experiential
The surface of the presence is an interface	The presence is inclusive, immersive
The representation is visual	The presentation is multimodal

In the context of table 3.1, using a desktop model for learning, the computer will make use of symbols to create a message that will be displayed on the user’s monitor. The experience would also be symbolic, meaning that it is predictable. With the use of a desktop, the computing is interfaced, meaning that there is an exchange between two or more components, such as computer software, or computer hardware, or even with peripheral devices and humans. By nature, the representation would be visual when using a desktop.

In a virtual model experience, the user’s reality is generated to believe the user is in the ‘real’ life. Users need to wear computer gear, such as a VR headset or goggles. The VR platform is an immersive experience, and the learning is presented in a multimodal format, meaning that images can be presented with tags or text explanations to have a clear message to the user. From table 3.1, it can be deduced that VR creates an enjoyable experience for the user. The advantages of this software are listed below.

3.2.1 Advantages of VR-learning

One of the main advantages of VR is that students can study in their **own space and time,** as the learner does not have to be in the classroom to view the presentations. In addition, VR experiences can be repeated, and a user can pause an experience; therefore, the study mentions that the user can learn within his own space and time (Pirker, 2017:48; Checa & Bustillo, 2020:3).

VR experiences are created to **mimic the real world** whereby students can touch, feel, and experience certain learning objects and even visit places (ClassVR, 2018a). Even students' **social experiences** are enhanced as they travel in VR. Students can visit places where they are not physically in and get in touch with other students around the world. As a result, global barriers are broken , whilst students get the opportunity to learn **foreign languages** to communicate with other students in the virtual world (Engels, 2017:1). VR software is available also to switch the tuition language between different languages, thus making learning possible in any language (Hicks, 2016:1).

The learning experience created through VR is not possible to create through a textbook, online video, or pictures. **Learning is stimulated by 'doing'** (the student can practically engage with the learning object) and therefore a 75%–90% knowledge retention is obtained versus the 5%–10% non-virtual reality or traditional classroom retention (Mulquin, 2020:2). In using VR, a person can feel and experience everything that is happening in their surrounding (Modi et al., 2016) as a "real environment" is simulated to the user. Barron (2006:58) points out that using VR, **simulations are created** with the purpose to stimulate the user. Hence, increasing the engagement with the student. Therefore, VR **improved the sensory stimulus** of students and ensuring a good attention rate (Uptale, 2020:1). Aczel (2017:6) points out that VR further creates a stimulating environment where students can observe, participate, and create. It also assists students to take a complex object and be able to break open the layers of the object to gain insight and experience multisensory interactions.

In certain VR programmes, students can **create avatars**. Through VR a student is five times more engaged due to the use of avatars in which students can present themselves (Gregory et al., 2016:88). Using a self-avatar, a student enters an immersive environment where they can present, interact with others, and have the perception of space (Steed et al., 2016:67).

Lastly, learning whilst using a VR device does not feel like work, as students see objects before their eyes whilst learning **new information through visualisation** and this is exciting for students (Hicks, 2016:1).

The repetition through certain actions **feels safe for the user** and allows some failing attempts without any physical damage to the user. Educational VR is linked to the physical reality of a student where the student is given the opportunity to operate within this VR in a safe environment whilst exploring certain concepts (Aczel, 2017:6).

Ravet and Layte (1998:15) note that a significant advantage of computer-based training is that students can be placed in a simulated environment whereby the sense of being in a real place while touching real objects can be experienced. Students are in **continuous control of**

their movements in the virtual environment. Ravet and Layte (1998:58) refer to students as actors while being in a virtual world. Burns (2020:17) concurs with Ravet that with the use of VR students can be taken to places they have never been and thus making the student more curious and ultimately increase student engagement. Through students' eyes, their **emotional reactions are stimulated, and memories are formed** (Babic, 2019:1).

VR does not only have advantages for the student, but also for the lecturer. With regards to the planning of VR lessons, a lecturer can design new curricula, which can effectively enhance the facilitation and assessment of teaching and development in **various disciplines**. Lecturers are now being inspired to create new teaching and research ideas using VR (Moila et al., 2022:1).

A further advantage of VR is that in the classroom, **dangerous and expensive educational content can be replaced by stimulating users**' interest in the VR platform by creating user-friendly study material (Kim et al., 2017). In most cases the learning subject is not easily accessible due to geography, medical or dangerous tools; however, with the use of VR, students are able to do investigations of issues that might be too dangerous or even expensive in real life. These might include detecting fraud, conducting a medical operation or learning to fly an aeroplane (Gregory et al*.,* 2016:130).

The benefits are extended to the HEI as VR can **attract and retain students** and help prepare them for their careers (University Wire, 2020) through the practical exercises, students are performing on the VR platform. A few tertiary institutions have used VR as a tool where students are introduced to the campus environment. Students are provided with the VR link to enable them to walk through the campus grounds.

Apart from the above advantages of VR-learning mentioned, the study further uses the figure below to illustrate more advantages. Figure 3.1 illustrates the benefits of VR in education. As can be seen in this figure, through **global teleportation**, students are able to visit places that they are not able to travel to. The entire planet can now be viewed. The '**time machine effect'** provides students with the opportunity to travel back in time and visit incredible places that no longer exist – it depends if it has been recorded at the time and placed on a virtual platform.

Through **contextualised learning**, the learning object that exists outside of the class can be brought into the classroom, without having learners move out of the classroom. **Multi-sensory experiences** in VR also allow students to move in the virtual space and engage with various elements. A further benefit is that active autonomy where learners can direct their path within a **virtual experience**.

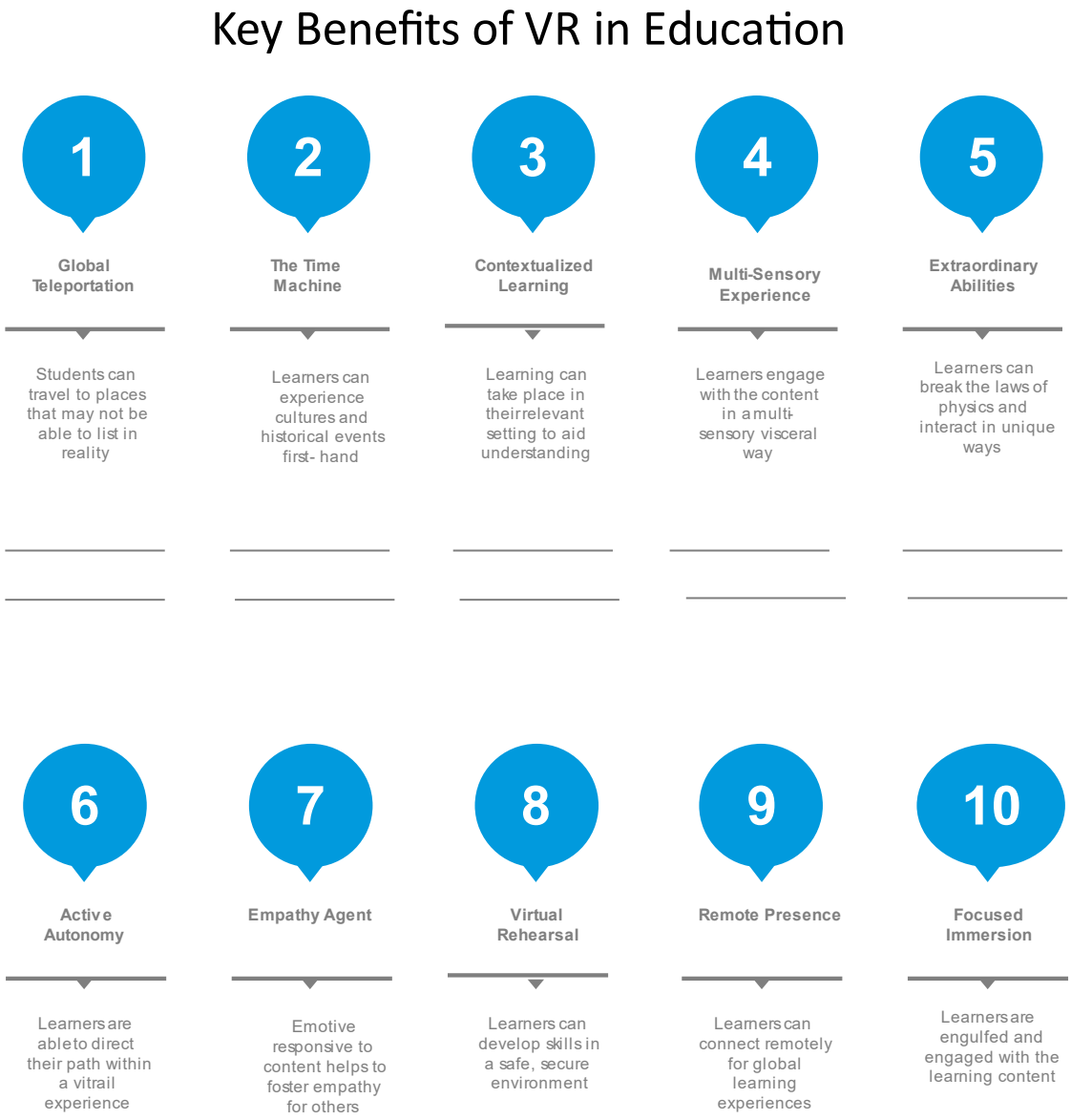

Figure 3.1: Ten key benefits of VR in education
(Source: VRFocus, 2020:1)

Using VR, even emotive responses by a learner can create a sense of empathy when viewing certain experiences, such as the sinking of the titanic and viewing the wreck. Another advantage of VR is the fact that errors can be made whilst you are practising a certain skill without any actual harm to yourself or the tools/resources you are using. A student, for example, can practice doing a heart operation in VR and make errors to see the effect of making mistakes in a real operation. Even '**virtual rehearsals'** is an ideal benefit for those students who are not able to be in the classroom. Students can connect with other students and the lecturer across the globe. This is ideal for when HEIs are unable to have the students in class, due to unrest or lockdowns. Lastly, a learner would be less prone to distractions due

to the very nature of VR and wearing the headset (VRFocus, 2020:1) and the eye's focus is confined to the headset only.

As noted in this section, VR is consistently evolving and can bring many benefits to education. However, a few disadvantages in using VR have been reported.

3.2.2 Disadvantages of VR in education

The first disadvantage, the study identified, is the concern with the **cost** of VR headsets and software. VR devices lend themselves to not be affordable to all students, due to the high cost of the headsets. If only the rich can afford VR, it will create inequality in education (Hicks, 2016:1). Mcllean (2004, cited in Aczel, 2017:5) agrees and notes that the use of VR hardware and software is still not functioning comfortably, and comes at an expensive price.

It is not only the individual who could find it difficult to afford, but also the institution. Not all HEIs might have the finances to invest in purchasing VR hardware alongside with setting up the VR framework. Building VR laboratories at HEIs is an expensive investment. A further burden to VR, is the maintenance of the VR headsets that HEIs will have to consider (ClassVR, 2018b). IN the case where the HEIs decides to develop their own VR framework, HEIs would need to appoint a VR expert that can teach lecturers how to use VR and build the lesson plans in VR, as the technology can be complex to many.

A further concern is the time available to setup a VR framework. Lecturers who choose to create their own VR lessons would need time to develop the content and lessons, which can be time-consuming (Meccawy 2022:1). The HEIs might wish to appoint instructional designers to take over this task, which will result in extra costs for the HEI. Meccawy (2022:1) adds that one of the main reasons for the poor adoption of VR is the lack of VR-learning **content** (learning material and assessments) as it is very expensive to develop at first. VR simulation is also time-consuming, adding to the development cost (Carvalho, 2014:538).

The question of **bandwidth** also needs to be taken into consideration (bandwidth refers to the connectivity and speed of a network). Data, compared to other countries, is quite expensive in South Africa (Bottomley, 2020:1). Universities, implementing VR in their teaching and learning would need to ensure that they have sufficient data and bandwidth so that there are no interruptions when connecting to the virtual world.

A further disadvantage to the use of VR is **the speed of updates** that needs to be taken into consideration. Due to VR being a relatively new concept in education, there will be several updates that the user will have to run frequently. Regular updates require the VR software to work optimally. If this is not done, there will not be a smooth running of the programme, and

this can irritate both the students and lectures. If students experience a disruption in their studies, students look interest (Hicks, 2016:2).

ClassVR (2018b) further cautions lecturers that the **emotional wellbeing of students** must be carefully monitored, as VR could have a negative effect on students' vision caused by the harmful sensory manipulation from the impulses. Side effects such as **dizziness and nausea** have been reported. Some motion sickness problems were also experienced by students, as reported in a study conducted by Checa and Bustillo (2020:151). This is due to the stimuli that are received by the eyes, are different from the stimuli received from the inner ear. Industry experts are working to reduce the motion sickness by investigating how additional brain-machine interface sensors can be used in the VR headset. Through this investigation, the goal is to seek ways how to detect when a user experience motion sickness.

As part of the study, Checa and Bustillo (2020:151) found that although VR provides students with the opportunity to learn with much freedom and flexibility, this **freedom can also mean that students miss out on important parts** of the learning experience. In his study, an introduction video was given to students; most students skipped the video and went on immediately to the virtual tour game. Thus, the disadvantage is students lose out on important information due to them skipping important sections in the virtual platform.

Another disadvantage to the use of VR in teaching and learning is that if the student is not clued up with the technology, it would be difficult to **navigate** through the VR platform, especially when the student is on his own. Like with many edtech software applications, things can go wrong during a student's learning activity, and this can become frustrating and inconvenient for the student (Hicks, 2016:1).

VR also reduces **physical connection with other humans** (Alpha Tango Delta, 2020). Maslow considers social interaction to be an important part of psychological development as relationships with others reduces anxiety. In a research study conducted by Mortell (2022:2), the evidence reflects the importance of students being able to interact with one another (and preferring contact learning above online learning) especially when there is an expert facilitator asking probing questions.

A final though on the disadvantages of VR is that **addiction** to technology remains to be a serious concern. VR, as with many other technologies, can become addictive to the user. If the VR experience is better for the user than reality, then the user will remain in the virtual world longer than what is required (LITSLINK, 2020). VR creates a momentary escape from the real world but the danger in this is when a student does not want to return to the 'real world' again, as the imaginary world that is created in VR, is much better. Students can get

obsessed with being in the virtual world. In summary, the study has now discussed the advantages and disadvantages of VR and will now move towards investigating the evolution of VR.

3.3 The evolution of VR

VR is forever evolving with new developments that becomes available. The below figure illustrates the major milestones that caused VR to be where it is today. Figure 3.2 presents the timeline of VR developments.

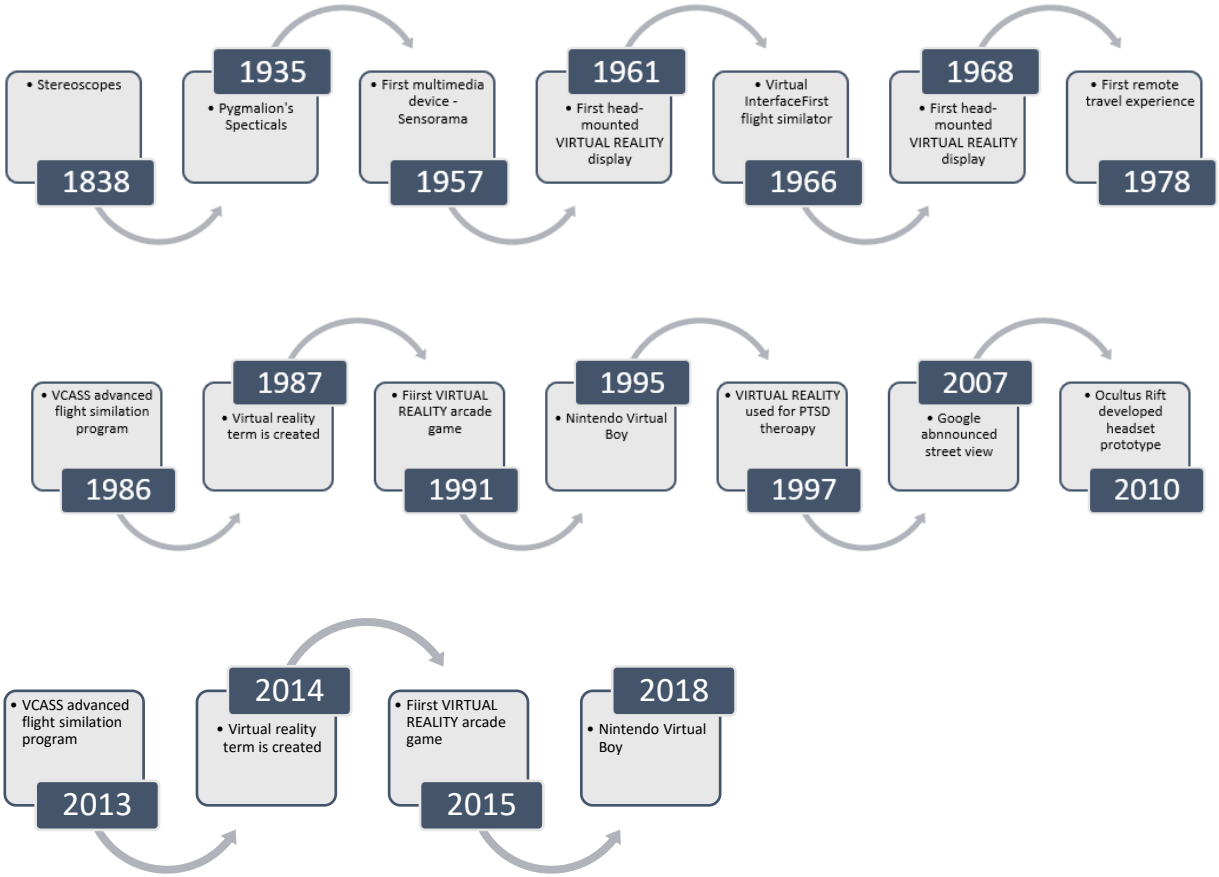

Figure 3.2: Timeline of VR developments
(Source: Poetker, 2019:1)

1838: The first steps towards creating a virtual experience were in 1838 when Sir Charles Wheatstone described *Stereoscopes*. These were a pair of mirrors held at a 45-degree angle to the user's eye, also known as binocular vision. This created depth and volume to the image the viewer looked at, as the brain combines two photographs (one eye viewing each) of the same object (Barnard, 2019).

1935: Stanley G. Weinbaum wrote an article in which a fictional model for VR was created. Weinbaum referred to it as the *Pygmalion's Spectacles* in which users who wear these spectacles have sight and sounds can taste, smell and touch. The main character, in this

fictional story, met a professor who invented the pair of goggles that allowed him to view a movie with sight, sound, smell and touch (Norman, 2020; Kei Studios, 2020). Below is a picture of the goggles created.

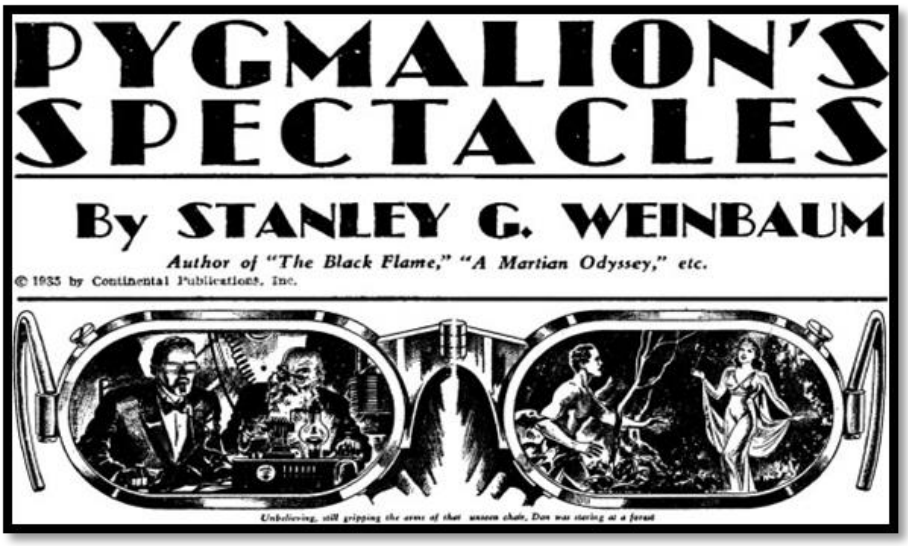

Figure 3.3: Pygmalion's Spectacles
(Source: Poetker, 2019:1)

1957: Morton Heilig, a cinematographer, who wrote the article "Cinema of the Future" build a prototype and named it *Sensorama*. Morton Heilig added layers of sensory stimuli to enhance a cinema presentation, which resulted in today's VR experience. The device caused the user's senses to be stimulated through sights, wavering fans for touch, devices that produced smells as well as audio speakers for sound (Poetker, 2019:1; Kei Studios, 2020:1). Below is an image of the Sensorama simulator.

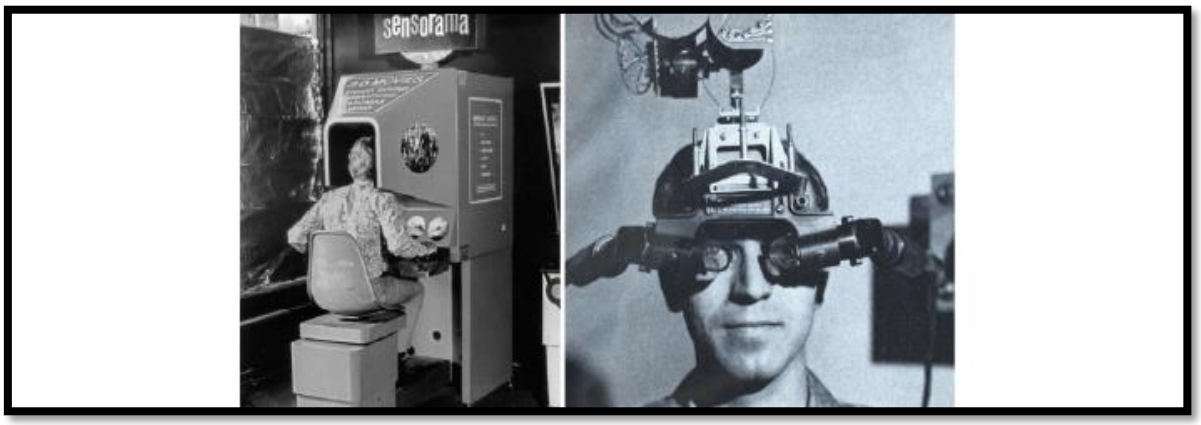

Figure 3.4: Sensorama simulator
(Source: Poetker, 2019:1)

1961: Two Philco Corporation engineers, Comeau and Brayan, were the founders of the first head-mounted display and named it the *Headsight*. Two video screens were displayed, one for each eye as well as a magnetic tracking device. This device was the first motion-tracking

device of its kind and allowed a user to see places without being physically there. Below is a picture of this device (Poetker, 2019:1).

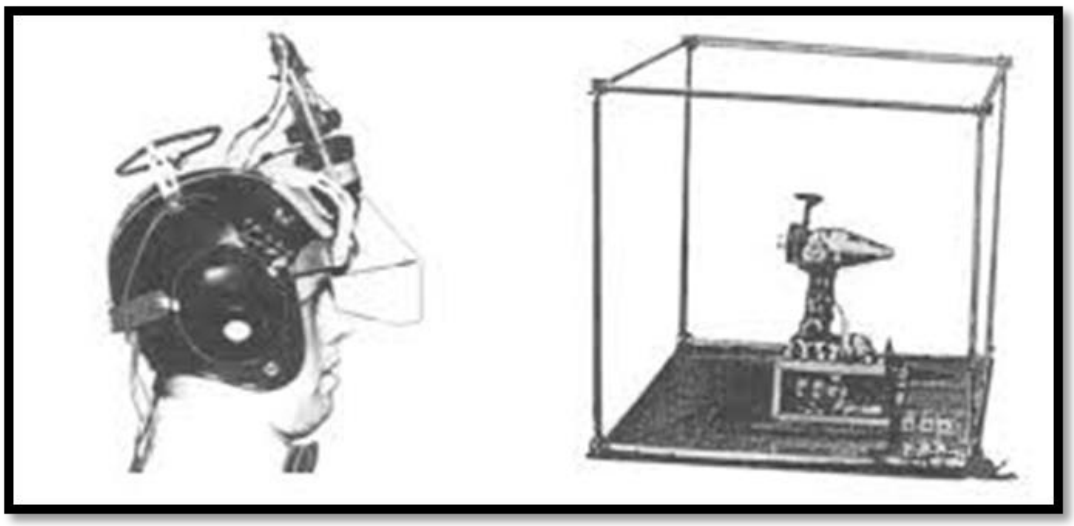

Figure 3.5: The first head-mounted headset
(Source: Poetker, 2019:1)

1966: Thomas Furness, a military engineer, developed the first flight simulator. It is from this innovation that much interest from the teaching and learning field has aroused (Norman, 2020:1).

1968: Furness's intervention was followed up by the "father of computer graphics", Ivan Sutherland, who reported the concept of the 'ultimate display' of objects and invented the first 3D modelling software. Sutherland and his student designed the *'Sword of Damocles'* which added graphic generation and computer integration (Norman, 2020:1; Poetker, 2019:1; Dormehl, 2017:1).

1978: The Aspen movie Map developed by MIT used photographs taken from a car in Aspen Colorado, to give viewers a 'surrogate travel' experience. Users could now travel through streets and even enter selected buildings. Michael Naimark created the viewer, under Professor Andrew Lippman at MIT's Architecture Machine Group (Norman, 2020:1; Dormehl, 2017:1).

1986: Furness, who invented the 'Sword of Damocles", continued his work and created an air force simulation, between 1986 and 1989, which gave pilots a virtual view of the magnitude of information pilots would need to know. This invention was named, the *Super Cockpit programme* (Dormehl, 2017:1).

1987: A computer scientist and researcher, John Lanier, created the term ‘virtual reality’. He was also involved in the development of VR gear and the selling of VR goggles (Poetker, 2019:1).

1991: This is when the use of computer games became very popular – thus creating real-time simulations in a 3D-gaming world. The Virtuality Group developed a series of games and arcade machines, which made VR very popular with the public. Users wore VR goggles while playing immersive games (Poetker, 2019:1).

In the same year, Alan Hunter introduced the Sega VR headset Modi et al. (2016). This would be the first headset being available to the public to purchase and had a visor-like look, similar to Robocop (a popular film at the time) (Norman, 2020:1).

1995: What followed in 1995 was the Virtual Boy, a 3D portable video game console. This production of the device was stopped shortly after its invention, due to dissatisfaction from its low-level immersion, such as the lack of colour graphics, lack of software support and the fact that it was not comfortable to use (Norman, 2020:1).

1997: Researchers used VR to create war zone scenarios for veterans that were exposed to post-traumatic stress disorder (Poetker, 2019:1).

2007: Today, the legacy of Aspen’s Movie Map continues in the form of Google Maps, which was introduced in 2007. The images were created by a panoramic of images that were captured from a camera on a car that drove through the streets (Inventing Interactive, 2020:1).

2010: Palmer Lucky, at the age of 18, designed the prototype of the Oculus Rift, in 2010, which allows for a 90-degree field of view. Since 2016, consumer interest rose steeply. Businesses embraced the medium and saw opportunities where VR can be used for teaching and learning (Dormehl, 2017:1; Kei Studios, 2020:1).

2013: The Valve Corporation created a lag-free (no delay in the user’s action and the computer’s projection) VR content and distributed it to Oculus and other vendors (Poetker, 2019:1).

2014: Sony Corporation revealed the PlayStation VR. This is a VR headset that is fully functional with the PlayStation 4 and PlayStation 5 video games consoles (Poetker, 2019:1).

2015: A cardboard, do-it-yourself stereoscopic viewer was introduced by Google. A user can now place their phone inside a piece of cardboard to view the VR experience. Below is a picture of the VR Cardboard.

Figure 3.6: VR cardboard
(Source: Poetker, 2019:1)

2018: Oculus revealed the half-dome headset with a 160-degree field of vision for users (Dormehl, 2017:1). Since then, innovative ideas on how to develop VR became even more popular with its users. VR has developed a long way since stereoscopic glasses has been introduced, in 1838. New applications by tech companies will ensure that VR software is advanced even more to create opportunities in teaching and development.

Since 2018, the Oculus Quest, Facebook's standalone headset, has been introduced. Facebook's latest edition of VR headsets was launched in September **2020**; they called it the Oculus Quest 2 (Barnard, 2019:4).

Although the use of VR-learning has been steadily increased (mostly internationally), the intake of VR has not been adopted by many HRD professionals as a learning tool in the workplace. According to the literature available during this research study, the update of VR for teaching and learning purposes has only really taken momentum since 2018. Eon Reality, who is a global leader in Virtual and Augmented reality (XR) has announced in June 2022, that a new parentships with merSETA in South Africa has been signed. This partnership has entered the doors for many training providers to experience VR first hand and be able to build VR experiences (Eon Reality, 2022:1).

3.4 VR tools

The section introduces a brief description of VR tools available in the educational sphere. As pointed out earlier in this chapter, VR creates an artificial environment with the use of VR software. Users can navigate themselves in the immersive environment and this creates a feeling for the user of being in the real environment (Creware, 2019:1).

For this study, an EduPro headset was used, and the content (software) was provided by Veative Group. Many other resources are designed frequently, that can be added to the VR experience, however the study will only focus on the most used tools (or resources) a VR user will utilise.

3.4.1 VR goggles or headset

Figure 3.7: VR goggles or headset
(Source: Shutterstock, 2020)

The VR headset or goggles is the most important device in the use of VR. The device is a thick pair of goggles that goes, whilst the entry-level headsets use a cell phone clipped to the front of the headset (Dredge, 2016:1). VR users have complaint about the discomfort and even paid they experience while wearing the VR headset (Tauscher et al., 2019:3).

3.4.2 VR microphone

Figure 3.8:VR microphone
(Source: Shutterstock, 2020)

With the use of a VR microphone, a user will be able to communicate with other users that take part in the same VR experience.

3.4.3 VR hand controls

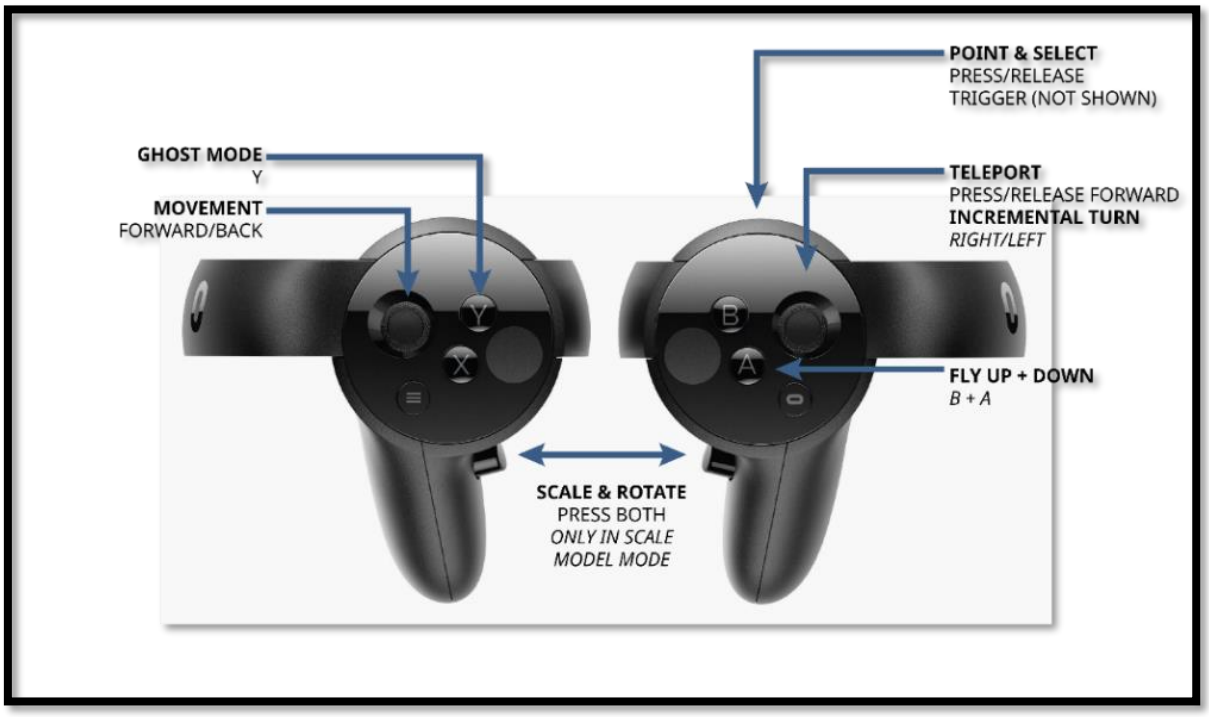

Figure 3.9: VR hand controls
(Source: IrisVR, 2020)

With VR, hand controls a user will be able to navigate through the virtual platform. In the case of desktop VR, students using a PC keyboard can also navigate themselves using certain icons on the desktop keyboard.

In this study, hand controls were provided to students to move, touched objects and conduct the assessments in VR. Oculus Quest has introduced a hand tracking tool in December 2019, (version 12.0) where users can use their own hands to click on an object. Users can use their thumb and index finger together for a click and touch and hold, to move around to scroll (Virtual Reality Oasis, 20219:1).

During an immersive experience (as per figure 3.9), students can use hand gestures and meet other VR users face-to-face in such an immersive environment by creating avatars, leading to an increase in student engagement levels (Birt & Vasilevski, 2021:5). Panigrahi et al. (2018) noted that students who engage with VR and make use of gestures with their hand controls are much more engaged as opposed to students who watch online videos (such as YouTube)—as most online learning platforms nowadays do.

Figure 3.10: Avatars used in VR
(Source: Podkosova et al., 2016)

3.4.4 PC/tablet/cell phone

Figure 3.11: PC/tablet/cell phone
(Source: Dreamstime, 2020)

Users who do not have access to VR goggles or a headset can also navigate within a VR platform through a personal computer, tablet, or cell phone. Though the VEATIVE platform, used in this study, the option is available for students to either make use of the VR headset or to perform the VR lesson on a desktop.

3.5 VR inventors' opinions

Even though there have been all these great developments, there are early doomsday predictions. Educational philosophers argued that the use of technology in education (or edtech as referred to more recently) and the workplace would be detrimental to the existence of humans and would dehumanise people (Mumfort, 1934, cited in Buckingham, 2007:40).

It is reported that Jacques Ellul, a Christian philosopher (1964) saw technology as a threat to human freedom (Buckingham, 2007:40). In 1986 Theodore Roszak attacked the incorporation of machines and note that it will kill creative thinking, following by Boweres (2000,

Buckingham, 2007:40), the educational philosopher who also criticised the use of computers in education and note that socialising of students will decrease due to the use of technology (Buckingham, 2007:42). In addition, it is believed that technology can have a negative psychological, social, and physical effect on users.

- Physical health issues can be anything from vision problems to hearing loss, even a neck strain.
- Technology can also have negative repercussions on social issues, such as a person who prefers to only spend his time with technology can demonstrate a sense of isolation and defects in social skills. Such a person can even show signs of depression.
- Psychological issues that can be caused by digitisation is when users expect instant gratification, even develop signs of narcissism, and can have cognitive losses (Digital Responsibility, 2020:1).

According to Dr Kato, a psychiatrist working in Japan discussed the depressive and obsessive-compulsive tendencies in some humans, while they “appeared to be addicted to the internet”. Kato (cited in Kim, 2015:2) reported many cases of humans who committed suicide after consecutive hours spent on Internet games. In 2009, a three-year old, passed away from malnutrition and dehydration after spending 15 hours a day on an internet game (Kim, 2015:3). Kim (2015) alluded to the following: “Researchers believe new immersive technology could lead to isolation, but maybe when social needs are met online, people will not need in-person interaction as much”.

In conclusion , it is important to note these different views as the research outcome is to build a theoretical framework for increasing student engagement with the use of technology, especially that of VR. The study would need to take these opinions into consideration for the development of the framework. In the next section, the study will focus on the different types of immersive VR.

3.6 The various types of immersive VR

VR is used to create immersive experiences that are used to help users experience the real world. Poetker (2019:1) explores three types of immersive simulations. It is important to investigate these three types of immersive VR experiences, as it relates to the research objectives of building a framework to increase student engagement using VR.

3.6.1 Fully immersive VR

Within a fully immersive VR state, the user has the feeling of being immersed in another world by using special equipment, like helmets, gloves, and special suits. Uptale (2020:2) adds that Immersive VR (or learning) replicates what happens in real life to help students practice

certain skills and techniques thus making it easier for students to remember what they have learned.

Humans mostly communicate by the means of gestures which is available in VR. The output channels of the human body will correspond with senses, vision, hearing, touch, and smell (Modi et al., 2016). Vision is a human's most dominant sense and is critical for the experience of VR. Sound can also be used as an additional source of sense; however, when vision is absent then the presence of sound can be linked to a 3D space or computer.

A VR headset is used to promote tracking for the VR device using magnetic transmitters. Through the magnetic transmitters, eye tracking can be used to determine the direction, which the user gaze and the VR simulation will focus on that area. Both the human senses, together with the VR hardware, are then combined with interactive software applications to ensure a real-time VR (or fully immersive) experience is created (Savickaite et al., 2022:3; Modi et al., 2016).

Apart from human senses, there are also different types of immersive setups or degrees of freedom (DoF), that are determined by the type of VR headset. When it comes to VR, there are two (2) types of degrees of freedom. The first and most common type of VR degrees of freedom, are the 3 degrees of freedom (3DoF). 3DOF refers to the tracking of the rotational motion being, pitch, yaw and roll which can be thought of as moving forward or backwards, moving up or down or left or right.

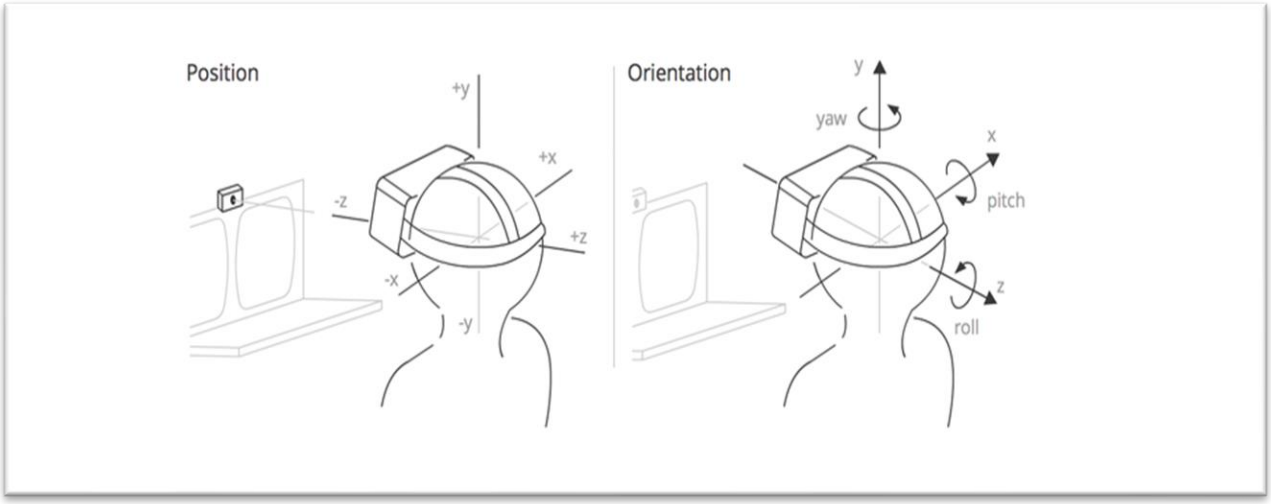

Figure 3.12: 3DOF
(Source: MDN Web Docs, 2019)

Finally, a VR experience can be created via 'positional' 6 degrees of freedom (6DoF). With 6DOF, both the user's position and rotation can be tracked (Hultman & Leijon, 2013:63). VR

goggles can be used to angle a person's head and allow the person a 360 degrees' view of his or her surroundings (Barron, 2006:58).

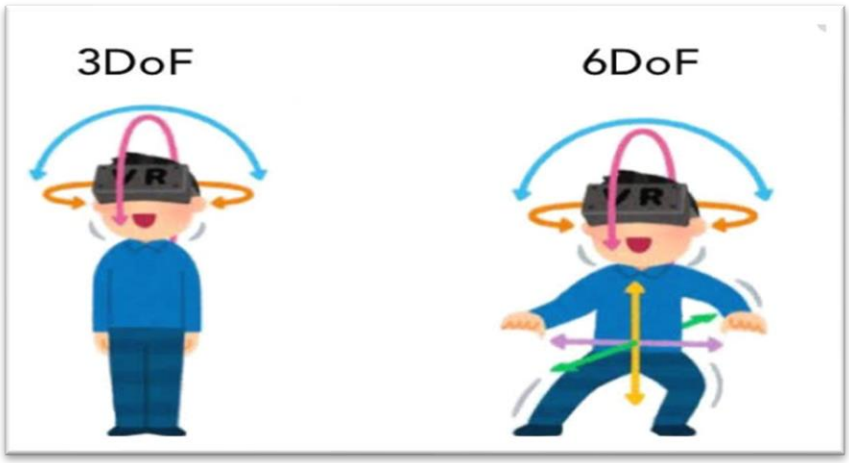

Figure 3.13: A comparison between 3DOF and 6DOF
(Source: Heaney, 2019)

To summarise, an 'all-in-one' VR setup is when a student will use VR goggles and have a 360% view. The degrees of freedom, namely the 360% degrees refer to the number of rigid objects that can move through a 3D space (Google VR, 2019:1).

"Positional" 3DoF means the user is seated and is only able to use head tracking and have rotational movement. Whereas the "positional" 6DoF, is where the user is standing, resulting in a user being able to use head-tracking by utilising both position and rotation (Google VR, 2019:1). All these movements are regarded as fully immersive for the user.

3.6.2 Semi-immersive simulations

The next immersive experience (semi-immersive) is created when a partial virtual environment is designed for users to interact with. The user experiences virtual 3D environments while remaining in the 'real' world. This is mainly used and very effective in teaching and learning purposes. It would be important that the designers of semi-immersive simulations ensure that there is a great deal of graphics in the VR platform to make the simulation feel real (Tsyktor, 2020:1).

Projection VR is such an example. This is where a large screen is used to project a view of a virtual world. VR can be experienced via a 3D projection. Users will wear 3D goggles to visualise architectural walkthroughs and experience the virtual world as if they were present in real life (Stereoscape, 2019). In another example, semi-immersive simulations are used for flight simulation. The instruments they will use inside the cockpit are real, however, the windows and displays they see, are virtual content (Poetker, 2019:1). Another example is a Formula 1 simulator, in which a user will sit in a true size car model with a steering wheel, but

the racing track will be in a virtual environment. Semi-immersive VR is also used when training machine operators, as they would require a lot of training before operating the expensive machinery for 'real' (Tsyktor, 2020:1).

3.6.3 Non-immersive VR

Non-immersive VR is commonly used in video games where the user is sitting in a physical space interacting with a virtual one. The visuals are portrayed on a desktop screen. Desktop VR is where the computer screen is used as a window to open the virtual world. This is one of the simplest ways to engage with VR and education as students can use their own devices, such as a tablet, smartphone, or computer (Uptale, 2020:5). By using a tablet or a smartphone, students will be able to use their fingers across the screen to walk through the entire VR environment. Students who wish to work with a computer can click and drag their cursor to explore images and objects in the VR environment (Uptale, 2020:5).

Berki (2018:1) conducted a study in the use of Desktop VR that is used with a normal Google browser, such as Chrome to determine the students' performance. Two groups (control and uncontrolled group) had to conduct a certain task, only one group were to use VR as a visual application to complete the task. The outcome was that the group that made use of VR had a much higher success rate of recall when compared to the group completing the task without VR visualisation, even though only a desktop virtual application was used. A further study conducted by Modjeska and Chignell (2003) also used the Desktop VR platform for an enjoyable immersive experience for users to test how user-friendly it is for users to navigate through the different learning experiences on the VR platform. Users rated the VR Desktop application as having a moderate-to-good sense of presence (Modjeska & Chignell, 2003:8).

Lee et al. (2010:1) further note that Desktop VR is popular in education as it provides students with real-time visualisation that is relatively cheap to obtain. Students will make use of a keyboard, mouse, joystick, or touch screen to experience the VR-learning platform using Desktop VR (Lee et al., 2010:1). Salzman et al. (1999, cited in Lee 2010:2) illustrated a conceptual framework of the outcomes and their causal relationships when using Desktop VR. It is important to know how these different types of VR simulations can be used in teaching and learning. This will be discussed in the next section.

3.7 When VR meets higher education

Various studies have shown (Wickens, 1992:2; Aczel, 2017:1; Alraizzah et al., 2017:2; Savickaite et al., 20212:2; Schoenlein et al., 2020:1; Sakaki et al., 2021:1; Richer et al., 2022:1) that when 'virtual reality' and 'teaching and learning' meet, endless possibilities for experiential learning are created through creative problem-solving techniques (within a flexible environment) that are possible (Gregory et al,. 2016). VR has the potential to enhance

collaboration between the learner, facilitator, classroom, and/or learning objects, which is much needed in HE, in an endeavour to reduce disengaged students.

With the enormous investment in educational technology (edtech) (Wenglinsky, 2005:43), the world is engaging rapidly with studies on how VR can be used to increase student engagement in the classroom. Some of the advantages to HEIs who takes on the opportunity to transform the way they teach; gain more efficiency and flexibility in the way they teach students. As mentioned previously, students are also more likely to have increased engagement levels as they enjoy the immersed learning environment.

Barron (2006:4) cautions that integrating technology into teaching and learning can be a frustrating, time-consuming, challenging, and expensive exercise. Yet, Burns (2020:7) believes that students who are unfamiliar with a topic will gain much more insight into a topic with the use of VR as opposed to reading a textbook. Students want to experience what they read. Therefore, VR awards students the power to scale objects in science labs and visualise complex functions/or objects to make easier sense of them (Babic, 2019:1; Wittenberg, 1995:12). Below are some examples where VR is used in teaching and learning:

- Research conducted in Europe and Britain measured the success of students when using VR for teaching students how to work with money. **Virtual *supermarkets*** were developed, to teach students monetary skills and independent living (Ravet & Layte, 1998:112). Students had the opportunity to search through shelves via the VR tool and placed the goods into their trolleys, which could be pushed through the checkout points. At the checkout points, a series of coins appeared in the student's hands, which was needed to pay with.
- Following on this trend, Williams (2016:19) adds that the first VR **retail store** was opened in 2016 by Myer, as an Australian retailer. Customers are able to view the products in the store wearing a VR headset, make their selection by gazing at it the item and then it is regarded as sold.
- **Field trips** can be done via the use of VR (Engels, 2017:1). An experiment conducted on Europe and Brittan's students was to transport students to St Moritz where students had the leisure of skiing. With the use of a joystick, the student could accelerate, jump, and control the skiing experience (Ravet & Layte, 1998:113).
- Through VR, students can now learn a new language without having the expense to travel to the country and spend time there, or even to purchase a book to learn the **language**. Stenger (2020:1) describes that VR immersion is one of the best ways to learn a new language.

- The Sevenoaks School in the United Kingdom used VR to teach students philosophical theory. Students were given VR headsets and could then feel and experience first-hand that life is nothing more than a **simulation** (Stenger, 2020:1).
- VR has been used very successfully for **students with special needs,** as the visions and sounds experienced by the students in the immersed environment sparks their imagination (Stenger, 2020:1).
- In 1992, a project "**medicine** meets virtual reality" was launched for researchers utilising IT to improve the diagnosis of patients as well as training staff (Westwood et al*.,* 2013:2).
- Virtual reality has also been used in **treadmill training** to improve body strength, balance and muscle strength in children with cerebral palsy (Cho et al., 2016:213).

The above are some examples of where VR was used in teaching and learning. However, there is no sector in the world where VR cannot be deployed to assist in the teaching and learning.

The promises for distance learning (correspondence learning) institutions using VR, seems promising as the gap between the learner and the facilitator can be reduced (Babic, 2019:1). Babic (2019:2) further explains that facilitators will be able to enter the virtual room, similar to what the student would do in a classroom and be able to interact with one another. Huge opportunities exist for VR in training, as students will be able to learn concepts while doing (acting out) the actual concepts. Students are inspired to discover new concepts (Adobe Blog, 2019). Rowan and Grootenboer (2016:1) also point out that with the use of cross-device learning platforms (where students can work on more than one e-learning platform) student engagement is increased.

An opposing view from Lambert et al. (2014) is that adult students are most often described as non-traditional, meaning that if they are over 25 years old and part of a traditional HEI, they tend to not easily conform to new teaching methods. A paradigm shift in students had to happen during the COVID-19 epidemic, as the majority of HEIs had to revert to teaching and learning online. It is unfortunate that students who do not accept to undergo a metamorphosis, may feel disengaged during the implementation of a new mode of delivery, such as VR-learning. Too much information over a short period can leave students disengaged and confused about what they are learning (Adobe Blog, 2019).

The SABPP is responsible for transformation and skills development, as mentioned in their People Factor Strategy for 2020–2030. Much emphasis is put on developing knowledge with regards to 'digital HR and productivity'. Through implementing VR as a learning tool, VR designers can crease immersed learning experiences to assist HR workers to understand

digital HR initiatives. By implementing VR in HE, foresight is embedded, which is another people factor strategy of the SABPP (2022:1).

In summary to this section, the information presented alludes to the fact that although there are numerous benefits to VR-learning than to traditional learning, a HEIs would need to take all facts into consideration before simply changing the mode of learning to VR 'only'. This brings this study to explore the challenges that exist when designing VR software.

3.8 VR design challenges

During the development stage of VR-learning, there are some accessibility challenges (experienced by the users) that need to be taken into consideration. Gregory et al. (2016:89) note that there is reluctance by users to accept VR as an educational tool and perceive it rather to be used in a 'gaming' environment. Adversely, technical problems with the VR headset or software can be time consuming and has caused frustration for the user.

Some of the major challenges in the design of a VR experience is the cause of motion sickness that some users experience. Designers need to be aware of this discomfort user experience when designing (Checa & Bustillo, 2020:151). Further challenges students experience during VR is the potential for distractions. This will occur when there are too many graphics, which removes the importance of the main object of learning. Designers need to remember to create a convincing and realistic environment that supports learning and student engagement. The designer should also keep text to the minimum, as it may be stressful on the users' eyes. Interestingly, in VR there is very little privacy for students, especially when they interact with other students and presenting themselves as an avatar. The authentication of users using the VR platform is a concern to lectures, as they cannot identify who is who in the classroom (Gregory et al., 2016:89).

Another challenge in the design of VR lessons is the cost. The cost depends on factors such as the complexity of the lesson, the hardware being used, the level of interaction required from the student. Designers and HEIS need to decide the level of VR engagement they are going to introduce to students and dependant on that the cost will be created (Marks &Thomas, 2022:1).

Despite the growing interest in VR, educators still struggle when trying to implement VR in the classroom as they are unaware of what the design and development considerations should be when implementing VR (Hanson & Shelton, 2008:118). Literature confirms that with the pace of VR adoption in HEIs, factors such as training for implementation, cost and other hurdles will become less created (Marks &Thomas, 2022:1).

It is not only the virtual software that poses challenges, but also the hardware. Elliott et al. (2018:2) continue to state that the design of the headset in size and weight remains to be a further prevalent challenge. One can imagine that a lighter headset would be more comfortable for students to wear. Gregory et al. (2016:88) concur with Elliott et al. (2018:2) and note that throughout the design phase it is important to liaise with the end-users (the person interacting with the VR system), the authors (who write and design the VR platform) are not the main users.

Babic (2019:1) explains that when creating a VR experience for a student, the following concepts should be taken into consideration:

- Firstly, designers must create the VR platform in such a way that it is fully immersive – meaning that the user will experience the VR platform as if in real-life.
- Secondly, the platform must be easy to use by the student.
- Thirdly, it should be meaningful for the student, they should be able to find the experience exiting while learning and being curious about the topic at hand.
- Fourthly, the VR platform must be adaptable for the student to explore new concepts in his own time and space.
- Finally, and perhaps most important, the lecturer must be able to measure the performance of the student throughout the learning process.

To assist with the design challenges, it is further recommended that the designers make use of the following principles:

- **Use immersion:** Students should be able to experience real-life feelings when using a VR application. With the use of VR, students are taken to a state of immersion without the necessity to be fully engaged. Pirker (2017:30) notes that with the use of immersion, concentration and involvement of the learning setting are increased as students are motivated by the VR immersions. To be fully engage in VR an engaging sensory experience are created.
- **Ease of use:** The application must be user-friendly for students to navigate.
- **Meaningful:** The experience must teach students the subject and stimulate their cognitive behaviour.
- **Adaptable:** Students need to be granted the option to study at their own pace.
- **Measurable:** The application must be measurable so that lectures can track the progress of students (Adobe Blog, 2019).

To add to the recommendations, Hanson and Shelton (2008:121) note design steps that should be considered when creating a VR lesson plan or platform.

Table 3.2: Basic steps in the design process
(Source: Hanson & Shelton, 2008:121)

Design Process Steps	Description
Articulate expectations	• State how the conceived lesson plan will be enhanced when using VR • Sate what the user needs to see, hear, and feel in the virtual world
Become familiar with VR	• Research articles and textbooks • Contact colleagues that are familiar with VR • Contact leaders in VR • Investigate open-sourced VR toolkits and applications • Start networking and making professional connections
Evaluate design considerations	• Design of the virtual world • Level of desired immersion • Modes of sensory feedback • Degree of user interactivity
Consider necessary resources	• Intellectual capacity for VR technology • Funding resources and amount of funding needed • Write funding proposals

In summary, well-designed virtual environments meet three criteria: They (i) permit students to experience a high level of presence, the VR session must be (ii) interactive, and VR should be (iii) autonomous (Hanson & Shelton, 2008:119). It is important to note these challenges and recommendations in this study, as it would assist the researcher in designing a VR-learning framework that will increase student engagement which will contribute towards the HR body of knowledge in terms of training and development.

3.9 Guidelines to implement VR in HEIs

With the increase of social networking through VR, the ‘unreal’ environments are becoming increasingly important for users living in the ‘unreal’ world. If the ‘real’ world is governed by laws, the ‘unreal’ world should also have rules (Lastowka & Hunter, 2004:12).

In the virtual world users often find themselves in magical places where wonderful things can happen, such as a user being an able to fly and to even manipulate his/or her physical appearance. HEIs need to consider some key questions before implementing VR as a learning tool. Gregory et al. (2016:275) mention a few questions that should be taken into consideration.

- How the intellectual property that is created with VR, should be protected? In other words, if one lecturer at a certain faculty creates virtual content, should the intellectual property of that lesson remain that of the developer, or can it be shared on social networks? (Latifi, 2018:2).

- If students develop VR content, should that intellectual property be that of the student or the university? Institutions should write up a policy around this matter.
- Should multiple students develop intellectual property within the VR environment, who is the owner of that property?
- Are student's speech, avatar and images protected? This involves students choosing an avatar to hide their identity. Virtual worlds can become spaces in which students exercise their free speech rights. In the case of hate speech used, the universities should implement a policy to prohibit such speech, although it is also covered by domestic law (Cheong, 2022:3).
- Can a video recording be made of a virtual classroom without the students' consent? For ethical reasons, students need to be made aware of any recordings being made of them.

The above questions are closely aligned to the Protection of Personal Information Act 4 of 2013 (POPI) of South Africa which promotes the protection of personal information processed by public and private bodies (South African Government, 2013). Using the internet and VR, companies and governments can identify a person's digital profile and reveal their 'world habits' (such as internet sites visited etc.). Through coding that is recorded, parsed, and re-sold, a user's everyday life can be tracked (Fairfield, 2012:48). The only way that a person can prevent that their personal information is shared, is to avoid using the internet at all.

Not only is intellectual property a concern, but also the protection of the user's personal information. The trend among students is to create avatars in which a person can hide his or her identity. An avatar is created by the user for social interaction and can either speak or create 'speech bubbles' that float over their heads. An avatar can express themselves through appearances where the user chooses the face, clothes, and body shape (Lastowka & Hunter, 2004:3). Students, who create avatars that closely resemble any other person, indicating the job title, etc.—as per the United States laws as privacy rights prohibit third parties to use another person's name and likeliness (Gregory et al., 2016:283). Qin et al. (2022:2) note that from a legal perspective a user's identity determines their rights and duties. However, in the case that the user (student) creates an avatar, the real-life identity of the user would not be public. It would be the responsibility of the tertiary institution to ensure that a student's personal data are protected when using VR. A student's identity should be known to the university, regardless of what avatar or user authentication is used. This is to avoid a student replicating an avatar of which could potentially be that of the lecturer or even another student (Fineman & Lewis, 2018).

Qin et al. (2022:1) advocate for an international legal framework to be established that will promote collaboration between countries to complement legislation in the virtual worlds. It is imposed in China's copyright laws that users are obligated to first receive written permission from the VR creator before any copies of another person's work may be made. The educational institution, wishing to use existing VR content, should therefore request permission from the user who created the VR platform, before using the virtual content (Gregory et al., 2016:283).

In conclusion, Kennedy (2009:12) states that the United Kingdom are considering setting up legalisation for virtual worlds. There is a disconnect between a user's virtual identity and the physical world and this complicates the law around virtual worlds (Qin, et al., 2022:12). To ensure harmony in the virtual world, consensus on the rights and responsibilities of users and VR designers should be reached. At the time of conducting this study, there could be no laws found that South Africa created around VR used in educational institutions.

Overall, the legal landscape for VR is still in development. However, it is important for developers, users and HEIs to be aware of the legal implications of using VR and creating VR experiences. In the next section, the study will focus on the deployment and use of VR in South-Africa, given the literature available at the time of this research study.

3.10 The VR South African landscape

Using technology in South Africa is increasingly becoming a trend. Most HRD practitioners working in training and development are becoming more inquisitive about the use of VR-learning. It is relatively expensive to implement However, it is believed that the internet giants such as Apple, Microsoft and Facebook and Google are committed to reduce the cost as they further research and develop the product (Maseko, 2019:1).

The previous Minister of Higher Education of South Africa, Naledi Pandor, requested tertiary institutes to train students to be ready for Industry 4.0 as part of her budget speech of 2018. She then intended to set up a multi-sectoral task team to advise her on the opportunities of Industry 4.0 (Gerber, 2018:1).

In 2018, the first intake of VR within South Africa's educational system started in schools, , when the government piloted the introduction of VR-learning solutions in government schools, especially in subjects such as mathematics, science, and technology. Students in South Africa were able to travel to New York and look at the Statue of Liberty, took a train ride and learn about the concept of motion and even looked at the production of oxygen through photosynthesis of a leave (Businesstech, 2018:1).

Shortly thereafter in 2018, the University of the Western Cape (in partnership with EON Reality) was the first university to launch an accredited postgraduate diploma in e-skills including VR immersive technologies. The objective of this diploma offering was to facilitate an immersive environment across a broad range of disciplines. Professor Bagula, head of the Computer Science Programme at UWC indicated that all sectors of industry are planning to use VR to increase their productivity (Businesstech, 2018:1).

In a paper written by Jantjies et al. (2018:3),), the authors explore the option of VR being used as a resource for the students to do their workplace practicals. Certain academic programmes require students to complete experiential learning (or practicals), which can be expensive and sometimes inaccessible . Thus, supported by South African universities, the new pedagogical tools, VR could serve as a learning tool. Again, this relates directly to the HR competency-based module, in which innovation is a core competency.

At the time of conducting this study, no policies and procedures could be found to regulate VR in HE. Given that VR is a relatively new learning tool institutions will have to create policies and procedures around the use of VR in higher education. However, Milpark Education, a private HE in South Africa, has implemented the following etiquette to guide students who are studying online, addressing matters such as:

i) Considering fellow students in the online class, especially when making contributions or responses.
ii) When users are on social media sites, they tend to speak freely and sometimes without limits, therefore the learning domain must be respected, and social chats are not appropriate in discussion forums.
iii) When a student participates in an online course, the student must remember that he or she is not anonymous.
iv) Students are encouraged to make positive contributions that will increase engagement with other students and the learning.
v) The guide further notes that emotional outbursts must be contained. Students must take time to respond to the contributions of other students.
vi) Lastly, during the online introductions and discussions, students reveal personal information, and fellow students must respect other student's privacy (Milpark Education, 2020:1).

In terms of availability, quality, or cost, no one VR device is best suited for the South African market, when compared to other international countries. It will all depend on the affordability and suitability of either the individual or the HEIs. Notwithstanding the importance of the experience VR has for students, this study investigates the devices used together with VR

to decide on the most appropriate devices to be used in the framework the researcher will build.

3.11 VR devices available for educational purposes

In this section the study identifies the number of devices and approaches developed throughout the years for educational purposes. At the time of publishing this thesis, the following VR devices were popular for the use of VR-learning.

3.11.1 Google Expeditions/Cardboard

Google created the Google cardboard VR device that they recommend being used in teaching and learning. The cardboard viewer let the student practice an immersive experience (Google for Education, 2019).

Table 3.3: Advantages and limitations of Google Expedition (Source: ClassVR, 2018b)

Advantages	Limitations
Low equipment cost	Requires mobile device
Tether free operation	Physical set-up takes time
Centralised content delivery for expeditions	

The Google Cardboard is a platform that is designed to work with most smartphones. The cost of this platform is the lowest of all VR devices and a tether free operation can be installed. The Google Cardboard further has a platform with thousands of videos and applications for students to view. Students would require a mobile device and the physical set-up on the student's mobile device inserting into the Google Cardboard takes some time.

3.11.2 Oculus Rift

With the use of the Oculus Rift, students can experience a 3D audio-effect, rotational and positional tracking. The device is wireless, which makes it easy to not be constricted to one space. (EdTech 4 Beginners, 2019; Oculus.com., 2019). Table 3.4 indicates the advantages and limitations of the Oculus Rift.

Table 3.4: Advantages and limitations of the Oculus Rift (Source: ClassVR, 2018b)

Advantages	Limitations
High-performance device	PC required to operate
Headset positional tracking	Primarily used for gaming
Immersive experience	Expensive
	No curriculum content
	No classroom controls

The Oculus Rift is a high-performance device that makes use of a headset that can rotates in a 3D vision to create an immersive experience for the student. This VR set uses a PC as its engine and is used mainly for VR gameplay. It comes in as quite expensive in the market and does not include any curriculum content or classroom controls. It is recommended that this headset is only used by people 13 years and older. Google-Earth, Space -plus VR, Anatomy Explorer and visiting certain museums is one of their famous contents used for educational purposes (Newegg, 2022:1).

3.11.3 Avantis ClassVR

A stand-alone VR headset has been designed to include a student interface along with educational resources loaded on these devices for students to learn in 360 degrees (ClassVR, 2018b). The advantages and limitations of Avantis ClassVR are illustrated in table 3.5.

Table 3.5: Advantages and limitations of the Avantis ClassVR (Source: ClassVR, 2018b)

Advantages	Limitations
Low-cost /standalone system	No positional tracking
Classroom device and content management	
Curriculum aligned resources	
Ability to create own content	
Supports VR and augmented reality	
Web based portal	

The ClassVR comes with a headset that is already loaded with VR educational lessons which are aligned to the curriculum. Lecturers also can create their own VR content. However, there is no positional tracking, meaning no recognition of the rotation and recording of the translational movements. Curriculum aligned content is available from Grade 1 to Grade 12, with the content viewing being controlled and monitored by the teacher. Therefore, the student only has access to view what the teacher has planned for the headset.

3.11.4 Oculus/Meta/Facebook Quest

Facebook has a strong relationship with Oculus Quest, which was developed in May 2019, being the upgrade from the Oculus Go VR Headset with software. Content that users purchased on the Oculus Go could not be transferred for the Oculus Quest. With the introduction of Oculus Quest, Facebook users could now play and collaborate and share ideas with one another, in the VR community (Kraus, 2022:3).

In 2022, Facebook has rebranded its hardware and will now be called, ‘Meta’. The Oculus Quest production line will be known as the Meta Quest. Dolan (2022:1) argues that although the Oculus/Meta/Facebook Quest is a wonderful device that comes at a fantastic price, it is great for entertainment but not appropriate for education.

Dolan (2022:1) listed the below reasons why the Oculus Quest/Meta/Facebook Quest is not suitable for educational purposes:

- The need for a phone to activate an account before you can start with the VR experience.
- The setup process is requiring every student having a Facebook account (it is mandatory) and cell phone on a mass scale is a concern. This can be a breach on a user’s privacy as it is easily hackable. The Oculus Terms of Service 3.3, states that the user gives Facebook /or Meta the permission to use your name, profile picture and information of your actions. Dolan (2022:1) questions the reason why this would be applicable and needed for students who wish to be educated.
- Two controllers, an issue for special needs students
- 6 Degrees of Freedom (DoF) movement and special needs students.
- Students under 13 are restricted from using the device. This is therefore not suitable for all STEM modules.
- Oculus business terms state that this is “not for education”.

The Oculus headset brings forth a further concern, which is *privacy*. Users are aware of their privacy rights and how one should protect your privacy. Hawthorne (2022:1) confirms that with the Oculus Quest 2, “privacy online has been eroded”. This headset uses four cameras to locate itself in a room and further makes use of a microphone. The developers of the Oculus Quest can use this raw data to compromise a user’s privacy. The parent company of Facebook is Meta, who can use a user’s data to sell targeted advertisements to the user. Meta’s privacy policy states that it collects data from a user.

3.11.5 VEATIVE/EDUPRO

The VEATIVE headset is loaded with educational content. The VEATIVE team has created immersive environments for students to learn from. VEATIVE offers the world’s largest library of interactive, curriculum-aligned, VR content for STEM modules and HE. Along with their content, each module has clear learning objectives, an immersive learning experience and assessments within the VR environment. The team designed the EduPro VR headset that were built specially with the student and teacher in mind.

Veative Group (2022:1) indicates that each module that are designed attends to simulate concepts for approximately 10 to 15 minutes. During this time students connect with the

learning objects experientially, whilst having full control over the pace of learning, without any distractions. Veative Group further allows for assessments to take place in the immersive world and academics can retrieve learner data via a teacher dashboard. Furthermore, a teacher has the ability to pause learning by pausing all headsets, in the case of a group of students work going through the same module. To ensure an interactive experience for the student, VEATIVE created interactions suitable for each module. Below are some of the unique interactions that VEATIVE created (Veative Group, 2020:1):

- During a **walkthrough experience**, the student can take a detailed tour, which allows for a better understanding and improved retention.
- **Assessable** allows a student to look inside an object by virtually moving the objects, or parts of the object. For example, should the student want to view the different sections of the heart, the student can perform this task during assembly.
- **Disassemble** is dismantling the objects and exploring each part of the object. The student can move the object around to learn more about each of its functions.
- The **Drag and drop** feature allow for a student to develop ownership of the interactive module. This is often used in complex mathematical equations, when ‘dragging’ and ‘dropping’ the parts of the equations and finally forming the complete equation.
- **Hotspots** are used in modules where the student will find himself in an extensive area, such as a large industrial space, for example. The student will select a tag point and will be taken directly to that specific location.
- During **Numeric operations** the student can play with numbers and make calculations with an interactive virtual calculator.
- **Quizzes** are the virtual online assessment platform where students’ progress is tracked.

In this study, the students who participated in the experiment, made use of most of these features offered by the EduPro/VEATIVE headset. This device differs much from the Oculus Quest and HTC, as this include no gaming aspects, this device is solely used for education (Veative Group, 2023:1).

3.12 Summary

VR is being used in many diverse settings and industries. However, over the last couple of years, much attention has been placed on how VR can be used in education. VR has been proven to be a suitable tool for teaching and learning and can transform the way education is provided. With the generation and continuous development in VR, many advantages of VR have been discussed in this chapter. On the other hand, the literature confirmed that there are several disadvantages also when using VR. These disadvantages are important to take note

of in this study, as the researcher aims to develop a framework in which VR can be used to the advantage of students and not the opposite.

The chapter further alluded to the timeline of events and VR development that occurred as of 1935 to the early 2020s. As a result of the development in the VR space, much attraction from HEIs is created.

As alluded to in this chapter, when designing legislation around virtual worlds, it is of global importance that countries collaborate to design an acceptable framework for users. Collaboration between countries is needed especially as the users are of different cultural norms, values, and legal systems. As a result of VR constantly evolving, it is important for legislation to keep up with the changes.

The three primary categories of VR were also discussed, the study investigated he non-immersive, semi-immersive and fully immersive simulations. During a non-immersive simulation, a computer-based simulation is provided, mostly in the form of a 2D or 3D graphic. During a semi-immersive simulation, a more interactive experience is created, examples of these are flight simulators or medical training. Lastly, through a fully immersive simulation, users experience the most realistic and immersive experience by wearing a headset which can track their movements and display stereoscopic images in the virtual world. Through VR an immersive experience is simulated with the assistance of VR tools, such as VR goggles/ or headset, VR microphone and VR hand controls.

Although VR is not a brand-new concept to the educational environment, it comes with design challenges that need to be considered when lecturers put together a VR platform. Due to the unique characteristics of VR, the study investigated some design challenges which both the VR designer and HEIs need to be aware of. Motion sickness seems to be the most common discomfort felt by users.

Enhancing the learning experience is at the heart of VR. Therefore, the HEIs need to transform as new technology becomes available. It is necessary for HEIs to conduct a re-examination of the way they teach and assess students. Moreover, for human resource developers, the use of VR is an important tool, as it allows for learners to experience practical skills in an immersive environment.

The next literature chapter discusses the concept of preparing academia to adapt to new technologies.

CHAPTER 4: ACADEMICS' READINESS FOR VR-LEARNING

4.1 Introduction

The 21st century is characterised by an influx of new technology that can be utilised in teaching and learning. This presents both challenges and opportunities for academic staff in HEIs. Therefore, universities should be at the forefront of researching the feasibility of adopting these new trends of technology in learning.

In Chapter 3, the potential of technology to transform the traditional training methodologies into a more immersive mode of delivery was discussed. VR-learning has the potential to reshape our thoughts on how a person believes a university should look like and operate in. This may result in fewer physical classrooms in HEIs in the future.

These changes in teaching and learning force academic staff to reshape their own thinking about teaching and learning. Notably, with change comes fear Therefore, academic staff may feel paralysed in having to adapt to new teaching methodologies and is not healthy for both the lecturer and the student. The fear of not understanding how to operate new educational tools can delay the rollout of change.

This chapter's genesis lies in two research objectives namely: (1) to investigate the relevance of the current teaching methods in terms of the modern student and (2) to create a framework to equip academic staff in the use of VR during facilitation and assessments.

The purpose of this chapter is to discuss the status of VR-learning in HE and the future role of academic staff who need to transition from a teacher-centred approach of learning to a learner-centred approach for teaching students. To facilitate this transition, it would be important for lecturers to understand the different learning models that exist. Two learning models by educational theorists are discussed: the Kolb learning model and the Honey and Mumford learning model.

additionally, this chapter aims to gather the views of individuals involved in teaching and learning regarding the use of VR in education.

4.2 Academics adopting VR

VR provides the freedom to break away from traditional teaching practices and offers outstanding immersive experiences. Although there is not a widespread adoption of VR in education across HEIs, both nationally and internationally, academics agree (Marks &Thomas, 2022:33) that students have a positive attitude using VR in teaching and learning. The delay in adopting VR training primarily stems from the institution's side. In Chapter 3, the

numerous advantages of VR in education were discussed. This section of the study will discuss the status of VR in HE by looking at the international uptake of VR in education first and exploring how academics have incorporated VR in teaching and learning.

Compared to the USA, China, Japan and South Korea and India, the Europe has slowly started utilising VR, and fear is that the Europe is lagging behind (Schwaiger, 2020:10). Specifically in the HE field, centred around the University in **Cyprus** in the European Union, several VR developments have been implemented. One these developments was the opening of research labs to promote VR in HE. The discipline in which VR was taught includes science, foreign languages, and history. In 2021, the university spearheaded a VR project aimed at training the future generation of innovators in the VR environment, with the goal of closing the gap between business needs and the university's curriculum (Kyriacos, 2021:1; Kosmas et al., 2021:2).

In **Belgium,** VR is primarily adopted in school education . It is used in various disciplines, ranging from health and safety to teaching students about proportions. For example, students can stand next to a building in their immersive VR environment to compare their own height with the height of a building. It is acknowledged that VR is not the solution of all pedagogical problems in learning; however, the country believes that it can add value (Martins, 2020:124).

Finland is known as one of the leading countries in the development of quality education. Interestingly, the adoption of VR is slow, and they seem to be lagging behind in developing VR content. This might be attributed to the high cost associated with delivering VR training (VRinSight, 2019a:1). Statistics indicate that only 8% of VR device users utilise the device for professional purposes, while the majority of users (51%) which use their devices for gaming (Statista, 2017:1).

Even in **Australia,** VR has not yet established itself as a common teaching instrument in HE. VR is currently used in only a few disciplines, such as medicine and virtual surgery training. . While it is gaining more attention, universities are still exploring the full potential of VR in education. VR applications are predominantly utilised in industry and manufacturing. However, there are several early adopter companies that are optimistic about the rapid growth of VR in Australia. According to Statista, the number of VR and augmented reality (AR) users is projected to reach 23.9 million by 2027 Statista (2021:1).

Shifting focus to African countries, specifically Uganda, many employers have expressed their concerns about the absence of work-based learning in the curriculum. They argue that students are remote and physically distant from organisations, making it difficult for them to perform the necessary practical skills in a workplace setting. Therefore, the Government of

Uganda has implemented a ten-year strategic plan to incorporate skills development in the country, with the aim of enhancing productivity and growth. Through this initiative, VR is being utilised in work-based learning to bridge the gap for students who lack access to workplaces to perform their workplace practical assignments (Al Shehri, 2012:1).

Nationally, the Mail & Guardian (2020) reports that in **South Africa**, there exists a digital divide resulting from the gap between the rich and the poor. One of the challenges faced by the economically disadvantaged is the lack of accessibility to technology, which hinders the adoption of VR in universities. Not all students have laptops and access to free data to connect to the VR applications for learning purposes. However, VR proves to be a valuable tool for students living in rural areas, as it allows them to access environments and lecturers without the need to travel anywhere.

Academic staff who have experience with VR recognises its potential; however, they are facing difficulties in persuading their management to implement VR training. The challenges in convincing management stem from the following:

i) The investment **cost** is high when considering the purchasing devices and developing content . Therefore, the cost of implementation and the return on investments need to be investigated by many HEIs. Day (2020:1) reports that when one considers the instructional design, creation, and management, the average cost of a full VR training is between $40,000 and $155,000 or more per project. PWC (2019:48) indicates that regardless of the learning methodology used (classroom, e-learn of learning through VR), each course requires planning, design, development, and deployment, all of which incur costs. Arguably, research shows that developing virtual learning is 47% more expensive compared to traditional classroom and e-learning methods (PWC, 2019:74).

ii) VR implementation requires **space** for students to move around, especially when they use motion tracking on VR devices. Most classrooms have a lack of adequate physical space.

iii) Considering the technical countries, VR is **complicated to set up**. Developers believe that users who want to develop content and share experiences with students would need training before they can operate the VR devices and software.

iv) Academics fear that the **lack of knowledge** regarding the real potential of VR will hinder them from adopting the new technology. Martec's law states that technology is changing very rapidly, while the change in organisations and perception of technology is very slow (Chiefmartec, 2021). Universities have the fear of implementing new technology too soon, yet at the end of the day, the students are being disadvantaged by not being ready for the world of work.

v) **Lack of digital skills** – to bridge the gap between getting students work-ready and lecturers needing to teach students using the latest technology, professional development of technology is needed.

To address the above challenges in South Africa, merSETA is one of the first SETAs to have partnered with Eon Reality, a provider of XR training solutions. merSETA specialises metal and engineering; automobile manufacturing; motor retail; automotives component manufacturing; tyre manufacturing, and plastics. These industries lend themselves to high-consequence and dangerous events, making VR-based learning an excellent fit for merSETA's students, as simulation-based training can be conducted (Eon Reality, 2023).

Majid (2019:6) implemented a Technology Acceptance Model (TAM) (Figure 4.1), to explain and predict a user's acceptance of new technology.

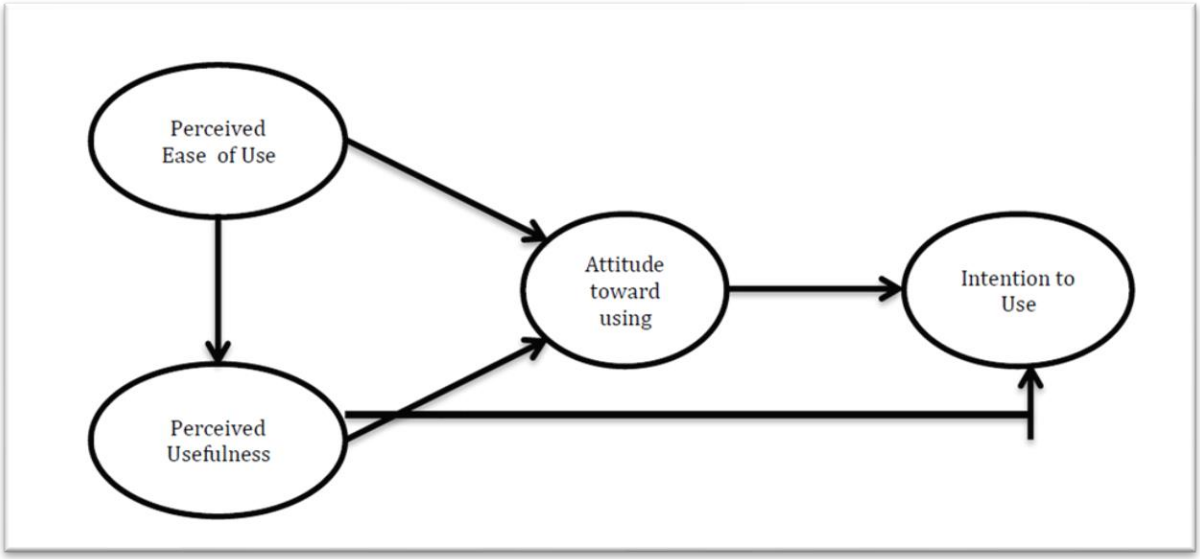

Figure 4.1: Technology Acceptance Model (TAM)
(Source: Majid, 2019)

The successful implementation of a VR-learning framework greatly depends on the acceptance of the new technology by the HRD practitioners in the organisation. In Universities, the academic team, together with the Dean of the faculty, will have to provide approval for implementation.

There is no doubt that there will be changes and challenges in the way students are trained and educated. It is now only a matter of time before VR will becomes prominent in education. This will require to academics to change the way they conduct training. The following section of the study will focus on the future role of academics. Therefore, it is concluded that the implementation of VR in the workplace is highly dependent on the attitude and perception of the HRD practitioner.

4.3 The future role of academic staff

The transition from traditional teaching practices to digital teaching practices is increasing, and there is much speculation about the future role of the lecturer . HEIs aim to be known for providing good quality education and preparing the students for the world of work. Therefore, it is necessary to examine current teaching and learning practices and how lecturers will have to adapt to a new way of teaching (Alhija, 2017:12).

A study conducted by Instructure (2022), which included 23 countries globally and over 7573 students, administrators, and faculty members, found that HEIs worldwide provide technology training (2022:49% vs 2021: 52%) and periodic workshops to empower academics with edtech tools.

A project was launched in South Africa in 2019when the vice-chancellor of the University of Stellenbosch, Professor Wim de Villiers, cautioned HEI staff that major changes need to be made to adapt to new circumstances in HE to remain relevant (Macupe, 2019). Menon and Castrillon (2019) agree with Macupe and explain that to encourage innovation, HEIs will have to adopt technology and most importantly, there needs to be commitment from all academic staff members to adopt VR as part of their learning resources. As part of Stellenbosch University's strategic plan for 2019–2040, the University created a strategic framework to ensure a transformative student experience. Stellenbosch University recognises the need for a digital revolution in teaching and learning and has embarked on collaborative teaching and learning initiatives for the academic staff. The University of Johannesburg has also established a Centre for Academic Staff Development to strengthen academic development in line with HEI changes (University of Johannesburg, 2018).

Authors warn educational institutions that there is too much talk and too little action in the implementation of VR-learning. Lecturers will not easily gain support from students to use new technology if academic staff themselves do not understand how to operate the new devices (Wenglinsky, 2005:29).

Internationally, the United States (US) started a programme as early as 1999 called "Preparing Tomorrow's Teacher for Technology". The purpose was to prepare lecturers to use advanced technology in teaching and assessing students (Wenglinsky, 2005:22; Barron, 2006:3). A special grant was established, (called the Technology Literacy Challenge Grants) to create an infrastructure for academic staff to incorporate technology in their teaching. A further initiative to develop academic staff for the future, started by the US, is the "International Society for Technology in Education" (ISTE), which is an organisation that encourages academic staff to be prepared for using technology in the classroom and be informed of the advantages it holds (Barron, 2006:4).

n having to adapt to this change, it is advisable for academic staff to have a mentor in the workplace that will lead and support staff in the change process to adapt to the new way of teaching and learning. This view was supported in a Mobile World Congress held in Barcelona in 2019, where the mentoring of academic staff was discussed and how to support academic staff in their journey in having to include new technology, such as virtual reality, in their classes. Academics need to be willing to be lifelong learners and adapt to research approaches to leverage technology such as virtual reality learning platforms. This will ensure that academics expands their knowledge and meet student's needs (Ayvaz-Tuncel, 2018: 5).

Academic staff must serve as the "change agents" of tomorrow by demonstrating a champion attitude to model and inspire other academic staff in adopting the use of new technology. According to Doring (2002:1), lecturers should transition from the *teacher* approach and take up the role of a facilitator whose role is being a "sole dispenser of information to a highly skilled orchestrator of learning".

There is no denying that the outbreak of the coronavirus pandemic, academic staff had to adapt rapidly in their teaching and assessing methods. The next section places special emphasis on this matter.

4.3.1 COVID-19's impact on academics

As a result of the COVID-19 virus, this has caused a springboard for the inclusion of digital learning and competence required from academics. The pandemic presented universities and colleges with unprecedented challenges by having to close campuses and reverting to online teaching in a matter of days. The use of online learning together with technology has become prevalent. Simultaneously, the problem of reliable internet access and/or technology were addressed immediately by tertiary institutions providing students with laptops and data (where possible). The National Student Financial Aid Scheme (NSFAS) also assisted in offering students with digital devices that can in future widen access to learning resources for students (CPUT 2020:1).

During this time, all public universities developed detailed strategies to remove multi-modal teaching and learning. Online training quickly became the new normal for teaching, and academic staff members had to train adequately and prepare accordingly for online lecturing. Often, online lecturers fail to keep their audience engaged as they tend to rely solely on a PowerPoint presentation and talk through the entire presentation.

Koseoglu and Bozkurt (2019:1) interviewed Dr Angel Pazurek (who teaches digital literacy at the University of Minnesota) to find out more about the online teaching philosophy. Dr Pazurek (2019:1, cited by Koseoglu and Bozkurt (2019:1) notes that the first thing lecturers should

think about is the educational philosophy and the pedagogical values by selecting the correct learning resources. The most important thing to remember when designing an online course is for the designer to create an 'experience' for the student – one that is active and not passive, one that is thought-provoking and meaningful, as per Pazurek (2019:1), who was interviewed by Koseoglu and Bozkurt (2019:1).

Furthermore, the online lecturer needs to actively encourage students to participate in the online learning process by creating break-away rooms, having open discussions, and encouraging students to seek solutions. Regardless of the subject discipline, students should always be the centre of the learning process. Pazurek, further explained that the role of the online lecturer should be supportive by allowing learners to engage with the learning and designing activities and allowing time for reflection and participation in discussions.

Before the pandemic, students would attend classes and can engage with one another and online learning was a choice (Hollister et al., 2022:3). With online learning, lecturers need to create breakout rooms in Zoom or MS Teams. The lecturer can split students into groups where students can engage and collaborate and learn from one another. The lecturer can also join any of these rooms to provide guidance during these discussions (Hollister et al., 2022:7). To ensure greater social learning, the lecturer can then request each group to provide feedback to the rest of the teams, so that it creates the opportunity to learn from one another and connect see how other students apply the learning concepts in their workplace (SABPP, 2022:3).

With the increase of online learning, there is a challenge of ensuring authenticity when writing online exams. The ability to use proctoring online exam shas become more prominent during the pandemic, where students were unable to sit down together with other students for exams. As a result, the role of having an invigilator is changing and lecturers are now able to monitor students writing exams via a webcam. However, Atoum et al. (2017:2) warn that proctoring exams are labour-intensive and costly. Students will need to have a webcam and in the case of monitoring acoustic sounds, a computer microphone would also be required.

Another challenge that lecturers will soon have to overcome is the fact that the study material is written for contact learning students and not for an online platform. Time would need to be dedicated ensuring that learning material is adapted to suit online learning (Jover, 2020:1). Furthermore, facilitators must consider all learning modalities (such as visual, auditory, and kinaesthetic learning) when designing online lesson plans., This is important because different learners approach learning differently. As a result, lecturers may need to think differently about training and have more flexibility in engaging with students.

Hodges et al. (2020:1) and Bao (2020:113) provide the following guidelines for lecturers to teach online:

- Create a lesson plan for students
- Create discussion/forum groups
- Divide the teaching content into smaller units
- Explain to students how to ask a question online
- Send out weekly updates to students
- Record live sessions for students to view the class again
- Emphasising the use of “voice” in teaching, slow down speech to allow students to capture the key points
- Have virtual office hours, where a student can reach out to you via video chat
- Make the learning material available to students one week before the class start
- Upload your assignments beforehand
- Upload any handouts beforehand
- Create break-away rooms before the class starts
- Ensure that your background is clean and professional when presenting

The points mentioned above are important to consider as it can be used as a guideline when creating VR lessons. It is important for HR practitioners to have insight of online, blended and VR-learning as they have a duty to society in delivering high quality HR work. In the Experience age where students spend most of their time online and are interconnected with their mobile devices (Majid et al., 2019:4) , it is crucial for HRD practitioners to consider having training material and assessments with similar attributes. This is possible with a VR-learning platform.

This matter stems from the four pillars of HR professionalism, with specific emphasis to two of these pillars: the “Duty to Society” and “HR and business acknowledge”. As these two pillars becomes the foundation of the South African HR model, the building blocks are that of “Citizenship for the future: Innovation, technology and sustainability” (SABPP, 2022:1). Meeting the needs of the digital student is crucial, and the role of the HRD practitioner is vital.

In the next section, the study focuses on the importance for HEIs lecturers to adapt to aa learner-centred approach, as opposed to a teacher-centred approach.

4.4 Teacher-centred approach versus a learner-centred approach

Teaching and learning can either be teacher-centred or learner-centred. VR-learning leans more towards a learner-centred approach. Within a ‘teacher-centred approach’, the lesson plans are controlled by a lecturer and the student remains passive as very little control is given

to the student where lecturing occurs through direct instruction (Van Wyk et al., 2016:19). In a teacher-centred approach, the focus is on the lecturer. Students often work alone during activities and collaboration is not encouraged.

On the other hand, the term 'learner-centred' refers to the approach where focus is placed on the knowledge, skills, attitudes and beliefs of learners in the educational setting (Donovan et al., 1999:121). The term, 'student-centred approach' is also used in literature and reference to the alignment to the principles of 'social constructivism and constructionism, the visually rich environment and experimental nature of VR' is referenced by Christopoulos et al. (2020:3).

Schreurs and Ahmad (2011:1) note that there is an international trend in education to transition from the traditional teaching and learning approach (teacher-centred approach) to a more learner-centred approach to teaching (Christopoulos et al., 2020:4). Yet, Torrisi-Steele (2020) disagrees and notes that despite the arrival of new technology, teaching and learning methodology has not changed much from what was done 1000 years ago. Despite some minor instances of introducing learner-centred strategies, most institution practices remain to be instructive rather than student-centred. According to Venter (2023), this phenomenon has changed after the COVID pandemic and HRD practitioners are more inclined to revert to digital learning, which include learner-centred strategies.

Very few learner-centred activities, such as 'flipped classes' have been introduced by universities. A 'flipped classroom' is a pedagogical approach of teaching where students will receive the learning lessons before the class commence. Students are required to do group work or independent studies before the class starts so that the time in class can be used for higher cognitive levels of learning, such as debating the topic (Divjak, 2022:3).

In table 4.1, the traditional learning environment is compared with the immersive VR-learning environment.

Table 4.1: Traditional Training approach versus a VR-learning environment (Source: STRIVR, 2020:5)

Traditional Training	VR-learning
Passive	Engaging
Learn by watching	Learn by doing
Forgettable	Memorable
Hours	Minutes
Basic data	Actionable insights

depicts the difference between the different learning environments. In a teacher-centred approach, the focus is on the lecturer that stands in front of a class, and therefore single-sense stimulation takes place. Information is delivered to students through passive learning. Therefore, the learning is factual and knowledge-based and students are required to have a reactive response. In a student-centred environment more stimulation, progression and collaborative work are required by the student. This is an environment in which information will be exchanged and learning is based on active and exploratory thinking. Students will be stimulated by critical thinking and problem solving that will take place in the real world. From the information reflected in table 4.1, learning with the use of VR fits in with the elements of a 'new' learning environment.

For academic staff to adapt to moving away from a teacher-centred approach to a more learner-centred approach, it is important for them to be aware of the advantages and disadvantages associated with a teacher-centred approach . Faculties will only support a new learning tradition if they understand the profound advantages of a learner-centred approach and witness the difference teaching with VR can make for the learner .

Advantages of a teacher-centred approach include:

- The classroom remains orderly, and students tend to be in the control of the lecturer.
- Students are more independent, as they learn on their own and make their own learning decisions.
- Lecturers are in control of the curriculum; therefore, the lecturer will ensure that the students are not skipping any learning topic (Resilient Educator, 2020).

Disadvantages of a teacher-centred approach include:

- Due to students working independently, there is no collaboration, and this may result in poor communication skills.
- Students find a teacher-centred approach boring and are often easily distracted.
- Students are not encouraged to be creative and express themselves in a teacher-centred approach (Resilient Educator, 2020).

Opposing the teacher-centred approach is the learner-centred approach in which students and lecturers interact equally. Below are the advantages and disadvantages of a student-centred approach to learning.

Advantages:

- Students are more collaborative and therefore more communication skills are learnt.
- Students can work independently.
- Students direct their own learning.

- Students feel comfortable asking questions.
- Students tend to be more interested in the learning activities.

Disadvantages:

- Classrooms are noisier and students are comfortable to talk and raise their opinions.
- Lecturers often find it difficult to control the class.
- Lecturers do not give instructions to all students simultaneously; therefore, it can happen that some students miss important facts (Resilient Educator, 2012).

When redesigning the learning experience for students, it is important to recognise that students are moving beyond the traditional instructional strategies of learning and embracing a more explorative learning method. Learner-centred learning seeks to interact and provide experiential learning opportunities for students where students can discover knowledge themselves. When academic staff will implement a learner-centred design for learning, it will create the opportunity for students to engage and be excited about the learning (Serin, 2018:3). Many creative opportunities will result from using, for instance, VR in education and incorporating the use thereof in the curriculum. Even before the discussions about moving towards a learner-centred approach to teaching, researchers created experiential learning models that relate to the elements of a learner-centred approach in teaching and learning.

4.5 The models of learning

With the ever-increasing demands to integrate technology into education, it is necessary to reflect on two prominent learning models which focus on experiential learning, to align with VR-learning.

4.5.1 Kolb's Experiential Model of Learning

In contrast to programmed learning (which are also referred to as traditional teacher-centred learning), there are experiential learning, where the student will go through the actual experience whilst learning. David Kolb developed the 'Kolb's experiential learning' model in 1970 and built his experimental learning framework, from the work done by educational theorist, John Dewey. Dewey stated that "amongst all uncertainties, there is one permanent frame of reference: namely, the organic connection between education and personal experience". Kolb's model provides holistic development of the learner by taking the learner through four stages of the learning process. Boggu (2016:25) depicts that the Kolb model provides for flexibility for the lecturer and student during teaching and learning.

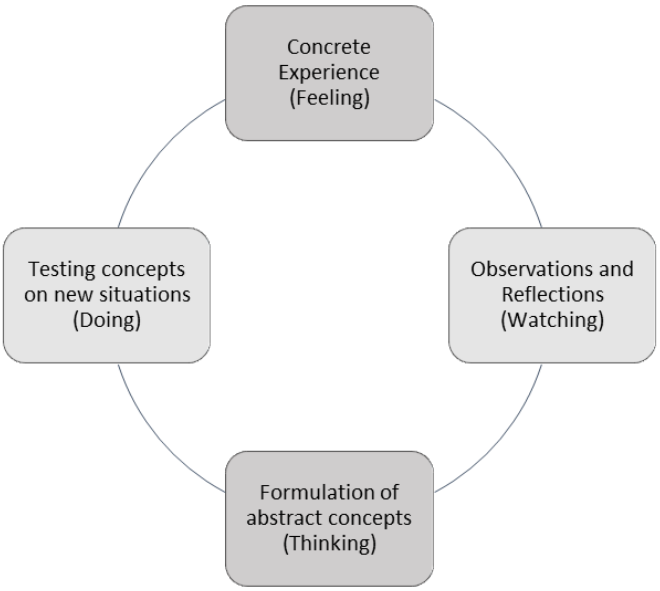

Figure 4.2: Kolb's Experiential Learning Model
(Source: Boggu, 2016:24)

In Kolb's experiential learning module as presented in figure 4.2, technology can be used as follows:

- **Concrete experience**: During this stage the student is running a simulation by doing or having the actual experience. The student is open-minded towards learning new experiences and can be fully immersive during a VR experience. An example would be a student who carries out an experiment or simulation in health and safety, for example and experiences the result.
- **Observations and reflections**: In this second stage, the student analyses the output and reflects on the experience, which is indispensable to any successful learning experience. In the Kolb model, the importance of reflection is of the essence as it allows the student to process what happened during the learning experience. It is at this point that the knowledge gained by the learner is transformed into a personal experience.
- **Formulation of abstract concepts**: This is followed by the student learning from all experiences, both past experiences and creating new experiences.
- **Testing new concepts in new situations:** In this last phase, the student is testing the new model to validate the hypothesis. During this phase, the student makes decisions and applies problem solving techniques (Boggu, 2016:204).

Therefore, Effective learning is seen as a process of four stages: (i) students have a concrete learning experience, (ii) which includes observations and the reflection of the experiences. This will lead to (iii) a formulation of abstract concepts or conclusions which are then used to (iv) test a hypothesis. This will result in a new experiential learning experience for the student

(Norwich University Online, 2017). The student is required to complete the entire learning cycle if 'true' learning is to take place.

The link between Kolb's model and learning via virtual reality is closed through the element of 'experience'. Virtual reality is based on students having an immersive experience. The Kolb model is extremely powerful, yet very simple to apply when taking a student through experiential learning. The 'learning by doing model' can be placed in context by figure 4.3.

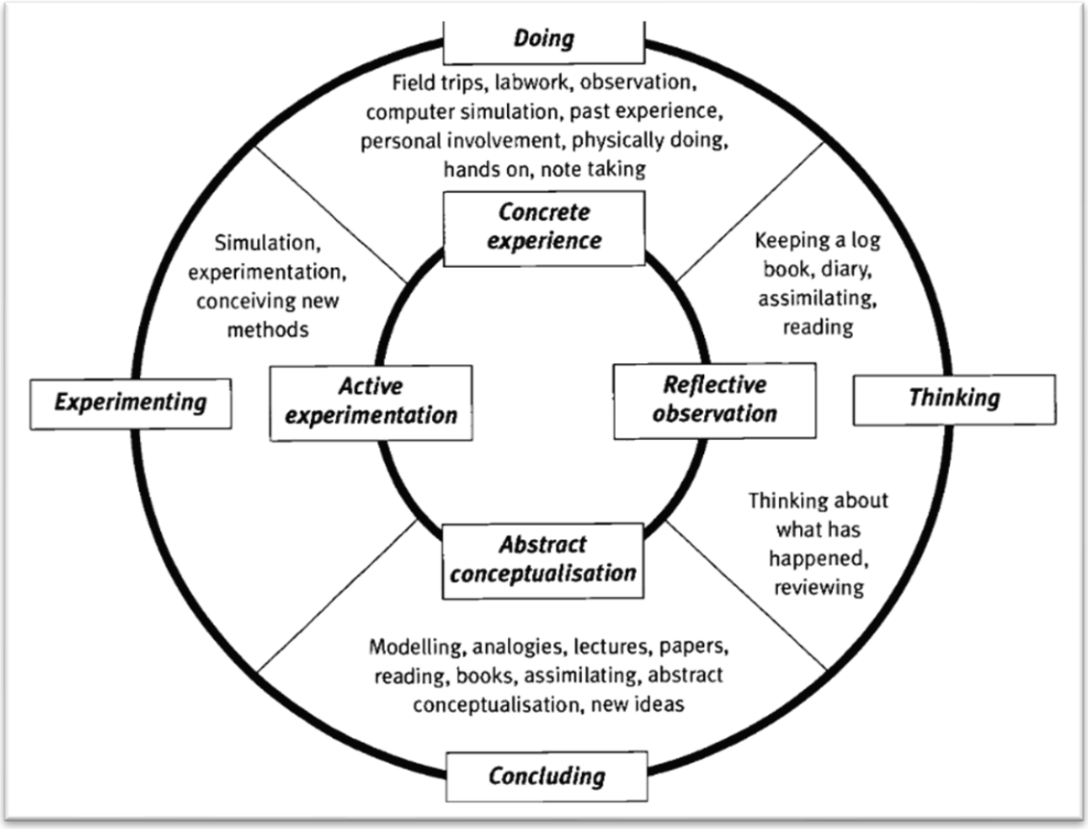

Figure 4.3: Placing the Kolb Learning by Doing Model in context
(Source: Skillshub, 2019:1)

The inner circle of figure 4.3 shows the Kolb 'learning by doing' model. The outside circles indicate the process at each stage, namely doing, thinking, concluding, and experimenting. The inner circle displays the four stages of the Kolb learning model and in-between are examples of types of activities that will enhance each part of the learning cycle. Drawing this model back to learning by means of VR the following are examples of activities at each stage.

- **Concrete experience**: A VR field trip can be made with the use of wearing VR goggles. The student can use his experience to provide a 'hands-on' approach to the learning taking place.
- **Reflective observation**: During the virtual field trip the student can make notes on important issues to discuss at a later stage.

- **Abstract conceptualisation**: After the virtual field trip the student will be able to compare his findings with theoretical experiments generated by the immersive experience. Students can discuss their experiences, research, and findings afterwards with one another.
- **Active experimentation:** Students can now draw their conclusions on the virtual field trip and generate new ideas and even propose a virtual field trip in which they can add or remove objects.

4.5.2 Honey and Mumford

Building on Kolb's work, Honey and Mumford (1986, cited in Ravet & Layte, 1998:31) developed a model focusing more on the activities of an adult student. Honey and Mumford found that although students have a preferred way of learning, most students are unaware of learning models and the style they prefer to be taught in. The authors used Kolb's model and superimposed his four stages of learning into the below four stages of learning (Figure 4.4).

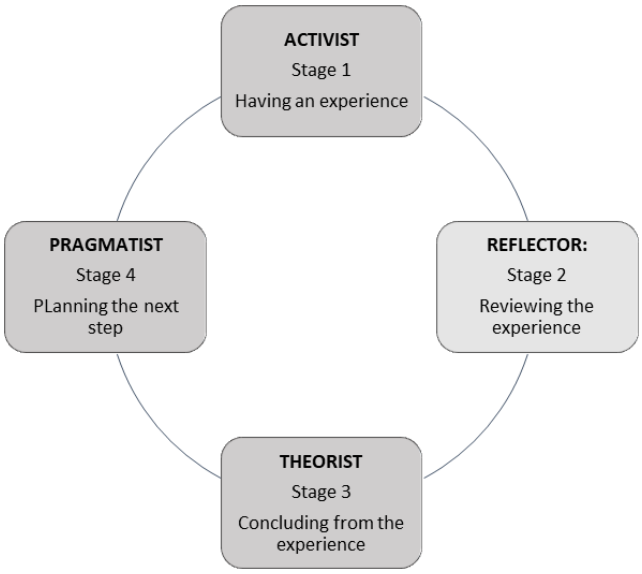

Figure 4.4: Honey and Mumford's Learning Model
(Source: Bontchev & Vassileva, 2011)

The four stages are:

i) **Activists:** These are students who thrive on new experiences and active learning. During this phase, students need to include themselves fully in the experience and will be open-minded and enthusiastic about the new experience. Drawing closer to the use of VR in education, students will experience the "here and now" during learning and will normally act first and then think about the consequences at a later stage Yadav (2020:107) notes that students are more willing to tackle problems, once the excitement of the new experience is over. During this phase students tend to thrive on the challenge.

ii) **Reflectors**: These students prefer taking time for exploration and review before teaching decisions. Students need to observe and ponder on thoughts, considering all the available information . Making a decision is a long process for students during this phase and students tend to be thorough and cautious before making decisions. It is important for them to look at the 'bigger picture'.

iii) **Theorists**: These are students who enjoy the logical and integrated exploration. They normally have a step-to-step approach to problem solving and are real perfectionists. Students in this stage prefer to analyse and synthesise ideas.

iv) **Pragmatists**: These are students who like to apply ideas to see if they work in practice. They are quick to get things done and are very practical (Ravet & Layte, 1998:31).

The focus of Honey and Mumford's learning model is that students are more likely to succeed in a subject when the learning style fits their needs, as opposed to a learning style that does not suit their needs (Ravet & Layte, 1998:31). Considering the views of Honey and Mumford into the current needs of students, one will realise that there is very little change on what made a student thrive in the 1980s when compared to the twentieth century. In practice, the activist learning style student still prefers problem solving learning activities where a hands-on approach is required. On the other hand, the effective learner prefers studying in his/her own time and thrives when receiving guidelines from the tutor.

The student who prefers the theorist learning style requires clearly defined assessment goals and can analyse and generalise learning concepts. Lastly, the pragmatist learning style student needs to be shown practical examples and requires time for reflection. Overall, students today still demonstrate a natural preference for one of the four Honey and Mumford's learning styles, and are not likely to switch between different learning styles once they have found the one most suitable.

Lalley and Miller (2007:64) note that isolating the various learning models is nearly impossible and a good balance of the different learning models should be used. It is important to have a balanced combination based on content, the background of the teacher, the preference of the students and the resources available for teaching.

In summary, Honey and Mumford analysed the learning style created by Kolb and implemented some changes. It is important to take note of these two learning styles as their focus is on 'experimental learning' that is fundamental to VR-learning.

Despite the difference to describe the stages of learning, there are similarities, and, as explained by Bontchev and Vassileva (2011), these two theories simply use different wording to explain the same concept.

Table 4.2 presents a comparison of the Kolb and the Honey and Mumford learning styles.

Table 4.2: Comparing the Kolb and the Honey and Mumford learning styles (Source: Bontchev & Vassileva, 2011)

Learning stages/styles	Kolb	Honey and Mumford
Four (4) Learning Stages	Concrete Experience Reflective Observation Abstract Conceptualisation Active Experimentation	Activist Reflector Theorist Pragmatist
Four (4) Learning Styles	Accommodating - Feeling Diverging - Watching Abstract - Thinking Converging - Doing	Having an experience Reviewing the experience Concluding the experience Planning the next steps

There is arguably a strong similarity between the learning styles of Kolb and Honey and Mumford:

- Activist = Accommodating
- Reflector = Diverging
- Theorist = Assimilating
- Pragmatist = Converging

The ‘activist’ in the Honey and Mumford model enjoys teamwork and being at the forefront of experiencing new concepts. This speaks directly to the fact that individuals choosing this learning style are accommodating in nature. The ‘reflectors’ in the Honey and Mumford style will be diverged in their approach to learning by always questioning techniques and concepts.

For the ‘theorist’ in the Honey and Mumford learning model, seeking opportunities to understand and learn new concepts is intriguing. Closely linked to the ‘theorist’ are those individuals who prefer to learn by conducting experiments and have a logical approach to learning – Kolb refer to this learning style as ‘assimilating’. Lastly, the ‘pragmatist’ is keen on trying out new ideas where the ‘converging’ learning style involves experimenting with new ideas that are stimulating. Thus, the similarities between the Kolb and the Honey and Mumford learning module are closely linked (Tsolova, 2019:2).

Human Resources plays a crucial role in supporting student -centred learning, as the HRD practitioner need to be ensure that the learning programmes are designed in such a way that it supports student-centred learning. Furthermore, it is crucial for HR practitioners to recruit and hire academic staff members who are committed to a student-centred approach of learning. This stems on the HR competency: *Organisational capability:* Understanding the organisational context and needs of the business is critical in the process of planning and delivering HR practices.

In addition to the experimental learning modules in this section of the study, it is also crucial to note the different learning modalities present in VR-learning.

4.6 VR-learning modalities

The effectiveness of implementing VR into education would be dependent on the instructional design of the teaching and more specifically the medium of technology that is used, also referred to as the learning modality. The four widely learning modalities are known as VARK: Visual, Auditory, Reading/Writing and Kinaesthetic.

Kumar (2020:1) confirms that with **visual learning** information is best retained.

During a study conducted in 1997, ten students were given the choice between actual hardcopy script and audio tracks. Eight out of the ten students preferred hardcopy scripts to learn from. It was concluded that the idea of having to stop, pause, rewind and forward was inconvenient for students while trying to make notes (Ravet & Layte, 1998:51). In contrast, Dale's Cone of Experience (which was discussed in Chapter 2) emphasised the fact that students will easily remember what they heard as opposed to what they have read.

Sound draws the sense of reality into learning. However, lecturers must be cautioned that the sound they choose to use, for example when students watch a virtual field trip, should not be a nuisance for students. The extent to which sound can be used is explored using beta waves which allows for logical thinking and conscious thoughts. Soothing sounds that are used during VR will assist students to focus (Cowan, 2016:26).

Relevant graphics and illustrations further assist students to grasps what has been learnt. Mostly graphs, illustrations, maps or cartoons are used to encourage 'visual thinking'. Kumar (2020:1) adds that some people will learn better by reading and writing down information. In essence, this is how VR is set up mainly, using graphics and immersive images, but adding assessments where students can write read short information pieces and write down their understanding in the assessment. (Morgan State University, n.d:1).

Simulations are frequently used in gamification (and therefore VR as well) and create a constructive pedagogy as students actively engage with the learning programme and are given the opportunity to discover, experience and practice, this getting the opportunity to gain knowledge by doing practical things, referred to as *kinesthetics* (Kumar, 2020:1). Taha et al. (2021:7) mention that structured simulations improve learning and motivate students to reach the highest potential.

Using these mediums optimally will transform the way lecturers teach and provide new opportunities between universities and students across many disciplines.

4.7 Academia's perspective on VR

As highlighted in this research study, literature confirms the benefit of using VR in education from a students' perspective, but very rarely from a lecturers' perception. In this section, the study focuses on the lecturers' views regarding the use of VR in education.

A study conducted with a purposeful sample of 10 lecturers from HEIs (University of Kwa-Zulu Natal) in 2018 to determine their readiness to use VR in their teaching methodology, revealed the following findings: (i) The adoption of VR is hampered by the lack of infrastructure, (ii) finance in HEIs and required (iii) VR skills from the academics' perspective (Solomon et al., 2019:2).

With regards to the affordability of the software and hardware, one participant from the study recommended that a long-term plan is required to ensure that the infrastructure is in place before the adoption of VR can even be considered. The study further revealed that lecturers feel that VR can cater for students with different learning styles. A learner may prefer to learn visually, and therefore would find virtual learning as a useful tool in the learning process. The role of a facilitator will change from content delivery to content facilitation. Further outcomes of the study indicated that facilitators will be focused on creating conditions for exploring and conducting experiments, rather than providing ready-made knowledge in textbooks. A final and extremely important outcome of this study is that the future of education does not solely relies on technology, but rather on the academic's decision to adopt the new edtech available (Solomon et al., 2019:5).

Another important finding from this research conducted at the University of KZN is the necessity for training of academic staff members to apply VR-learning methods. VR in education is no longer a futuristic concept that belongs to the future; educators agree that it is crucial for them to start understanding VR technology and find it highly intriguing. To support the need for training by academics, D'Agustino (2013:11) alludes to the fact that for proper student engagement to take place, VR developers/and or academics should link the learning to the world outside of VR. It is on this premises that the content of the VR-learning environment should be written with an understanding of how the brain learn and remember concepts.

In a survey conducted in 2010 by the US Department of Education, it was found that 97% of educators have computers in the classrooms. However, less than 40% of the educators said they 'often' use technology in the classrooms and 29% said 'sometimes'. It is counterintuitive for lecturers to not have technology in the classrooms, when in fact this is what students utilise most of the day (Francis, 2017:72). It is important to take note that changes within digital

technology adoption in classrooms changes dramatically each year as new technology is introduced and trainers start to utilise these.

However, students at the Washington Leadership Academy use VR as part of their curriculum. Lecturers feel that using VR, students can share their experiences easily with one another and can solve complex problems and can collaborate with other students outside their discipline (Fineman & Lewis, 2018:1). During the XR in Education Summit, educational institutions, innovators, content creators and educators are brought together to discuss the latest trends in virtual and augmented reality. This summit took place in January 2020 and lecturers shared their experience in teaching with VR. Strong emotional opinions were shared on the use of VR in education—much focus has been places on the accessibility, empathy, data collection and ethics of the technology (Fineman & Lewis, 2018:1). The XR summit took place just before the outbreak of the COVID-19 pandemic and if nothing else, has taught HEIs the importance of using technology for distance learning. VR is a good example of resources that can be used to teach students remotely.

On the downside, every VR development has its own repository. In other words, each institution will develop VR material for its own institution and use. Although there are applications available to download some educational VR programmes, they are in the monitory (Fineman & Lewis, 2018:1). Another challenge experienced by academic staff members are finding the time to learn the new technology as they are teaching and assessing for hours in a day. It is hard for lecturers to find the time in a day to still learn a new skill thoroughly.

Literature (Walsh, 2019:13) cautions universities to avoid large technology deployments and investments. It is advisable to start with a pilot project to ensure it is a feasible resource to be used. The next section consulted the literature on advice that is provided to trainers who want to implement VR in the classrooms.

4.8 VR advice for academia

This study argues that virtual reality should be implemented in teaching and learning as it increases student engagement in class. Before trainers consider using VR in class, it is important to take advice from experts in the field.

- It is advisable to first consider the most appropriate platform to use for VR in education. Should students use head-mounted VR hardware, which needs to be connected to a computer, the immersive experience would be extremely powerful to students, but the space required for a student to operate in, need to be spacious enough. If classroom space is a problem, one would want to consider using a mobile head-mounted display,

which is less expensive. It is further advisable to move furniture so that the student does not fall over the furniture whilst in the immersive space (VRinSight, 2019b:1).

- The safety of students is important, therefore consider the age recommendations when using headsets. To avoid this, modern VR systems forces students to mark a chaperone who will be another student who looks after the other person who is in the immersive world.
- Academics should be cautious about the duration of VR time that is allowed, as many of the students can become addicted to being in the immersive world. As with reading a book or watching excessive television, using the VR headset, can cause eyestrain.
- If learning content is difficult to source, the trainer would need to create his/her own learning content in VR and this is time-consuming and expensive, should one get a third party to develop the content.
- Always do research on the VR applications and ensure the content are of quality to use.
- Trainers are to always optimise safety and therefore limit the time the student uses the VR headset as it can cause dizziness (VRinSight, 2019b:1). Some VR applications contain a plethora of stimuli, and this may be disturbing for hypertensive students suffering from autism. The fact that VR allows a student to look around 360 degrees can make the entire immersive experience overwhelming to students.

In summary, HEIs should consider how VR will be used in the classroom to support the curriculum. The integration of introducing VR into the classroom needs to support the learning goals/outcomes.

4.9 Deploying VR in teaching and learning

It is important for the study to showcase the areas in which VR is already used to see the impact over a range of industries, including education. Table 4.3 lists several industries where VR is already in use.

Table 4.3: Different industries where VR are implemented successfully (Source: Thomson, 2019:1)

Industry	Application
Automotive	Engineers can now easily build a vehicle in a VR environment before having to commission expensive prototypes.
Healthcare	VR has a significant impact on the healthcare industry and is used for pain relief, mental health issues and the treatment of post-traumatic stress disorder (PTSD).
Retail	With body-scanning technology, VR allows a person to try on new clothes and view themselves in the virtual world.

Industry	Application
Tourism	Travellers can now use the 'try before you buy' application to visit a destination they wish to travel to. 'Google Expeditions' is also a useful application to use in the tourism industry.
Real Estate	House seekers can explore houses online using a 'Matterport' camera that produces realistic scanning of buildings that can be visited through VR.
Architecture	Through immersive VR tools such as 'Revit Live', it is possible to experience the space in a house or building before it is physically built.
Events and Conferences	VR enables individuals from around the world to attend virtual conferences.
Marketing	It is becoming more popular for companies to market their product via a virtual platform where the user can experience the product. Many universities are also creating virtual campus tours for student induction.
Law Enforcement	The police are using VR tools to train personnel in simulated scenarios. This is also a much cheaper and safer way to teach police officers and military officers.

VR-learning is further successfully used in teaching and learning and holds significant benefits to students. The section below aims to address the VR training initiatives.

Medical Education: In conventional surgical training practices, surgeons used animals or volunteer patients to practice their surgical skills. For several years, the effectiveness and safety of these practice procedures have been a concern for practitioners. In recent years, VR has become more prevalent in offering medical education. Through VR simulators, surgical planning, training, and rehearsals are now possible (Clarke, 2021:7).

Aviation Training: Flight simulators have been in use for over 80 years (Ellis, 2020:1). Through the successful use of VR applications, better and higher quality visuals are now possible to be used in pilot training. Students make use of VR headsets and students can feel the vibration and other sensations.

Engineering studies: The industry requires engineering graduates with distinctive skills that can design products in a cost-effective way whilst guaranteeing quality. Through VR the productivity of training is improved by allowing students to apply theoretical knowledge to real industrial problems in a VR environment. Engineers can develop products and be more creative and innovative and even repeat the process over and over, without spending a lot of money. Engineers are now able to visualise design options and explore alternative designs (Abulrub et al., 2011:3; Eon Reality, 2023).

Physiotherapy training: The normal practice for physiotherapy patients is to complete their exercises at home. This can lead to poor attendance of the exercises or even doing the exercises wrong and causing more injury to the patients' bodies. The University of Wire

(2020:1) reports that patient's movements can now, with the use of VR, be transformed into an avatar that can be viewed in the virtual environment. A virtual physiotherapist can now demonstrate the exercises to the patient.

The subject areas mentioned above are some of the most common areas in which VR-learning has been practiced. However, VR-learning is not limited to any other training field. Due to HR subjects not really having tangible 3D objects that can be dismantled, moved around etc, these softer skills programmes did not get much attention with the implementation phase of VR in education. Fortunately, VR developers have realised that there are a growing soft skills/HR & Business skills gap that requires attention (Lawton, 2021:1). A deeper level of thinking is required when HR VR-learning experiences are created, and much focus is put on simulations. The research study attempts to address the gap in the HR body of knowledge by making VR lessons part of the teaching and learning, as well as the curriculum design.

4.10 Summary

Being digitally competent is at the forefront of the skills that academics need in this era of technology. Digital competence in academics has gained a strong prominence in the HEI context. Academics need to reimagine the way teaching and learning take place. This chapter provides a summary of the current status of VR within higher education. Although the use of VR is still limited, especially in higher education, there is increased interest in testing VR as a learning tool at various universities.

As a result, teaching and learning practices will have to change to embrace the use of VR in teaching. Trainers will need to adapt to a learner-centred approach, with a focus towards more experiential learning is needed in training. Some trainers may feel that universities are not yet ready to adapt to this new teaching philosophy. Nevertheless, although trainers have a diverse opinion of adopting VR as a learning tool, most are optimistic about the benefits VR can offer students' experience whilst learning.

It is advisable that universities learn from other intuitions that have used VR as a learning tool in the past and build on the lessons learnt so that both the academic and student have a good experience when dealing with VR in the classroom. There is no doubt that academics need to be prepared to respond to the needs of the digital society we are immersed in.

In the next chapter, the study focuses on the importance of building/developing assessments that can be used in a virtual world.

CHAPTER 5: BEST PRACTICES OF VR-LEARNING FOR HR CURRICULUM DESIGN

5.1 Introduction

The previous literature review chapters expounded on how virtual reality (VR) creates an opportunity to enhance student engagement through the learning experience across various subject areas. It addressed academics needing to reimagine themselves in a digital society. Chapter 5 is the final literature review chapter and focuses on the design and implementation of curriculum and assessment plans within the VR environment. The design with demonstration of assessments has remained fairly unchained for decades. With the transition to include VR into teaching and learning, the focus moves towards the adaptation of the curriculum.

This chapter commences with discussing the VR-learning process. The elements of a curriculum and an assessment plan are outlined. Thereafter, the use of a VR curriculum in HE, both in South Africa and internationally, are discussed. Finally, the implementation of a VR curriculum and assessment plan is investigated.

5.2 The VR-learning process

Before implementing a curriculum plan, it is important to understand the immersive VR-learning process. The immersive learning cycle is built on a curriculum and as a result, the content and assessments are developed. Equally important, is implementing a learning strategy before commencing with any VR teaching and learning practices. This process is described in detail following the illustration of the learning process below.

To understand this process, figure 5.1 presents the VR-learning design process. Figure 5.1 **explains that process one must follow when creating an immersive VR experience**. The first step is to identify the learning objective. The VR designer will have to decide on which **learning strategy** (indicated as step 1 in figure 5.1) to follow. when implementing the learning programme Questions such as what are the fundamental and core learning outcomes that need to be achieved by the student needs to be asked. The VR designer should also keep the target audience in mind. Decisions around the training infrastructure need to be made. For example, how long will sessions be conducted, or at which point in the VR environment will the students have to perform an activity. Once these questions are answered, the curriculum design process can start.

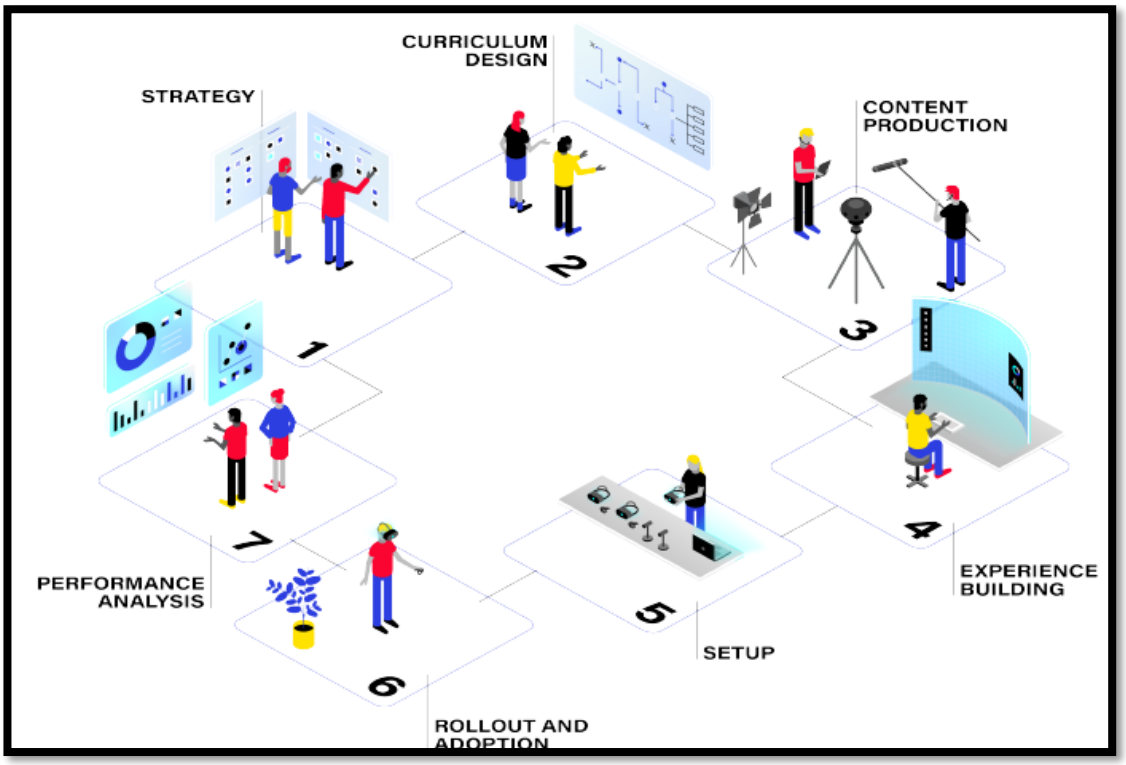

Figure 5.1: The immersive learning process
(Source: STRIVR, 2020:28)

The second step in the VR-learning design process is **curriculum design** (step 2). In the South African context, a group of subject matter experts is consulted to write the curriculum. In a VR context, the developer of the curriculum is referred to as a learning designer who will ensure that the curriculum is developed, approved, and the content production is in line with the curriculum. This process is done in consultation with the academics (STRIVR, 2020:24-54).

The third step is to produce the learning **content** (step 3). During this phase, the learning modules will be filmed using a 360-degree camera. This will be followed by designers who will now build the **immersive experience** (step 4) using a VR software platform that brings the videos together into an engaging training module. During the **set-up stage** (step 5), all components to this process is merged and tested for rollout. During **rollout and production** (step 6), also defined as the 'storytelling' step in the process of creating an immersive learning environment, the sharing of vivid descriptions of ideas, beliefs, personal experiences and /or any personal narratives that evoke strong emotions and insights in users, summarises what storytelling is about (Dodds, 2022:5). During the final phase, all training data is being gathered from which **performance analysis** (step 7) records can be retrieved.

The next sections (5.3 & 5.4) focus briefly on the key elements of creating a curriculum plan.

5.3 The concept of a curriculum plan

As VR-learning becomes more popular in the teaching and learning field, academia will be expected to foster a new way of designing curricula. Therefore, for this research study, it would be important to create a curriculum that includes the use of VR-learning for both teaching and assessment.

Meyer and Abbott. (2017:92) describe a curriculum as a 'long-term, strategic instructional plan for all formal learning events. The key elements as set out by the South African Qualifications Authority (SAQA, 2021:12) in a curriculum are as follows:

- Determining the purpose and values of the learning
- Analysing the needs and nature of the learners
- Deciding on the outcomes or the learning objectives
- Selecting the content, the subject matter will support achieving the outcomes
- Deciding on the activities, the methods, and media for training
- Planning how assessments will be done
- Planning how the overall effectiveness of the delivery of the curriculum will be evaluated

Babic (2019:1) explains that to create a curriculum that includes VR-learning applications, it is important to write conditions for exploring the curriculum. ClassVR is one of many other VR platforms that allows educators to create, upload and share their own content that is aligned to a curriculum (ClassVR, 2018b:1). It is ideal for facilitators to create and add their own content to support teaching and learning. To start such a process, educators would need to choose an application, (such as ClassVR, EON-XR, VEATIVE) and infuse the application into the curriculum. Ultimately, the VR application needs to support students in an immersive environment where students have access to their study material, equipment, processes, and procedures that are not replicable in the classroom (Lejerskar, 2021).

In this study, the VEATIVE VR headset and learner management system was used, comprising 650+ learning modules loaded for all school grades, including lessons for HE. VEATIVE has aligned to the major curricula across the globe, including South Africa's CAPS to allow for these lessons to be relevant. A content mapping team would be responsible for a selection of topics relevant to the major curricula around the globe (Veative Group, 2022).

To summarise, VR-learning platforms can be immersive experiences, requiring HEIs to be creative ways to incorporate VR-learning modules. The curriculum should promote collaborative learning and reinforce critical thinking and problem-solving skills, as prescribed by the South African Qualifications Authority (SAQA, 2021).

Assessment Design is an important element of any curriculum. The key principle of assessment is to test the student's understanding and recall certain topics or concepts. Authors and academics such as Erasmus and Loedolff (2019:240) and DHET (2019:1) define assessment as the measurement, through various methods, of a person to perform an activity or demonstrate knowledge, usually against pre-set criteria.

Traditional assessments lack in technical rigor as it largely depends on the learning outcomes and lack the practical knowledge that is required (Shute et al., 2016:8). When learning occurs via VR, it is advisable to include the assessments within VR as well. These assessments can mirror the real world and the students are able to practice skills within a safe environment. By doing so, students can immediately witness the consequences of their actions, as noted by (Stephan, 2022:3).

When designing assessments, a set of principles should be adhered to. In the book, Education, Training and Development (ETD) practices in South Africa, co-authored by Meyer and Abbott (2019:163), the principles of assessments are discussed and include the below:

- **Validity** should be the priority when setting assessments. The actual assessment should assess the student according to the specific outcomes set in the curriculum guide. Literature further refers to ecological validity that is present in VR-learning, as perceptual fidelity is created though a learning environment that looks and sounds like the real environment (Casale, n.d.: 9).
- **Reliability** refers to the fact that any two assessors should be able to assess the same student and make the same judgement about the student.
- **Fairness** is the concept of not favouring any student above another student.
- **Flexibility** in assessments requires the assessor to be able to perform the assessment slightly different in case of a student being disabled, for example.
- Students will sign a 'Declaration of **Authenticity'** to declare that the evidence submitted is their own work. Further, should the assessment design be of such a standard, that there is **transparency** across the assessments, where learners will have a clear understanding of the relevant process.
- Finally, the assessment evidence should be **sufficient**, the student should not be over or under-assessed.

The above principles of assessments are important to note as the researcher aims to align the curriculum for assessments to occur in the virtual world and not necessarily a paper or online format. One of the key advantages of stealth assessment is that it can provide more accurate and objective feedback on a person's skills and knowledge, as it is based on their actual performance in real-world situations. It can also reduce the stress and pressure that

traditional assessment methods can create, as the person being assessed is often unaware that they are being evaluated. The goal of stealth assessment is to provide a more accurate and authentic evaluation of a person's knowledge and skills, without the biases and limitations of traditional assessment methods (Shute et al., 2017:73).

Conducting assessments in VR creates a more realistic assessment experience to the student. In the past HEIs struggled to imitate the workplace environment and students had to reply on their imagination. Currently, with assessments occurring in VR, it can be 100% aligned to the workplace environment (Stephan, 2022:1). Assessments in VR are greatly dependent on gamification, in which a student will make both cognitive and non-cognitive decisions in the immersive world. These assessments that takes place in VR promote problem solving skills, and increase engagement and motivation (Shute et al., 2017:76).

As with assessments being conducted in VR, immediate feedback can be provided to students and a more realistic observation can be made. The assessment judgements in VR can be based on the relevant hand movements, speech recognitions and or head movement (Stephan, 2022:3 Notably, academics should also consider whether the assessment activity measures the application of required skills set by the student, as suggested by (Shute et al., 2017:12).

In summary, there are numerous assessment methods available to assess students, including assessments within the virtual learning environment. Each assessment is designed for a specific purpose, and when possible (mostly in practical modules), the use of VR is recommended, as it offers a reflective and safe environment to conduct assessments (Hanover Research, 2020:7). It is important to note the points above, as this study will develop a framework for conducting assessments in a virtual environment.

5.4 International VR-learning in curriculum plans

By integrating VR-learning into international HR curriculum plans, institutions can enhance students' global awareness, cultural competence, and critical thinking skills, and assist students in preparing them to thrive in an increasingly interconnected and diverse world.

Google for Education (2019) partnered with a global team of researchers to examine educational shifts in education and to assist students to connect with digital technologies in the classroom. New Zealand became the first country in the world to use digital VR teachers, in the form of avatars, in the classroom. In 2021, Google for Education predicted that 15% of schools in the United States (US) will utilise of VR headsets in their training.

In February 2019, EHL launched its first-ever VR course, which focused on housekeeping. According to Terrier (2019:1)), five students played the same game where one student wore Oculus glasses. The other players were only able to see the VR player's view on a screen. The students provided positive feedback and valued the idea of teamwork, as it encouraged participation. Gamification or 'experienced-based learning' using VR-learning, will be introduced into their future curriculum. However, there was no mention of assessing these students in the virtual environment, at the time of this article.

The company, Veative Group, specialises in educational content for users across the globe and has been using immersive assessments since 2016. Veative Group (2022:1) reports that the immersive assessments assist in fostering high order thinking and helps to develop critical thinking through experiential learning. Answers are scored automatically by the learner management system, which is an offline database of the VR device, that assist with assessment reporting and analytics.

In contrast with a more traditional paper-based assessment approach, assessments within the VR environment have the advantage of capturing comprehensive data that can be quickly analysed. STRIVR (2020:1), a company based in Menlo Park, California, performs VR-based assessments that gather performance data on the user. During the assessment, students are requested to complete multiple-choice questions, and decision data is collected.

On the other hand, contract data can also be collected, by measuring the attention and behaviour of the user. These two data sets are then combined to provide a robust understanding of the user's behaviour. The four pillars being used in immersive learning (VR environments) are: (i) virtual reality, (ii) learning theory, (iii) data science, and (iv) spatial design. During the data science process, the traditional assessment evidence is collected. The following data can be collected during an immersive experience by a user:

- **Usage:** Checking the user's training frequency, duration, and completion.
- **Performance:** Completion of tasks and correct answers to evaluate proficiency.
- **Attention and engagement:** Checking the where and how the trainees pay attention to most. This can be an indicator of possible problem areas.
- **Predictive analytics:** a combination of immersive data mapped to real-world data to create a machine, learning-based predictive model.
- **Sentiment:** Qualitative feedback can be obtained from participants.

Lewis (2019:1)) adds that Walmart conducts assessments in a virtual environment during their recruitment and selection process. A VR headset is worn by an applicant and observations are made on the various scenarios the applicant is presented with in the virtual

environment. Calming an angry shopper or testing soft skills like decision-making and leadership skills, are examples of assessments that take place in VR..

As the HR function is responsible for the employees' learning and development, HRD practitioners should ensure that all employees are provided with opportunities for development, upskilling and reskilling to be prepared for future of work. Incorporating VR into HEI teaching and learning, including assessments, pave the way for VR to be incorporated in organisational HRD interventions. As stated in the research study, HRD practitioners are required to upskill in VR-learning, specifically how to incorporate the VR platforms into curriculum plans. Note that at the time of this research, no evidence could be found that in South Africa VR-learning was adopted in learning or assessment in any curriculum.

5.5 Incorporating VR into the HR curriculum

Menon and Castrillon (2019:1), director of the Centre for Academic Planning and quality promotion at the University of Johannesburg, explains that "to encourage innovations, universities need to adapt quickly to technology and obtain the buy-in from all academics who are willing to implement a curriculum that is appropriate to the fourth industrial revolutions requirements". For the purpose of this study, the qualification under consideration is the National Diploma in Human Resource Management and Practice. This is a NQF level 5 qualification and registered with SAQA as a professional body, namely the SABPP.

The Council on Higher Education (CHE) provides clear guidance in its teaching and learning strategy. In **criterion 5** of the CHE criteria for programme development, it is stated that institutions can choose the mode of delivery that is most appropriate for the institution and reflective in its mission. This is an important point of the research study, as it will determine the implementation of a new VR-learning framework.

However, it is equally important for the HEIs to have mechanisms in place to ensure that effective teaching and learning takes place. **Criterion 11**, of the CHE's programme accreditation guidelines note that it is important to promote academic development initiatives and their adoption of VR as a teaching and learning tool could be easily accepted. **Criterion 13**, of the CHE's programme accreditation guidelines address the notion of effective assessment practices that should be adhered to (CHE, 2022:11).

Likewise, in organisational learning the QCTO has through its qualification development processes developed a curriculum statement document and assessment framework to assist and guide providers with the development of material to support the implementation of occupational qualifications and skills programmes (QCTO, 2018). Therefore, HRD

practitioners have the creative freedom to incorporate VR-learning as a platform for learning and development.

Sangari Education in South Africa has partnered with Veative Educational Solutions (based in Singapore) in 2018 to bring VR solutions to South African Schools. Pazvakavambwa (2018:1) explains that Veative visited many South African schools to introduce VR and to encourage students to become active learners rather than passive recipients. Educators were excited about VR as it can track a student's understanding of a specific topic through data analytics. Pazvakavambwa (2018:1) argues that it will take South African schools a significant amount of time to adopt VR in the classrooms and curriculum, as it took a substantial time for the introduction of technology to schools. This is further due to the cost factor involved.

Based on the literature available, the first HEI to adopt VR was the University of Pretoria Mining Engineering Department, in 2012. With the assistance of Anglo-American group, a world-class VR centre was opened where students could engage with immersive technology. Furthermore, in 2018, the University of Western Cape, along with EON Reality's interactive Digital Centre started offering an accredited Postgraduate Diploma in e-skills with immersive technologies stream, incorporating augmented and VR (University of the Western Cape, 2018:2). During the learning interaction, the company Eon noted that the problem experienced in some HEIs were that students graduate with knowledge but little practical experience, Hence, the reason for them to partner with a HEIs to bring the practical component of VR to the students (Lejerskar, 2021:1).

By offering online assessments through a virtual environment will allow students to solve problems in the 'real world' situation. Noticeably, students can learn in an immersive environment, where it is safe to make mistakes repeatedly. This demands a revised curriculum and assessment plan for subjects, to be more adaptive and relevant to respond to the new available technology . Although there are talks about incorporating assessments into the virtual environment, during the course of the study there was no tertiary institution in South Africa using a virtual environment to conduct assessments.

In South Africa, Meyer and Abbott (2019) found that HEIs employ different philosophies towards HR curricula, which is either psychology-based or business-related that perpetuates HR ambiguous identity (Gie, 2021:6). Therefore, the HR professional body, SABPP developed the HR Competency Model and HR Standards Model to create uniformity within HR curricula.

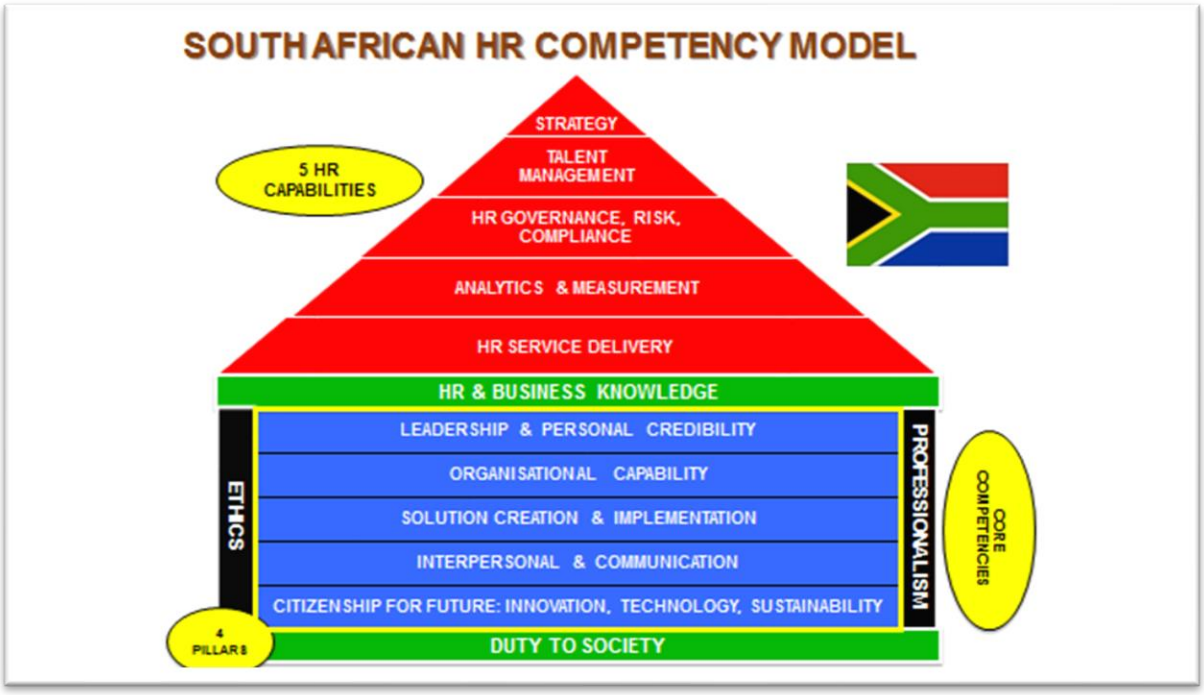

Figure 5.2: SAPBB HR Competency Model
(Source: SABPP, 2022; Meyer, 2012:24)

The SABPP launched the HR Competency Model in 2012 (Figure 5.2) "to set a national standard for HR competence and to provide HR professionals with a common framework for developing the required competencies in meeting the national standard" (Meyer, 2012:23, cited in Gie, 2021:60). According to the SABPP HR competency: *citizenship for future: innovation, technology and sustainability,* HR students should become familiar with new technological teaching and learning styles during HE studies., Thus, experiencing higher student engagement levels to be ready and adaptable for HR practitioners, HRD facilitators, or training providers.

The HR Competency Model was followed by the HR Systems Standards Model (Figure 5.3) to provide "HR management system standards [that] are needed to set a national benchmark of good practice and provide a consistent way of managing HR functions and people in organisations" (Meyer, 2013:23). Of particular importance to this research study is HR Technology or HR Information Systems where relevant technological applications and platforms enables better decision-making and implementation of the business strategy (Gie, 2021:65). HR practitioners have the opportunity to engage on a VR innovation journey, ensuring that the HR value chain can meet the demands of the new world of work, both physically and virtually (Lawton, 2021:2).

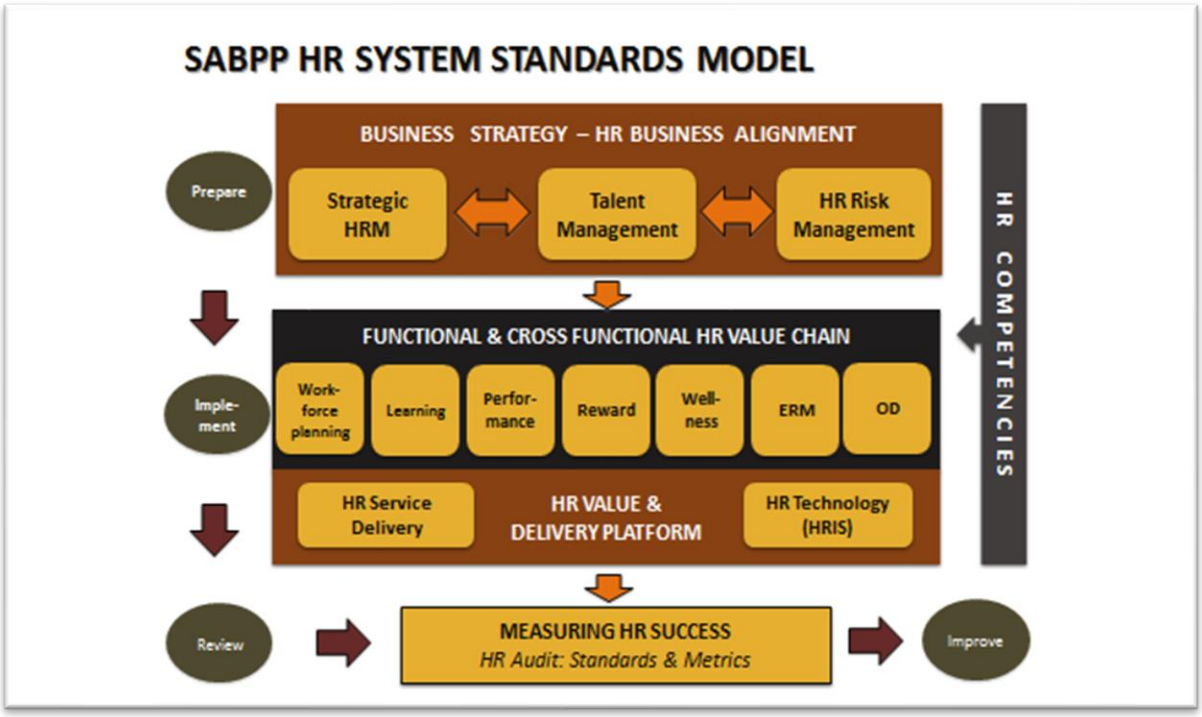

Figure 5.3: SABPP HR System Standards Model
(Source: SABPP, 2022; Meyer, 2013:24)

By incorporating VR-learning into HR curricula, HEIs will promote the development the professional body, SABPP's HR Competencies and HR Technology Standard by introducing HR students to technology as a medium in their tertiary studies, while preparing them for the technology-orientated world of work.

5.6 The transition towards VR-learning in curricula

Learning through the virtual world is receiving more focus from an academic point of view and therefore academics will soon be called on to define what constitutes an innovative curriculum and assessment plan that includes VR.

Students value a course as important if it contains assessments. Lejerskar (2021:1) from the Eon Reality group believes that a student being assessed in the virtual environment, can learn concepts and apply critical thinking, which makes the assessment valid (meaning that it tests what it is supposed to test).

For several years, students have been exposed to learning via the VR mode. The question being asked by critics is whether VR supplies sufficient educational content to support learning and whether it is possible for students to be assessed through the VR environment (ClassVR, 2018a). Menon and Castrillon (2019:1) argue that "in a world where interdisciplinary research is of growing importance, traditional departmental structures may be preventing education from evolving and creating barriers between departments. Looking at international trends,

universities are focusing on how best to prepare HE graduates for future employment and leadership positions" (NAEP, 2017:1).

During COVID-2019, many educators had to convert to online training, and VR being an immersive online platform, have very similar instructional designs in common when being compared to normal online learning. STRIVR (2020:44) has created the elements and tools listed below that can be used in the lesson plan and would automatically become part of the curriculum. Table 5.1 illustrates the elements that should be included in an online or VR curriculum.

Table 5.1: Lesson elements in VR
(Source: STRIVR (2020:44)

Lesson Elements	What does it look like?
Engage	*Brainstorm* • What do you think? *Ask questions* • What do you wonder? What are you're curious about? *Access to prior knowledge* • What do you know? • How did you learn it?
Explore	*Research* • Watch videos • Read articles • Discuss • Crowdsource
Explain	Live synchronous sessions • Video Lessons • Instruction • Modelling
Elaborate	Make connections Connect concepts to life beyond the classroom Tackle real-world problems Explain how you solved a tricky problem
Evaluate	Video reflections Quizzes

By using the lesson elements of engagement, explore, explain, elaborate, and evaluate an effective online VR-learning experience can be created, which includes an assessment and curriculum plan to allow student engagement.

Buenaventry, an instructional designer at STRIVR, further states that a good traditional curriculum does not easily translate into a virtual environment. A curriculum plan in VR needs to be written with the understanding that the student will be in a fully immersive world but a realistic environment. For example, teaching a medical practitioner to perform a medical

procedure will take place in a surgery room. Students should be able to participate in interactive lessons to obtain an assessment decision. Therefore, it is important that the curriculum designers write the VR programme to capture the correct data to obtain the correct results. At the point of creating the curriculum, designers need to ensure that the content script is provided to the filmmakers and spatial design team (STRIVR, 2020:1).

When setting assessments in the VR environment, the designer should be cautious of setting the questions differently, rather than opposed to the traditional assessment methods. Here it is all about knowledge and practical experience that is gained (Lejerskar, 2021:1). In a study conducted by Makransky et al. (2020:1), 105 engineering students were divided into three groups; the first one was an immersive VR simulation, the second one a desktop simulation and the third one a traditional text-based assessment. The results of the intrinsic motivation test were the same for all three groups. However, it is interesting to note that while the test results were the same for all three groups, a significant difference in test results was observed when the students were later asked to complete a practical task in a real-life situation. It was only the students who were part of the immersive VR simulation group that were able to complete the tasks successfully.

Tomorrow's challenge may well be to train HEI academic staff members so they can become more confident with using edtech, or to convince them of the usefulness of implementing such tools. While the future of education is promising, it is important to conduct more scientific studies to measure the effectiveness of these new methods before drawing a definitive conclusion regarding the relevance of developing such solutions in teaching (Maseko, 20191:1). Overall, amending the curriculum to incorporate the use of VR in teaching and learning requires a strategic and systematic approach. This approach involves identifying learning objectives, developing VR-learning materials, incorporating VR into existing courses, integrating VR into assessment practices, and training educators in VR technology. Therefore, it is crucial for the HRD to ensure that employees are capacitated to deliver on the execution of VR in HE.

5.7 Summary

Using technology is quickly establishing itself as the future of education, and therefore academia needs to start considering ways to incorporate VR in the curriculum and assessment plans. While VR has gained increased research in learning, there has not been much development on creating VR curriculum and assessment plans that are approved by regulatory bodies. When designing a VR curriculum for the subject human resources, it is important to follow best practices to ensure that the curriculum is engaging for students. The chapter alluded to that fact that clear learning objectives are important, which should be developed by a team that can covert the content to interactive immersed content. VR

developers to create realistic scenarios and to allow for students to get feedback on their immersed assessments.

Although many countries have recognised the benefits of VR-learning and the assessments for various purposes, the study could not find any evidence that South African qualifications refer to VR as an approved assessment instrument. However, it is important for all assessments to be valid, reliable, fair, flexible, authentic, transparent, and sufficient.

Virtual assessment would become more popular as teaching and learning move towards online learning. HEIs would need to be forward thinking and start discussing how students will be trained and assessed in future. The critical scarce skills of the future are communication skills, creativity skills, collaborations, and contextual learning skills. A renewed curriculum and assessment plan would be required to cultivate these needed skills of the future. Teaching and learning specialists would need to prepare for VR assessments that can replace text-based assessments. Though the science of assessments lies in traditional paper-based assessments, academics should prepare to meet the needs of the technological society students. Innovated assessments should be developed, as training takes place in the immersive world.

CHAPTER 6: RESEARCH METHODOLOGY

6.1 Introduction

Following the four literature review chapters, the research methodology suitable for this study is presented in Chapter 6. The research methodology was formulated in accordance with the research problem and questions. This chapter indicates the line of approach of the study.

Research is concerned with acquiring knowledge by collecting facts and interpreting them to obtain new knowledge. According to anthropologist Zora Neale Hurston, “Research is formalized curiosity which poke and pry with purpose” (Boncz, 2021:11). Research furthermore focuses on providing findings of a piece of research that is authentic, verifiable and contributes to the knowledge in a specific field (Singh, 2016:3). The ultimate output of this study was derived from the chosen qualitative research methodology through which various relevant and inter-related pieces of information were gathered using open-ended questionnaires, semi-structured interviews, and a true experiment.

This chapter commences with restating the research questions as a reminder to the reader. Thereafter, the overall research practices are discussed, which include the research paradigm (interpretivism), methodology (qualitative), and design (descriptive case study). Next, the target population is defined, and the sampling method used is described. Data collection methods and the instruments used are explained. A discussion of the ethics for this study follows, describing the various ways in which ethics was guaranteed during the research process. Towards the end of this chapter the researcher elaborates on the data collection procedure and data analysis conducted. The chapter concludes with a discussion of the authenticity of qualitative studies.

6.2 The research questions

The purpose of the study is to propose a framework for improving student engagement using virtual reality (VR). To build the framework, tertiary institutions’ current dropout rates and throughout rates for a particular qualification was investigated to determine the relationship between VR-learning and student engagement to ultimately increase dropout rates and throughput rates at the selected private HEI.

The study followed a descriptive approach. It is against this backdrop that the below research questions and research objectives were formulated.

The study aims to address several questions as stated in Chapter1, section 1.3:

1. To what extent can VR technology be incorporated into teaching and learning to improve HR students’ **level of engagement**?

2. To what extent can VR technology in teaching and learning increase HR students' **pass rates?**
3. What is the **relevance of current teaching and learning** methods of instruction in terms of engaging with HR students?
4. To what extent are **academic staff prepared** to use VR technology in their teaching and learning practices?
5. How can VR-learning be incorporated into the **HR curriculum** that are acceptable to regulatory bodies?
6. What **recommendations** can be proposed to the selected HEI in adopting VR-learning in teaching and learning practices to improve HR student engagement?

6.3 Research paradigm

A research paradigm is defined as a "model or pattern containing a set of legitimate assumptions and a design for collecting and interpreting data" (Barker, 2003:312, cited in de Vos et al., 2011:40). Rehman and Alharthi (2016:50) further describes a research paradigm as "a basic belief system and theoretical framework with assumptions about the differences and similarities in their ontological, epistemological, and axiological assumptions".

Ontology includes having a research problem and then discussing the general features and relations to the entity that exists. Ontology forms the foundation of the research and are most often referred to as the nature of our beliefs of reality (Rehman & Alharthi, 2016:51). It can further describe the nature of the researcher's assumptions and beliefs (Aliyu et al., 2015:8).

The term **epistemology** can be interpreted as *knowledge* or *understanding* and is an attempt to understand the degrees of rationalising the evidence (Aliyu et al., 2015:1). It is the epistemological question that leads this study, namely, whether the use of VR can increase student engagement levels.

Lastly, **axiology** refers to the value theory and classifies what is good and the extent to which the findings are good (Suprapto, 2021:3). It is also referred to as the *methodological* question and involves methods of how the researcher could gather information (Aliyu et al., 2015:8).

From this philosophical perspective, the researcher firstly accepted the nature of student engagement levels at private higher education institution (HEI) X (ontology), and secondly gathered knowledge and an understanding of how VR can play a role in addressing the research problem (epistemology). Lastly, the researcher examined the primary and secondary data collected to reveal its value (axiology) (Rehman & Alharthi, 2018:52). Although the ontology and epistemology of the researcher are not explicit in the study but rather more

deduced, it allows the reader to understand the importance of relevance of the study (Rehman & Alharthi, 2018:53).

In social sciences, seven main approaches stem from the researcher's ontological and epistemological point of view. These seven approaches are: (i) positivism, (ii) post-positivism, (iii) constructivism, (iv) interpretive approach, (v) critical approach, (vi) feminism, and (vii) postmodernism (De Vos et al., 2011:10). The **interpretivist paradigm** was adopted for this study as the researcher relied on the dialog between the participants and the researcher.

The interpretivist paradigm is rooted in physical sciences, evidenced by individuals interpreting their understanding, feelings and experience about a given subject, which results in the researcher deeply understanding the individual in their social context. In alignment with the interpretivist paradigm, the study adapted to a relativist ontology in which a single phenomenon can have multiple interpretations. Therefore, it was important to the researcher to ensure the avoidance of any bias during the research process. This is crucial as bias has the potential to introduce subjectivity into the findings. (Pham, 2018:3; Rehman & Alharthi, 2018:55). Rehman and Alharthi (2018:56) add that interpretive methodology should be "understood through the eyes of the participants rather than the researcher". This method has required the researcher to rigorously attend to detail and follow a systematic precision during the research.

The study adopted the **inductive research paradigm** as theory was developed from observing the empirical reality of students studying using VR, and thereafter the researcher determined how the levels of student engagement increased (or declined) because of studying using VR (Aliyu et al., 2015:6). Newman (2000, cited in Aliyu et al., 2015:6) concurs and states that an inductive thought starts with either an observation of examination (like in this study's case) of events or processes to derive general statements.

Through the inductive research paradigm, this study is grounded in theory whereby the researcher could develop a theoretical account of the data observed (Aliyu et al., 2015:10).

The researcher made use of **hermeneutics** to acquire knowledge. The original purpose of hermeneutics as described by Aliyu et al. (2015:12) and Krauss (2022:1) was to understand 'the religious', being the Bible. Since then, hermeneutics has been used as a general approach to understand text as well as the true meaning of the text. The researcher has applied the concept of a hermeneutic circle though understanding the relationship between proper knowledge of a text and comparing it with new/or the same text.

6.4 Research methodology

This study adopted qualitative research methodology. The focus of qualitative research is to explore and describe experiences of a social group (Durdella, 2019a:4) and stems from the interpretivist approach. Creswell (2007:37-39, cited in de Vos et al., 2011:65) explicates the characteristics of qualitative research as research that "tend[s] to collect data in the field where the problem exists. It is a form of enquiry in which the researcher makes an interpretation of what has been seen, heard and understood".

6.5 Research design

The ontological and epistemological belief of the researcher assisted in choose the research design. **Descriptive case study design** was chosen**.** Case study design is described as a microscopic approach where rigorous examination takes place (De Vos et al., 2011:166). The researcher tested the theory of student engagement levels increasing as a result of VR-learning. A one-shot (or snapshot as it is also referred to) case study design has been used in this study. This exemplifies only one case for this study ranging between six weeks and six months (De Vos et al., 2011:168), which provided the opportunity to use this case study as a programme evaluation in which the researcher could provide recommendations or changes to be made to the programme. Programme evaluation focuses on the careful examination of the nature of the rules, regulations and procedures intended to set boundaries and expectations in formal and informal settings.

To conduct the case study, the researcher made the case selection (i.e., framed the boundaries of where and what time the data would be collected), and then ensured that the research questions indeed address the case study.

6.6 Population and sampling

The research population comprised the entire group from which the study wanted to draw a conclusion.

Because the researcher made use of three data collection methods, the defined population parameters were set individually for the open-ended questionnaire, semi-structured interviews, and the true experiment. A parameter is a measure that defines the entire population.

- For the open-ended questionnaire, the population consisted of academics employed at HEIs.
- For the interviews, the population consisted of VR experts focusing on VR in education.

- Lastly, for the true experiment, students who were registered for the ND in Human Resource Management during the 2018 and 2022 academic years at the selected private HEI formed the population.

Sampling is fundamental to all statistical methodology of behavioural and social research (Singh, 2016:91). Gibbs (2012:34) notes “the importance of choosing a sampling design as it is an exact sketch determined prior to any type of data collection for obtaining a sample form a given universe”. Resulting from choosing qualitative research for the study, the **non-probability sampling was done through purposive sampling** (Boncz, 2016:29). Purposive sampling is used when researchers wish to target certain individuals with characteristics of interest in the study (Turner et al., 2020:1).

For the questionnaires, fourteen (14) academics employed by HEIs have been selected purposively to ensure the credibility of the study participants. The researchers chose the participants based on years’ experience and expertise in the field of teaching and learning. Twelve (12) of the fourteen (14) academics who formed the sample were part of the selected private HEI used in this study. The other two (2) academics were chosen for their extensive experience in the field of teaching and learning, not taking away from the fact that the other eight (8) academics did not have extensive experience in teaching and learning.

For the interviews, purposive sampling was again selected as the researcher deliberately chose three (3) participants who are well-recognised in the field of VR. Two (2) international and one (1) national participant have been selected.

Finally, for the true experiment, twenty (20) students who were/are still registered with the selected private HEI formed the sample. Ten (10) of the control group students have been chosen purposively as they were all part of a distance learning online class that ran concurrently with the planned experiment taking place. The other ten (10) students from the experimental group were purposively chosen in terms of residing in the Western Cape to perform the experiment.

The advantages of choosing a non-probability, i.e., purposive sampling, in this study, are listed below (Singh, 2016:100):

- The researcher has better control of the significant variables
- The sample group’s data can easily be matched
- There is similarity of subjects used in the sample

From the accepted sample, the researcher could apply the below feasible data collection methods.

6.7 Data collection methods

The first data collection method used in this study was **open-ended questionnaires**. The purpose of providing respondents with this type of questionnaire is to allow the researcher to collect the participants' own views instead of giving them a predetermined a set of answers to select from. The participants could offer further opinions, leading to the data being more diverse (Albudaiwi, 2017:1).

Secondly, semi-structured interviews were used. An advantage of the **semi-structured interviews** was that the researcher could have a plan (or guide) of what questions to ask , which brought a level of predictability to the data collection process (Durdella, 2019b:2).

As a result of the **true experiment** used in this study, the researcher could manipulate the independent variable, *virtual reality*. Both a control and experimental group were assembled to determine changes, if any, to the dependent variable, *student engagement* (Lapan & Quartaroli, 2009:37; Pham, 2018:2).

The experimental design chosen was the **random post-test-only control group design**. Although experiments are quantitative in nature, there have been various studies conducted using a qualitative experiment (Robinson & Mendelson, 2012:1). Literature supports this idea and notes that qualitative research design is probably the most flexible design and therefore experimental techniques are accepted (Shuttleworth & Wilson, n.d.:1). Applied to qualitative research, true experimental design is supported by an open and interpretivist approach (Robinson & Mendelson, 2012:2).

Harald and Garfinkel (1967, cited in Flick et al. (2004:187) were able to use experimental design in qualitative research to describe the social integration between participants. This method of using a quantitative measurement in a qualitative study is often referred to as a phase model (Flick et al., 2004:187) and is a classic approach introduced by Barton and Lazarsfield in 1955. Lapan et al. (2009:244) further support this view as it is multimethod research where more than one method is used during the data collection and analysis phase to provide a more meaningful answer to the research question.

The study confirmed that no statistical figures (such as means, mediums, and modes or distribution or deviation tables) have been used for the experiment.

The study refers to evidence table 6.1 below to support the use of experimental design in a qualitative study.

Table 6.1: Experimental design in a qualitative study

Article/Book	Author, Year	Statistically significant
• A qualitative experiment • Research on mediated meaning construction using a hybrid approach (article)	Robinson and Mendelson (2012)	Yes. The article was published.
A companion to qualitative research (book)	Flick et al., 2004:49)	Yes. The qualitative study made no explicit pronouncements on questions from the qualitative study, but rather from their criticism of quantitate research and their use of an interpretative approach using a case study. In their own minds they associated themselves with a qualitative social research study, as it gave them a better guarantee of preserve the integrity of the data.
A companion to qualitative research (book)	Barton and Lazarsfield (1955)	Yes. The opposite was also achieved by using a qualitative method in a quantitative approach. This is referred to as a phase-model.
Research essentials	Lapan et al. (2009)	The potential to use multiple methods can include a combination of qualitative and quantitative research (Lapan et al., 2009:144).

In this study, a more comprehensive and valid picture could be presented by collecting data thought the three chosen methods, namely, open-ended questionnaires, semi-structured interviews, and conducting a true experiment.

6.8 Data collection instruments

A data collection instrument is defined as a means of producing qualitative (as in the case of this study) data to be analysed. For this study, the researcher made use of open-ended questionaries, semi-structured interviews, and a true experiment.

Singh (2016:200) defines a questionnaire as “a form which is prepared and distributed for the purpose of securing responses”. The questionnaire contained a list of written questions. The answers of both the control and experimental group of participants were recorded. The questionnaire was self-administered. Prior to sending the questionnaire to participants, a letter of consent was first obtained from the participants. As part of the questionnaire, the following ethical considerations have been adhered to: confidentiality, informed consent, clear instructions and questions, and the freedom to remove themselves from the study at any stage during the research process.

The researcher divided the questionnaire (see Appendix C) into three sections, as follows:

The first page of the questionnaire is a covering letter, informing the students of the purpose of the study and how the questionnaire is structured. On the second page of the questionnaire, the researcher's contact details are provided along with the contact details of the supervisor. The research title, purpose of the research, research methods, significance of the study, and statement regarding ethics are also provided.

Pages 3 to 11 of the questionnaire comprises Research Question 1 to Research Question 4, all aligned with the research questions mentioned in Chapter 1 of this study.

In total, the questionnaire has 38 questions. Each of these main research questions has section sub-questions. The questionnaire format portrays a user-friendly design, with the questions grouped according to their function (e.g., main questions directly concerned with the aim of the study).

The participants were requested to complete the questionnaire within ten (10) days and return it to the researcher via email to upload the documents into ATLAS.ti and then code the data. One reminder had to be sent to three (3) participants who did not submit their completed questionnaire on time.

The study eliminated biases throughout the conduct of the questionnaire by:

- Having no influence on the completion of the questionnaire by the respondents—the participants completed the questionnaire on their own without any interference of the researcher
- Ensuring that the questions address the research objectives

The second research instrument that was used, were semi-structured interviews. According to Singh, (2016:19), "informal interviews are a conscious attempt by the researcher to find out more information about the setting of the person". The researcher forwarded the interview invite to six (6) VR specialists of which only three (3) returned their consent form. The interviews were conducted and recoded using MS Teams. This also assisted the researcher to decode the information in MS Teams as the transcribing function was used. The interview took about 30-45 minutes per participant to conclude.

In this study, both primary and secondary resources were used to collate the information as illustrated in figure 6.1.

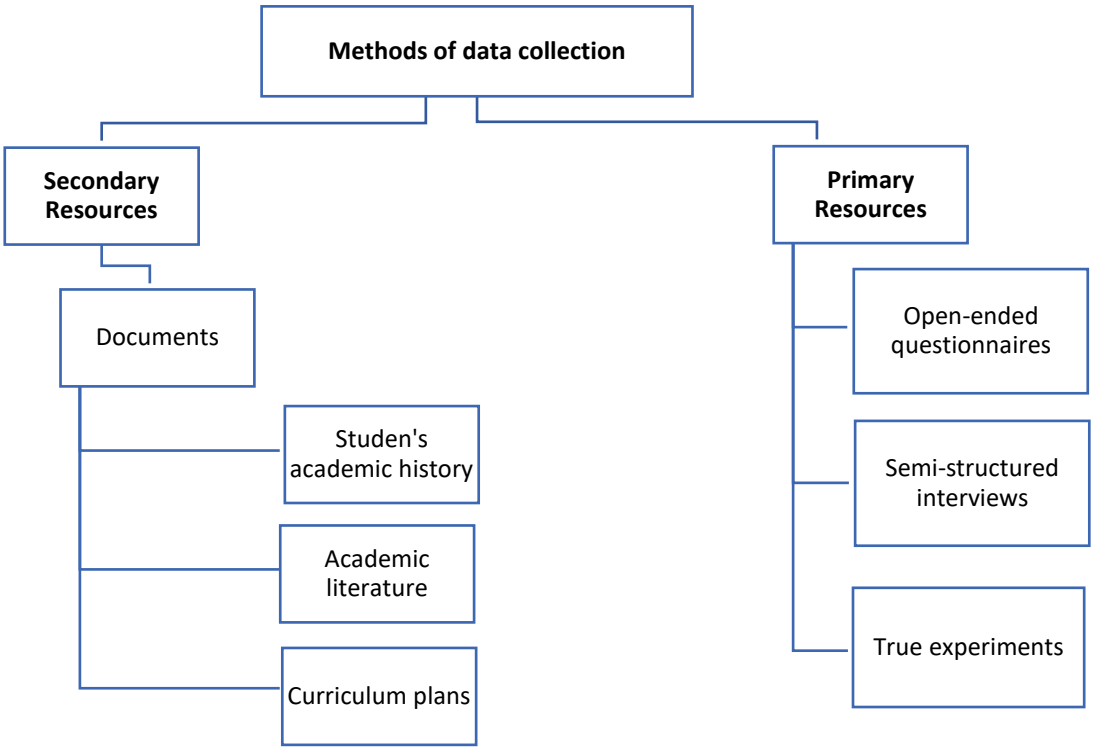

Figure 6.1: Methods of data collection

Data collection instruments and data collection procedures (section 6.8) are closely related (Durdella, 2019a:4) and often considered together, yet when presented in qualitative research, each one is discussed separately. While data collection instruments and data collection procedures are separate, they are closely related because the choice of data collection instrument influences the data collection procedures. For example, while the research question requires the use of interviews, the data collection procedures involve selecting the participants, scheduling the interviews, and conducting the interviews according to the semi-structured interview guide.

6.9 Pilot study

A pilot study was conducted to test the validity of the questionnaire and the interview. The researcher used two participants for the pilot study. One advantage of conducting the pilot study was that the researcher could determine an estimate of the duration of time required to complete the questionnaire and conduct the interview (Lapan & Quartaroli, 2009:86). After conducting the interview pilot study, the participants and the researcher made minor changes to the instrument, such as eliminating any ambiguity. The researcher further ensured that participants understand how to navigate in the immersive space when wearing the headset as this was a first-time experience for all participants involved in the experiment. Babbie (2001:250, cited in de Vos et al., 2011:242) noted that no matter how prepared the researcher is for the interview, there is always the possibility of error, hence the need to conduct a pilot study first.

6.10 Data collection procedure

The process of data collection is described by Bhandari (2021:1) as “a systematic process of gathering observations or measurements”. For data collection using the open-ended **questionnaire,** the researcher invited twenty (20) participants to take part in the study; fourteen (14) participants completed and returned the consent form. The researcher introduced the study to the participants, provided the title, aim and how data would be collected. Finally, the researcher shared the significance of the study with the participants. After receiving the consent forms, the researcher emailed the questionnaire to the participants, who were all academics. The questionnaire was drafted in a simple and comprehensive manner making it easy for the participants to identify and understand the focus areas of the questionnaire and to complete the sub-questions of each section.

Twelve (12) of the respondents working for University X were selected for this study, while the other two (2) have been invited for their experience in teaching and learning. On receipt of the questionnaires, the researcher saved the documents in ATLAS.ti to code.

A similar process was followed for the **semi-structured interview**. The researcher requested six (6) individuals to take part in the study. Only three (3) accepted and completed the consent form. Interviews were conducted using MS Teams and were recorded for transcription purposes. The transcriptions were also uploaded to ATLAS.ti for coding and analysis. Although the interview was semi-structured, the researcher soon realised that the interviewee also referred to other themes in the study, which means the researcher could therefore not ask each question in sequence as per the interview guide. The researcher did ensure that all themes and/or research objectives were covered. Durdella (2019a:1) alludes to this notion and indicates that some impromptu scenes and improvised lines can be expected during a qualitative semi-structure interview. The paradox is that impromptu comments did not happen in the pilot study as the researcher followed each question in the interview guide rigorously. It could be inferred that the experience interviewees have in using VR can broaden the discussion.

For the **true experiments**, the researcher invited the selected students. The students were grouped into a control and experimental group. Students completed and thereby accepted the consent form. For the experimental group, the researcher met with the individuals in person at a venue in Cape Town to conduct the VR training. For the control group, the researcher conducted the training via MS Teams. The experimental group wrote their assessment while being in the immersive world (in VR). The control group wrote their assessment directly after the training commenced online. The assessment results for the experimental group were marked by the VR-learning management system (LMS) and saved in the VR LMS. The researcher had to physically mark the assessments of the control group of students. Following

the collection of the assessment results for the experiment, the researcher conducted a short interview with each student from both groups. Each interview of the experimental group was recorded in MS Teams to obtain the transcription immediately and upload it to ATLAS.ti. The control group was also allowed to have a debrief session whereby the students were requested to complete the questions designed with Google Forms. The link was sent to students in the chat forum in MS Teams upon completion of the training session.

Following the true experiment, a debrief session was conducted individually with each student in the experimental group. This session was recorded in MS Teams to automatically obtain the transcription and upload it to ATLAS.ti for analysis. The students in the control group completed online questions designed with Google Forms. The link was sent to students upon completion of the online training session. Similar questions were posed to both groups; however, the experimental group of students were also asked how they enjoyed the immersive experience and what challenges (if any) they experienced during the VR-learning experience.

6.11 Data analysis

One of the major tasks of this study was to make the raw data meaningful through the analysis process (Singh, 2016:231). Gibbs (2012:2) summarises the idea of data collection well by stating that data analysis implies some sort of transformation that needs to take place. Data analysis takes the raw collected data through processes to deliver information that is clear, understandable, insightful, and most importantly, trustworthy (Gibbs, 2012:2). It is important to analyse the data to reach a conclusion in a research study (Boncz, 2021:41).

When the data analysis stage commences, the data are already available to the researcher. The data collected from questionnaires, interviews, and experiments have very little meaning until they are classified in a systematic way. For this study, the statistical software programme ATLAS.ti was used to analyse the data and create data visualisations most used for qualitative research studies. ATLAS.ti is a sophisticated software tool to arrange, reassemble, and manage data in creative and systematic ways. The researcher had to update (remove spelling and grammar errors from) various text documents before it could be coded to produce meaningful information.

After the data were imported into ATLAS.ti, the researcher coded the data. Coding refers to a word or a phrase that are selected for categorising, sorting, labelling, organising, or comparing (Lapan et al., 2009:264). The researcher created a set of initial codes (also referred to as open coding) before the text was categorised. During the coding process, the researcher had to create additional codes. The data had to be read and re-read multiple times to ensure it was coded correctly.. This ensured data reliability (ATLAS.ti, 2022:1) By the end of the coding

session, the researcher could compare some of the similarly worded codes that contained matching concepts and meanings.

Making use of the code manager function of ATLAS.ti, the researcher could navigate through the different codes and group them into categories (themes) that were created based on the research questions. From there, the researcher could draw certain conclusions using the ATLAS.ti functionality.

6.12 Ethical standards

Ethical standards are guidelines that direct the researcher when making certain decisions (Lapan & Quartaroli, 2009:3). According to Bos (2020:31-40), ethics provide guidelines to the researcher on how to conduct the research according to high ethical standards. Some of the ethical principles include honestly, objectivity, integrity, carefulness, openness, objectivity, non-discrimination, respect for intellectual property, and confidentiality, to mention a few.

Throughout this study, the dignity and welfare of the participants were protected. The academic staff and students who took part in the research had the freedom to decline participation, but they were ensured of the confidentiality of the research data.

To minimise any risk to participants, the researcher requested that each participant complete an informed consent form. In this study, the consent form notified the participant of the background and aim of the study, and more importantly, of the right of a participant to withdraw from the study at any time. By signing the consent form, the participants further understood that their participation in the study will remain anonymous.

As a safety measure, the researcher ensured that the VR headset and hand controls used by the experimental group in the true experiment, were sanitised after being used. The researcher further ensured that the area where the true experiment for the experimental group of student took place, would not cause any harm to them. The researcher also ensured that no participants were deceived in any way on what to expect from the study.

Secure storage of research data is at the core of research ethics, especially today. It was therefore important that the study adhered to the POPPIA Act of 2013 and guarded against the invasion of privacy and the sharing of personal information. The data collected were relevant to the research problem and analysed using the ATLAS.ti research tool. After publication, only the data necessary for the verification of the study results will be kept and stored safely.

Confidentiality of the participants was maintained throughout the study. For the data collection, participants were informed that their responses would remain anonymous by default. The

researcher also did not collect any private data from the participants unless it could be justified. Participants were briefed prior to conducting the research on the research aims and objectives, and that they (the participants) had the right to withdraw their cooperation at any time. Lastly, participants were informed that they could retrieve their data and correct mistakes (Bos, 2020:153).

Equally important to the above, ethics clearance was obtained from Cape Peninsula University of Technology (CPUT) prior to conducting the study. Several ethical questions posed by CPUT had to be answered by the researcher, and the document had to be submitted for approval to the Faculty of Business Management Sciences Ethics Committee, which provided the ethical clearance.

The researcher further obtained approval from University X to collect data from the institution regarding students' previous throughput rates and attendance records.

6.13 Authenticity of qualitative data

As alluded to in Chapter 1, utmost trustworthiness is crucial in qualitative research. Trustworthiness comprises various criteria, namely credibility, transferability, dependability, confirmability, and reflexivity (Korstjens & Moser, 2018:120). It is important for all stakeholders (the researcher, HEIs, academics, students, and any individual interests in implementing VR as an educational tool) to trust the information provided in this thesis.

Credibility was achieved by the researcher through triangulation. The researcher made use of various data sources and different methods to collect the data. Through triangulation, the researcher could produce truthful information (Noble & Smith, 2015:2). Credibility can also be seen as internal validity in quantitative research, however, for this qualitative research study, the word validity cannot be used (Korstjens & Moser, 2018:120). By applying the hermeneutic circle, the researcher ensured that there was a deep understanding of the text by critically reading the descriptive data.

Transferability was achieved by providing 'thick descriptive data' that can be passed on to other groups in a similar setting. In contrast to credibility, transferability is like external validity of quantitative data. This study succeeded in delivering a 'thick' description of data by providing a robust and detailed account of experiences during the data collection phase (Korstjens & Moser, 2018:122; Elo et al., 2014:4).

In terms of **dependability,** the researcher ensured that the research findings were consistent with the raw data that were collected (Statistics Solutions, 2022:1). By applying the

hermeneutic circle, the researcher ensured a deep understanding of the collected data through critically reading the descriptive data.

Equally important is the criterion of **confirmability,** which was achieved by the researcher documenting the procedures and keeping documents organised and secure. At any given time, the researcher could access the data to confirm the analysis that was performed (Elo et al., 2014:5).

Finally, **reflexivity** is the process of self-reflection. The researcher ensured that no bias or preconceptions were evident in the study (Korstjens & Moser, 2018:120). Other authors such as Elo et al. (2014:5) prefer to use the word *authenticity* as the final criterion of trustworthiness.

In summary, it is imperative for a qualitative research study to incorporate authenticity of the qualitative data by focusing on the various criteria of trustworthiness.

6.14 Summary

In this chapter, the researcher explained the various research practices or methodology used in this study. A qualitative interpretive approach was used for this study.

Three data instruments were used in this study, namely, (i) open ended questionnaires, (ii) semi-structured interviews, and (iii) a true experiment. Although experimental design forms primarily part of a quantitative study, the chapter outlined the reasons for using the experiment in a qualitative study and provided literature to support this decision.

The population comprised academics employed at HEIs, VR specialists, and students registered for the National Diploma in Human Resource Management during the academic years 2018 to 2020. A non-probability sample was used, with the respondents selected through the technique of purposive sampling. The sample comprised participants who would be best represented or have sufficient knowledge of the research topic.

The data collection process for each of the data instruments used, was explained. The data collection process was systematic, the data could be imported into ATLAS.ti, a computerised qualitative research tool. With ATLAS.ti, the researcher could code and analyse the transcripts to build the research outcomes.

The ethical standards applied in this study were identified and discussed. The researcher supports ethics practice in research and ensured that all the necessary and appropriate ethics were adhered to in this study. The chapter concluded with a discussion about the authenticity of this qualitative study. The principle of trustworthiness has been applied through the sub-criteria of credibility, transferability, dependability, confirmability, and reflexivity.

CHAPTER 7: PRESENTATION OF THE RESEARCH FINDINGS

7.1 Introduction

This chapter presents the research analysis and findings linked to the research questions as presented in Chapter 1, section 1.3. The findings serve to establish the synergy (if any) between *student engagement* and *virtual reality* (VR) in training, and how VR can may be used to influence student engagement.

The study adopted a qualitative research approach to allowed for greater capacity to gain in-depth data based on the participants' experience of VR used in training. Data were collected through questionnaires, interviews, and by conducting a true experiment. The profile of the questionnaire is presented in section 7.5 and the outline of the interviews is presented in section 7.6. this is followed by the profile of data collected for the experiment in section 7.7. Each section presents the themes related to the data source. The themes are divided into sub-sections to address each of the research objectives stated in Chapter 1. The findings derived from analysing the data collected from participants through the questionnaires and interviews are presented in the form of narratives and quotations to provide a deeper understanding of the thoughts and feelings of the students. For the experiments, the study made use of graphs and narratives to illustrate the findings derived from analysing the data collected from the students.

7.2 Descriptive statistics of the sample

The sample comprised three (3) participant experts in the field of VR who were interviewed, thirteen (13) academic staff members who completed the questionnaire; twenty (20) students who took part in the true experiment, and e-mail correspondence with one regulatory expert to determine if VR can be incorporated into the HR curriculum. Figure 7.1 illustrates the division percentage of stakeholders (participants) who took part in this study.

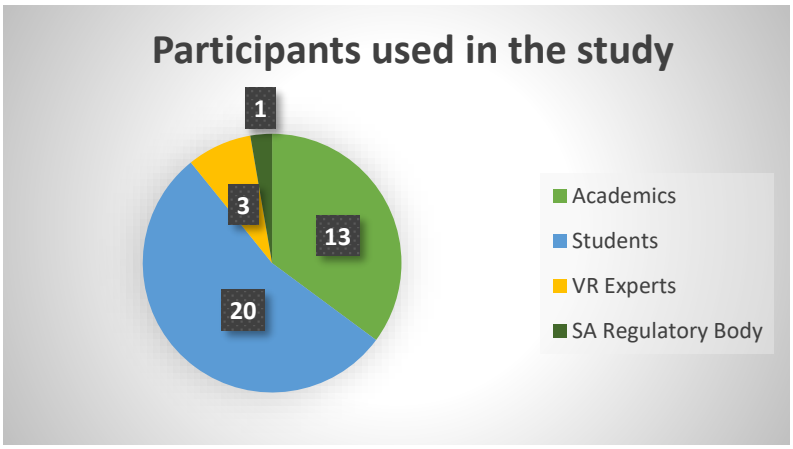

Figure 7.1: Participants who took part in the study
(Source: Author's own illustration)

7.3 Data collection and analysis approach

There are no agreed rules or procedures for analysing qualitative data, but there are different approaches, as described by Ritchie et al. (2013:19) and discussed in Chapter 6. The study adopted the **inductive thematic qualitative research** approach. The inductive approach involves data that are analysed where little or no predetermined theories, structures or frameworks exist.

The thematic qualitative research approach arose from grounded theory and is a widely used method of analysing qualitative data. It involves identifying themes or patterns within the data, which can be used to draw conclusions or make inferences about the research topic (Ritchie et al., 2013:19; Javadi & Zarea, 2016:1).

The data were initially extracted in its raw format, after which it was carefully analysed by considering a wide range of perspectives and experiences. Through this analysis, fundamental elements and underlying dimensions were identified, leading to the proposal of key themes.

The **initial** thematic framework was developed from a list of topics for inclusion and in alignment with the research questions, also referred to as research question themes or the core idea of each research question. Refining research question themes and sorting them into a set of themes and sub-themes is a common process in qualitative data analysis. It involves going through the data and grouping together similar codes or themes into larger categories, and then further refining these categories into sub-categories or sub-themes. During **indexing and sorting,** the study coded the data using computer-assisted qualitative data analysis software (CAQDAS) called ATLAS.ti, which is a software program that is commonly used in qualitative data analysis. Similar words or concepts were given the same code. In total, 32 codes were created using ATLAS.ti. . The ATLAS.ti software program provides a range of functions and tools that can be used to sort and analyse qualitative data, as well as to produce summaries and displays of the findings.

For this study, the coding was a lengthy and time-consuming exercise; however, it was required to categorise and sub-categorise the data to derive themes that are in alignment with the research questions. The data were well-ordered, forming neat ‘piles’ of coded data. Specific functions within ATLAS.ti were used to sort the data and then to produce the data summary and displays. The study identified associations in the text (data that were transcribed) and made the connections between experiences, behaviour, and perspectives from the data collected.

As mentioned in Chapter 6, both secondary and primary data were collected. In the next section the secondary data are presented (brief introduction of University X, showcasing the pass rate and dropout rate for the specific qualification under investigation). Thereafter the results from the research instruments are presented.

7.4 Overview of University X

University X is a private HEI that delivers accredited qualifications ranging from undergraduate certificates and degrees to postgraduate diplomas and degrees, up to the level of master's and doctoral Business Administration degrees. University X offers short courses, executive education, and continuous professional development. Their qualifications are offered in a range of modes to suit individual requirements via distance learning (DL) or distance learning online (DLO), which includes live lecturer sessions. The range of students registered between 2019 and 2022 was on average 24,000 students per annum.

The main problem statement identifies the lack of using VR-learning as the reason why University X is experiencing a decrease in student engagement, specifically within the Diploma in Human Resource Development and Practices. The problem has resulted in the following sub-problems: a decrease in pass rates, an increase in dropout rates, and a plateau in teaching and learning methods because of academic staff not engaging with emerging technology, specifically VR technology.

The average pass rate per annum per subject (module) and dropout rates have been collected and are presented in table 7.1. The key to determining the statistics is as follows:

- Pass rate = *Number of Pass/Competent* divided by *Number of Enrolled* minus *Incomplete*
- Dropout = *Number of Incomplete* divided by *Number of Enrolled*

Table 7.1: Average pass rate and dropout rate

Year	Enrolled	Qualified for summative	Students submitted	No. of Comp/PASS	Pass rate	Dropout
2018	280	184	172	156	89%	27%
2019	521	406	395	360	88%	28%
2020	434	357	328	281	74%	30%

Table 7.1 indicates the downward trend from 2018 to 2020 in dropout rate for the qualification National Diploma in Human Resource Management and Practice. A downward trend is noticed in pass rates from 2018 to 2020 (89% to 74%), indicating a 15% decrease in pass rates. The dropout rate further increased by 3%, from 27% to 30%. In total, 1,547 students

were registered during the period 2018 and 2020 for the National Diploma in Human Resource Management and Practices (NQF 5).

This study links a decrease in pass rate and an increase in dropout rate directly to student engagement levels.

The **primary data** collected are presented starting with the open-ended questionnaire findings (section 7.5), then the interviews (section 7.6), and finally the true experiment data (section 7.7).

7.5 Questionnaires

Four themes were derived from analysing the data collected using a questionnaire.

7.5.1 Demographics

Table 7.2illustrates the participants who completed the questionnaire.

Table 7.2: Biographical information of participants who completed the questionnaire

	Designation	Number of years' experience in HE	Gender
1	HoD: Human Resource Management (LB)	17	Female
2	HoD: Banking (DV)	18	Male
3	Lecturer (PB)	12	Male
4	Senior Lecturer (BE)	25	Female
5	Senior Lecturer	28	Female
6	Strategic Academic Advisor (AC)	35	Male
7	Lecturer and Programme Coordinator (MG)	3	Female
8	Lecturer, Assessor & Moderator	9	Male
9	Lecturer, Assessor & Moderator (FN)	16	Female
10	Lecturer, Assessor & Moderator (JS)	8	Female
11	Lecturer, Assessor & Moderator (K)	12	Female
12	Lecturer, Assessor & Moderator (EB)	23	Female
13	Lecturer (C)	18	Female
14	Training Manager (CL)	18	Female

7.5.2 Questionnaire categories

To set the scene for this section, the researcher included an explanation of the **background of the study** in the open-ended questionnaire and provided the participants with the main and sub-problem statements. In the next section of the questionnaire, the researcher focused on **student engagement,** the understanding of the concepts thereof, and the tracking of student engagement during facilitation. Each of the main questions were sub-divided into four or five sub-questions. Thereafter, questions related to the independent variable, **virtual reality,** were

compiled. In the fourth section, the researcher dealt with the preparedness of **academic staff** to use VR during training and development as well as during the assessment stage. For the conclusion of the questionnaire, the researcher focused on the participants' opinions of **regulatory bodies** and their acceptance of VR.

The four main themes derived from the questionnaires are discussed in more detail below.

7.5 3 Summary of findings: Questionnaires

The four main themes derived from the questionnaires are discussed in more detail below. This assisted the researcher with answering the research questions.

7.5.3.1 Theme 1: Student engagement

In total, 479 codes were created in ATLAS.ti to conceptualise the data obtained from the open-ended questionnaire. Figure 7.2 is a wordcount list showing the number of word frequencies and how they are distributed throughout the completed questionnaires.

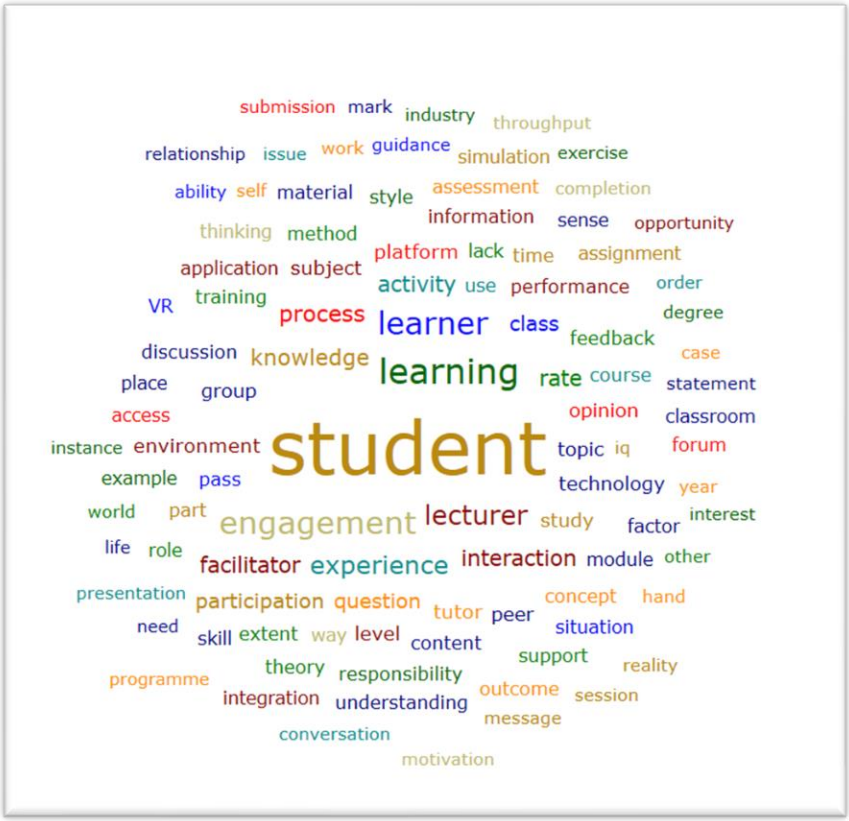

Figure 7.2: ATLAS.ti word count: Student Engagement (Source: ATLAS.ti, 2022)

The top three words identified to conceptualise this theme are:

- ***Student*****,** mentioned 180 times with 15 tokens,
- ***Learning*****,** mentioned 58 times with 15 tokens, and
- ***Engagement*****,** mentioned 48 times with 6 tokens.

The type-token ratio (TTR) is the relationship between the number of unique words that occur in a text, and their frequencies. The number of unique words in a text is often referred to as the number of tokens. See extract below from ATLAS.ti for the word list used.

Concept	C...
student	180
learning	58
engagement	48

Figure 7.3: ATLAS.ti word list: Student Engagement
(Source: ATLAS.ti, 2022)

It can be deduced (from figures 7.2 & 7.3) that the relevance between the three words lies in the fact that engaged students are more likely to be active learners. The literature in both chapters 2 and 3 alerted to the fact that engaged students are more motivated to acquire knowledge and be involved in their learning.

Of the 479 codes, 10 code groups were created to sort, organise, and filter the data into the research question groups. Figure 7.4 is an image from ATLAS.ti indicating the 10 code groups.

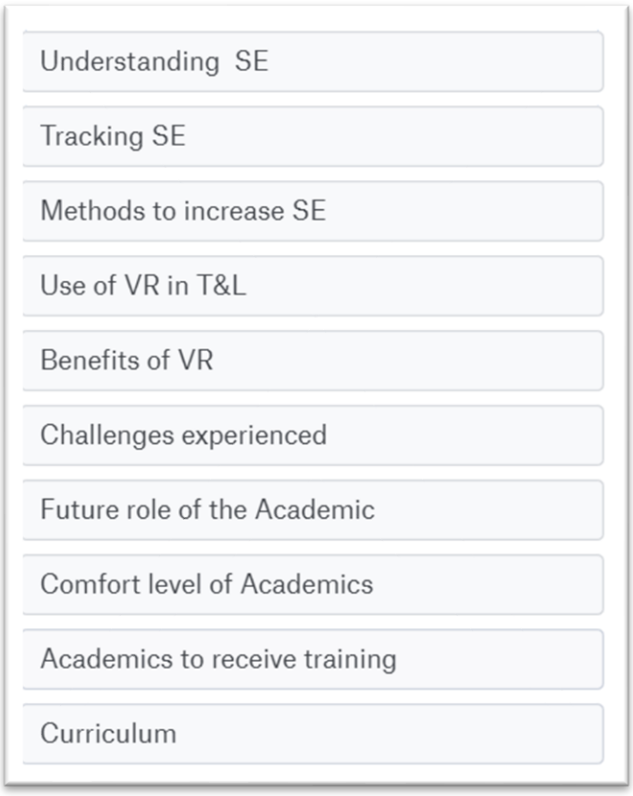

Figure 7.4: ATLAS.ti Code distribution across questionnaires
(Source: ATLAS.ti, 2022)

Although ATLAS.ti was the computer software analysis tool, the researcher still had to identify patterns in themes form the data imported into ATLAS.ti. From there, the created codes were aligned to the research questions so that the analysis could be done for generating insights relevant to the research. The study further ran a query report to search for specific themes within the qualitative data. This was particularly useful to assist with the large datasets. Figure 7.5 is an illustration of the query report that was run in ATLAS.ti. The report was based on the perception of participants understanding the concept of *student engagement* and how it relates to teaching and learning.

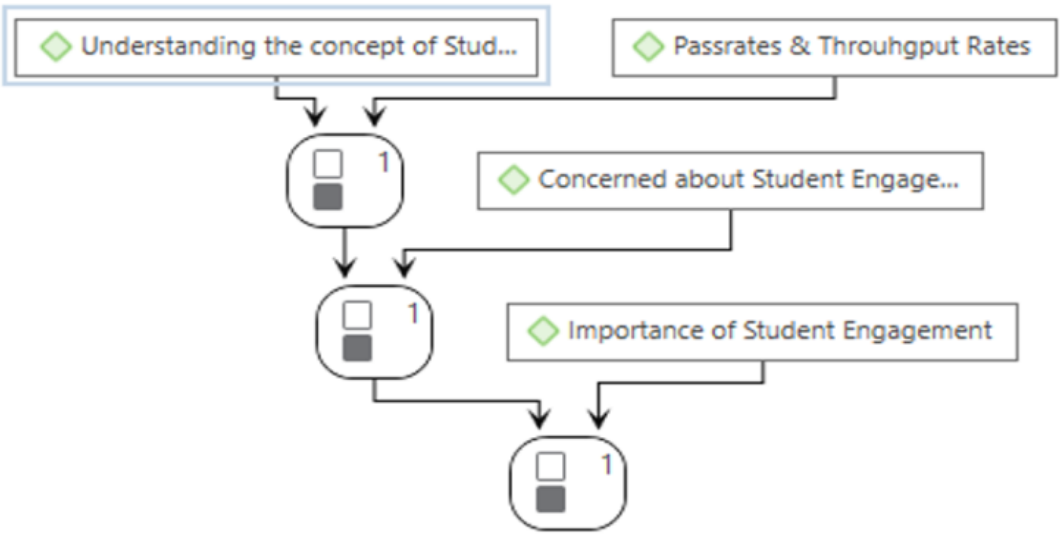

Figure 7.5: ATLAS.ti network diagramme: Student engagement vs. pass rates (Source: ATLAS.ti, 2022)

The purpose of running this query was to reflect on the connection between the two key concepts in the research study, *student engagement* and how it relates to *pass rates*. The data analysis confirmed that student engagement positively relates to increased pass rates. All participants indicated that they have a good understanding of what student engagement is and how it relates to student pass rates in HE.

Participants shared a common understanding of how student engagement affects teaching and learning. Participant 8 described in the absence of student engagement as *"… students will only be passengers in the learning journey".*

For questions relating to **a traditional approach of learning versus a student-centred approach,** all participants agreed that teaching and learning should be designed and delivered using a student-centred approach. The participants stated that they believe a student-centred approach will promote student engagement and increase the pass rate of a

subject. This outcome is particularly important for the student, as academics need to design VR experiences which are student-centred.

The study further reports on the responses of the participants to the **importance of student engagement.** The findings revealed that disengaged students are more likely to drop out of the programme or achieve poor results. The literature (Chapter 2) further confirms that disengaged students are likely to grasp concepts and understand the work, but they are also less likely to attend classes and submit assignments or participate in class discussions.

Contrary to the above, students who are engaged during their studies may *"…lead to higher levels of critical thinking and focus",* as described by participant 1. Added to this believe, participant 4 summarised the importance of student engagement as follows:

> *"*When *students experience the engagement as being meaningful and useful to their study, job and career aspirations, and when students experience the engagement as positive, challenging and constructive, the likelihood of their proactive and responsive participation in the learning process is significantly enhanced."*

Participant 6 elaborated on the notion that student engagement is a multidimensional construct that encompasses behavioural, emotional, and cognitive behaviour. Below is an abstract of the response.

> *"Student engagement consists of behavioural, emotional, and cognitive engagement. A student's participation in the learning process refers to behavioural engagement. Positive or negative reactions to peers, the lecturer and the university refers to the emotional engagement of a student. The student's thoughtfulness and willingness to master difficult skills refers to cognitive engagement."*

Participant 6 agreed with participant 4, stating the following:

> *"Student engagement enhances the motivation of the student to learn, increases satisfaction, reduces the sense of isolation, and improves the performance of the student."*

Participants were further asked whether they are **concerned about student engagement** in their classes. Interestingly, the findings revealed that the concept of student engagement is the responsibility of both the student and the lecturer. Seventeen per cent (17%) of the participants felt that students need to take ownership of their studies. Participant 4 noted:

> *"There are other factors outside the control of the student, such as financial support, illness, and internet access, which impact on pass rate and throughput rates."*

These participants felt that students need to take an active role in their learning by submitting assignments, partaking in class activities, and collaborating with fellow students. In addition, Participant 12 noted that he is concerned with students just passing without a good understanding of the material and the training delivered. The lack of student engagement in asynchronous online learning is a common issue of concern for academics. Participant 5 indicated that through the following interventions, she can track student engagement:

> *"… on time-submissions, high participation in discussion forums, asking questions – classmates and lecturer and the quality of assessment submission – do they demonstrate critical thinking and application of theory."*

Conversely, the remainder of the academic team deemed student engagement as crucial in a student's learning journey. Below are extracts from the answers of some of the participants who shared the same notion. Participant 3 added:

> *"Yes, I am concerned, and it is important to me because students that do not remain involved in the learning tend to fall behind or even drop out."*

Participant 6 said:

> *"Yes. As an academic I want my students to focus on the learning process, to motivate them to practice higher-level critical thinking skills and to achieve the learning objectives of the course."*

Participant 9 stated that:

> *"… engaged students work harder and progress quicker."*

Participant 5 noted that:

> *"… students who devote substantial effort and time to their studies, engage with their tutor and other students, are most likely to have good pass rates and throughput rates."*

Most academics who partook in this study are teaching online and their views stem from teaching in an online learning environment. The participants stressed that while VR can enhance the educational experience for them and the students, HEIs need to provide their support and be willing to experiment and take risks in testing new technology.

A further query ran in ATLAS.ti identified the ways in which student engagement can be tracked in the classroom. The results can be viewed in the diagramme (Figure 7.6) below.

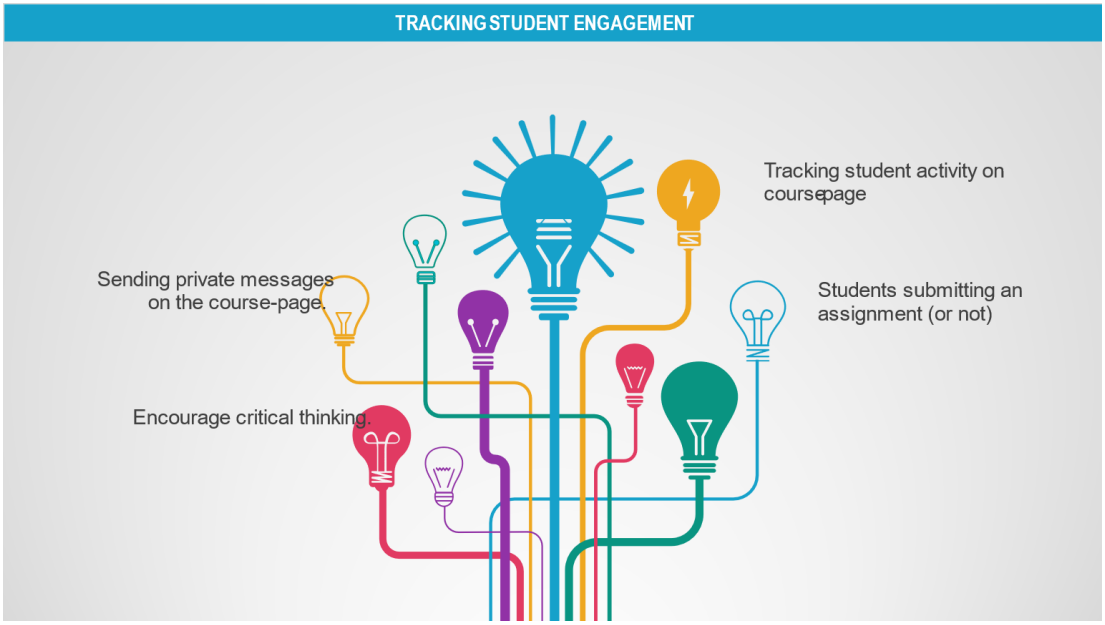

Figure 7.6: Tracking student engagement
(Source: Author's own illustration)

Figure 7.6 indicates that student engagement can be tracked by sending students messages via their course page, encourage them to participate and track their engagement on the student forum. Several academics further indicated that they would check the student's activity or 'last seen' statistics on the course pages. A further tool to check the student's engagement is whether they submitted their assignments or wrote the test.

The questionnaire data also offered insight into which is more important, *students interacting with other students* or *students interacting with emerging technology*. Mixed responses were provided by the participants. Most of the respondents felt that it is much more important for students to interact with one another and the facilitator. There were also participants who indicated that both student interaction and students interacting with technology are important to enhance student engagement. The study confirmed the potential benefits of utilising both concepts in a class.

Participant 2 said:

> *"Both are vital, but in my experience online — interaction has proven to be more important, the higher the interaction between students/lecturer the more motivated students seem to be to complete the module successfully."*

Participant 11 responded:

> *"Students should be given the opportunity for both integration and interaction because students have different learning styles."*

Ultimately, the learning design and outcomes together with the learning resources available play in role in deciding the extent that emerging technology are used in teaching and learning as well as the extent that students engage with one another.

Figure 7.7 is a word cloud query created by ATLAS.ti to support the analysis of *integration with technology* versus *interaction with students*. The degree that the participants answer the question relating to interaction with other students versus the integration with emerging technology is indicated. The analysis revealed that interaction with other students received twelve (12) tokens while integration received five (5).

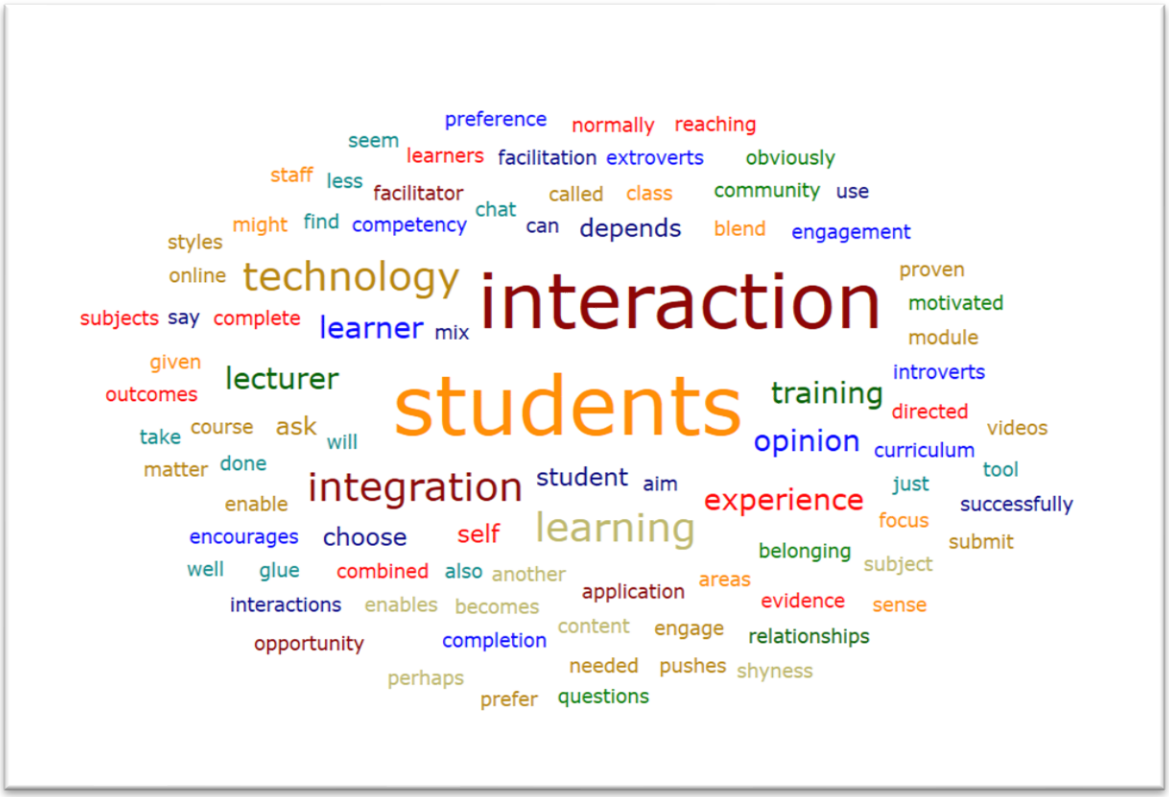

Figure 7.7: ATLAS.ti Word cloud: Integration with technology vs. interaction with students (Source: ATLAS.ti, 2022)

The focus of the questionnaire then shifted towards **factors that can influence student engagement**. In theory, it is understood that the level of investment from a student in his or her learning journey will influence student engagement.

However, conversely, participant 1 mentioned that the "*… Lack of data or internet connection. Lack of technological skills. Lack of understanding. Work and family commitments that influence time management. Being unapproachable as a facilitator*" are some of the reasons that may influence student engagement. Adding to this thought, participant 5 also provided a list of factors that can influence student engagement.

"*The Socio-economic situation of the learner – i.e., where they live and financial aspects; Access to technology; Functional use of technology; Language barriers and Cultural differences*."

Looking more towards the emotional needs of a student, participant 4 indicated that:

> *"… Some of the factors which influence student engagement include the degree to which the students have trust and confidence in their inherent or learned ability to perform (master the requirements associated with the course activities), and the degree to which the student feels supported and challenged to raise their performance to the academic standards required of them. Other factors include the extent to which a student is afforded the opportunity to construct their own knowledge and the extent to which collaborative and cooperative learning methods are made available to the student."*

Participant 8 agreed with the view of participant 4 and provided a similar explanation where trust plays a major role. The study ran a network diagramme in ATLAS.ti. to summarise the responses received for this question.

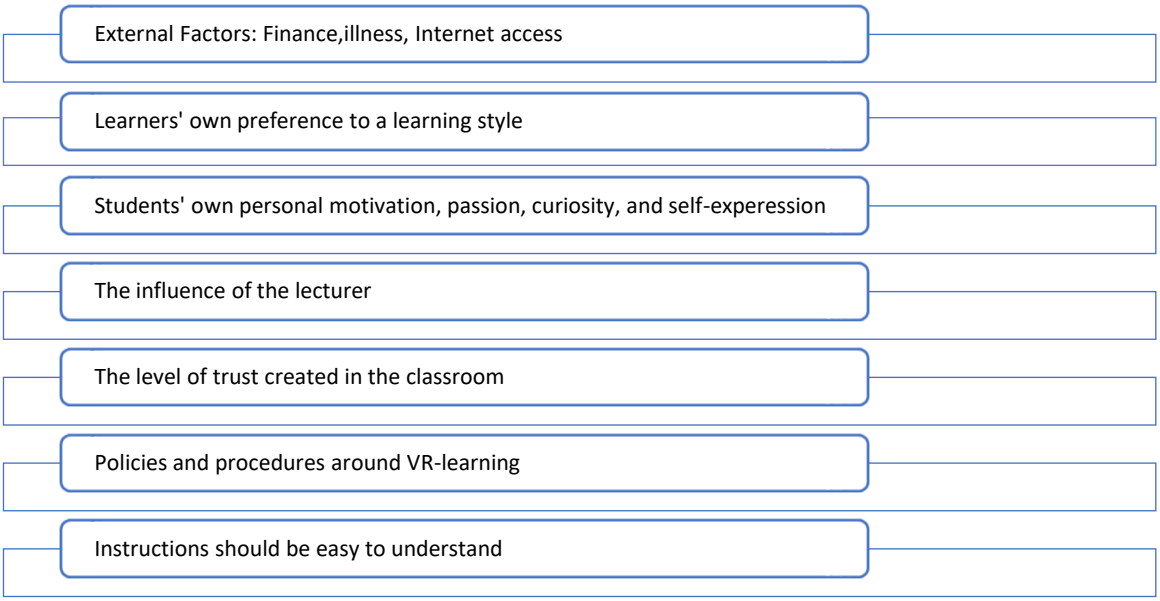

Figure 7.8: ATLAS.ti factors influencing student engagement (Source: ATLAS.ti, 2022)

Participants were then asked if they agree with the statement, "In the classrooms, there should be mostly **interaction between students**, the lecturer only needs to guide conversations". Fifty per cent (50%) of the participants agreed with the statement and the other 50% disagreed. Those who agreed argued that should students be left to their own devices they will lose interest in learning and feel isolated in their learning journey. Most often these

students fall behind as there is no facilitator to guide them through the learning outcomes. The participants who agreed with the statement had the following views:

Participant 4 mentioned:

> *"Yes, I agree with the statement, to the extent that agreement is reached with the students in terms of their role in the classroom and the role of the tutor, where the tutor presents topics and ideas and the students then initially engage with their peers, and when required, with the tutor, the tutor present at all times but not involved to the extent that the students feel the need to constantly 'ask the tutor'. The collective experience and knowledge of the students is significant; hence, peer to peer engagement is critical in the development of student-related knowledge and student performance."*

Participant 12 said:

> *"A lecturer can give the students' knowledge, but by collaboration with other students will create deeper learning and understanding."*

The questionnaire also alerted the researcher to the fact that VR training platforms can increase **students' creativity and results in a higher pass rate**. Only one of the participants was of the belief that VR cannot be used to increase all subjects' results, it depends on the subject offered. All other participants agreed that through the use of VR in training, students' creativity is increased and as a result, students obtain a higher pass rate.

A further report was created in ATLAS.ti to indicate how often each of the below selected codes (Figure 7.9) was applied in the questionnaires. Based on the findings of the report, it becomes clear that the participants expressed concerns regarding three main aspects: student engagement, the acquisition of knowledge during the learning process, and students' pass rates. A fundamental principle underlying the relationship between student engagement and pass rates is the significance of practical experiences in the acquisition of knowledge by students.

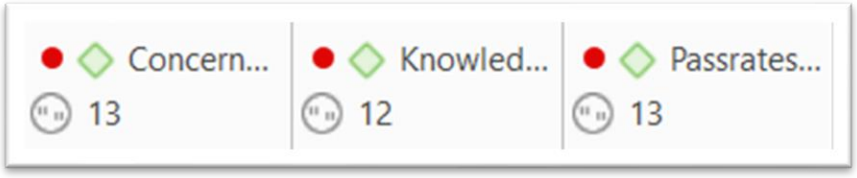

Figure 7.9: ATLAS.ti frequency of codes used in the questionnaire (Source: ATLAS.ti, 2022)

An important factor when discussing student engagement is **how to deal with disengaged students**. Participant 1 believed that should a facilitator reach out to the student it can change

the mindset of the student and the student will feel valued as a member of the study group. Probing questions on a statement that students made can also be used to engage with students. Furthermore, through the use of WhatsApp groups students feel they are not alone in the learning journey.

Participant 2 made an interesting remark, stating that students are at times disengaged as they have a fear of being judged:

> *"I would engage the student in a conversation to assess what the reason for the disengagement is. In most cases with new students, it is fear of being judged or negative previous experiences that hinder their engagement. I provide tips and encourage the student to engage with classmates – always ensuring that the class is well briefed on engagement expectations and 'house rules."*

Participant 10 made referred to the challenge of managing disengage students in a synchronous and asynchronous learning environment:

> *"This is challenging and a question I ask myself all the time. The synchronous learning environment will I, create small group activities where students need to work together and present feedback to the group whereas in the asynchronous learning will I engage with students through personal communication."*

The number of frequencies can also be viewed in the word cloud typewriter report, which can be seen in Figure 7.10 below.

Figure 7.10: ATLAS.ti typewriter report: Student engagement
(Source: ATLAS.ti, 2022)

Adding to asynchronous learning environments, participant 11 made the following comment:

> *"In the virtual world you can call them by name or put them in breakout rooms as they might be more comfortable in sharing when in smaller groups. Have an activity that forces them to participate."*

A further question asked to the participants was **whose responsibility it is to ensure that there are appropriate levels of student engagement** during teaching and learning. All participants believed that it is a dual responsibility shared between the facilitator and the student.

A further method to increase student engagement is to add visual concepts to the learning programme. Although the majority of participants believed that visual features in training are important, participant 5 indicated that a facilitator would understand the needs of all types of students and then be able to adapt the facilitation style to meet the students' needs.

Participant 13 said:

> *"In a study conducted it noted that 75% of everything we remember and take in is due to visual stimulus."*

Eighty-five per cent (85%) of the participants believed that a combination of both listening and doing is of importance, as listening enhances the ability to do or perform a certain task. The minority (15%) of participants believed that by only listening, students will also be able to succeed in a task.

This led to a question whether participants agree or disagree with the statement that "***the only source of knowledge is experience***". All participants disagreed with this statement. Below are some of their comments.

Participant 1 mentioned that:

> *"No, I don't agree with this. You build up knowledge through various methods. Reading, listening, research, practical application, that results in experience."*

Participant 3 responded:

> *"I do not agree with this statement because the basis of knowledge is having access to information, understanding it, and then processing it to eventually become part of the student's knowledge. Thereafter applying this theory into a practical environment will check for competency."*

Participant 6 said:

> *"I disagree. A student must first learn the knowledge to gain understanding and then perform certain activities that are further strengthened through practice and experience."*

7.5.3.2 Theme 2: VR-learning

The participants that took part in the questionnaire all understood the concept of VR and its functionality and were asked whether they have experienced VR.

Eighty-five per cent (85%) of the respondents have not yet had any experience with VR. The other fifteen (15%) of respondents have engaged in discussions or forums on what VR in education can do, but none of the participants have ever experienced being an immersive VR educational world.

Figure 7.11: Participants' experience with VR
(Source: Author's own illustration)

All the participants felt that if they **receive training** on how to operate the virtual headset and work with the software, they would be very comfortable to train with VR.

Participant 10 mentioned:

> *"I would love to train in a virtual environment but would like to first practice and experience the technology self before training students."*

Participant 14, stated:

> *"I think that would be amazing, but I will require a lot of training to ensure that it is done well and to the fullest potential."*

All participants indicated that they are interested in including **VR in their future training**. Herewith below some of the comments recorded.

Participant 1 said:

> *"This is most definitely something I would be interested in and interested in applying for my classes."*

Participant 9 concurred by adding:

> *"Absolutely yes. Learning is enhanced through playing and practical application."*

Participant 7 touched on the importance of changing from contact learning to digitalised learning.

> *"Given the pandemic and how it has affected contact learning … I think that VR could potentially be utilized (as opposed to online classrooms) to create a classroom feel, if one could use a VR set to "enter" a classroom and you could 'see' your classmates sitting next to you and "see" your lecturer at the front of the class! This could go a far way in creating a community feeling etc. and could also be a useful tool which could potentially decrease the need for physical university infrastructure. From this point of view, it could be a very scalable technological intervention to widen access to students."*

It was also important to consider the **benefits of teaching in an immersive world**. The preference of visual learning has been more popular among the participants than teaching from a textbook.

Participant 2 said:

> *"Most students use visual learning and do not enjoy reading a lot of content in one sitting. Research has also shown that visual learning helps learners store information for a longer period, as images are processed directly by the long-term memory function of the brain. This will in turn help students retain the information learnt longer which would not only improve their summative assessment results but will enable students to use the knowledge learnt practically for years to come."*

Participant 7 added that a benefit of a student learning in the virtual world is that they can make mistakes without any physical harm being done to an object or person:

> *"In a virtual environment, real-life situations can be displayed. The students can apply, analyse, and evaluate the situation and create new solutions to problems. They can do that without being fearful of making mistakes because the only way to innovate is by making mistakes and learning from them."*

A further overarching view of most participants is t that students will engage more with their learning should they be in an immersive world. Participant 12 spoke about the flexibility of

being able to work from anywhere in the world. Participant 11 concurred with participant 12, noting that working from home while teaching students in the virtual world would be an asset in managing his work life balance.

Adding to the above view, five of the participants also said that the time spent on preparing for a class would become less. Specific mention was made of the preparation of practical workplace scenarios that need to be created. The questionnaire also requested participants to share the **challenges** they (the academics) foresee should they teach using a VR headset and software.

Participant 7 alerted to the start of the COVID-19 epidemic in 2020 when educational institutions had to stop all face-to-face activities and find new ways to continue educating. There were several concerns that not all students have access to technology. According to StatsSA (2020), only 37% of South African households have consistent access to the Internet. However, the data collected from the participants showed that all students in their class have access to a computer or laptop. During COVID-19, a few tertiary institutions provided students with laptops.

Participant 4 emphasised:

> *"Perhaps the resistance to trying something new and being apprehensive that they would not get it right might be a factor, but this could be overcome easily. Also, data connections might have an impact on staying connected during sessions."*

Participant 6 also spoke about the current challenges regarding data and electricity that is currently experienced in South Africa.

> *"The current challenges in South Africa would be stability of electricity and network connections."*

A further challenge for the participants (all academics), said that training would also be a huge factor for the success of VR rollout. Academics indicated that they would need to be trained in how to use the VR headset, operate the software, and possibly build the content.

Participant 12, added:

> *"Upskilling lecturers and students on how to utilise the tools would be a minor teething challenge to begin with! Any data requirements may be an issue given RSA's high cost of mobile data for most residents*."

Participant 5 touched on the digital learning platform that is new to both students and lecturers.

> *"Challenges would include the amount of time and effort required to on-board students unfamiliar with the 'new' teaching tools and methods of learning associated with those tools. Also, the individual students philosophical, cultural, religious, and ethical beliefs would need to be considered prior to launching VR type training/teaching methods, as facilitating using VR tools 'to a resistant cohort' will be problematic."*

7.5.3.3 Theme 3: Academics adopting VR (preparedness of academic staff)

It is expected that the **future role of an academic staff** member will include the use of VR as a means through which training will occur. The question was raised to participants on how prepared they are for the future role as an academic staff member. Academic staff members reported that they are comfortable to teach using an online learning platform and therefore there is no real concern to include VR in their training. All participants agreed that they are willing to learn more about teaching in VR. Participants were not naïve about complexities that will have to be overcome from the offset to teach in VR. However, a huge majority of participants mentioned that they feel training in VR will be easier because of less preparation time for training as well as higher engagement levels from students. Participant 1 mentioned that:

> *"I think it is what you make of it. If you embrace it and make it your own you can have fun with it and provide learners with better learning opportunities and experiences."*

Comments regarding the difference between a **teacher-centred approach** of lecturing and a **learner-centred approach** of lecturing were collected. Below are comments of how a few academic staff explained the difference between teacher-centred and learner-centred learning. Participant 5 said:

> *"Teacher-centred – communicating the subject matter not being too concerned with understanding as long as information has been disseminated. Learner-centred – communicating information but checking understanding and involving learners through interaction with subject matter and checking learner's understanding. Also giving practical exercises."*

Participant 6 added:

> *"Through the teacher-centred approach, the learner is 'socialised' to become dependent on the teacher, whereas in the learner-centred approach, the learner is the central component upon which the appropriate resources are brought to bear, with support, guidance and encouragement provided via the teacher/tutor/lecturer, the student more fully appreciating their own responsibility for their learning and development."*

Participant 8 further said:

> *"In a teacher-centred approach the lecturer is on the stage, presenting information to the students who are expected to passively receive the knowledge being presented. In a learner-centred approach the lecturer is the guide on the side, functions more as a coach or facilitators, and the students embrace a more active and collaborative role in their own learning."*

All participants said that a learner-centred approach to learning is in their opinion the most effective way of teaching. Below is the view of participant 5:

> *"The learner-centred approach is more effective, assuming that the lecturer is proactive and responsive to student learning needs, providing relevant guidance and continuous encouragement, and that the student fully appreciates their responsibility associated with the learning process and the learning results and outcomes."*

Participants were further asked that should they be given the opportunity to **provide advice to a VR educational content developer**, what would it be. The participants mentioned that it is important for any training to be aligned with the curriculum document. Therefore, some participants immediately made mention of the fact that the VR content need to be aligned with the curriculum document. Some participants further referred to the user-friendliness of the operating system that needs to be easy enough for first time users to operate the VR headset and software.

Along with the user-friendliness of the VR environment, a support team is needed. Participant 6 mentioned the following:

> *"It depends on how well I know the technology and how user-friendly the technology is. Plus, a very good support team that is available when I facilitate in a virtual environment is an absolute must."*

It is furthermore important to involve the lecturers in the development of VR content. Participant 10 made the following comment:

> *"Involve the lecturers from the start of the development. Lecturers can assist with their requirements and can provide valuable input. Lecturers are key in the UAT process. Assist lecturers with an environment for practice. A workshop for lecturers to be students to familiarise themselves with the VR tool and techniques of facilitation in the VR world."*

The evidence revealed that *time* was the most mentioned reason to why engaging with learning VR in learning would be a challenge. Time to learn new technology seems to be an

overarching possible challenge to adopting the new technology. The participants were all in agreement that challenges can be overcome if there is full commitment from the institution and academics to invest in VR.

Forty per cent (40%) of participants indicated that they are not up to standard with the latest trends in the development of educational technology and how it can be utilised. The other 60% of participants made mention of artificial intelligence (AI) and VR that can be used, but they are not using these technologies as a learning tool.

7.5.3.4 Theme 4: Curriculum and assessment

A network query has been created in ATLAS.ti to show the relationship between the data collected in theme 4.

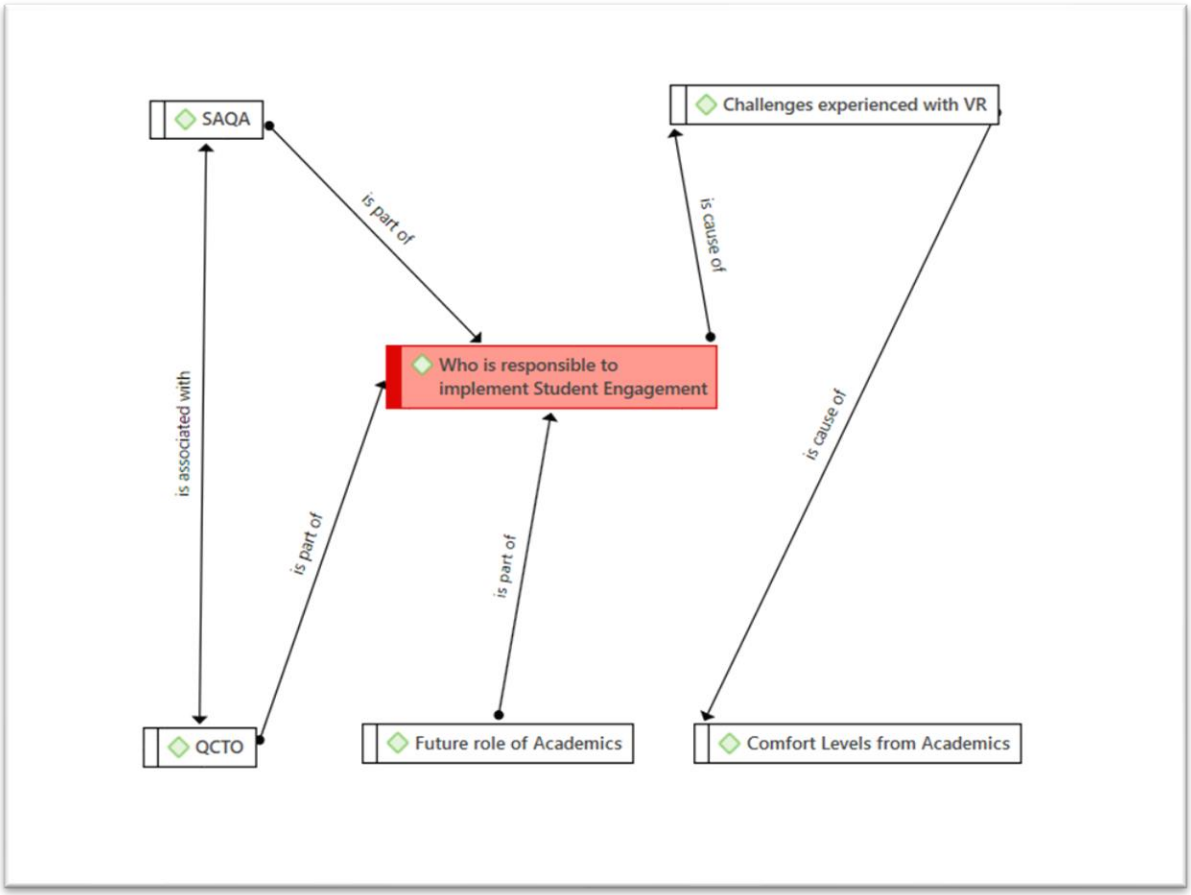

Figure 7.12: ATLAS.ti Network diagramme: Who is responsible to implement student engagement? (Source: ATLAS.ti, 2022)

Participants were asked how a **curriculum and assessment plan** that includes VR differs from a normal SAQA assessment plan? Some participants indicated that there should not really be any difference in the curriculum and assessment plans when implementing VR.

To support figure 7.12, the responses from respondents are indicated.

Participant 11 noted:

> *"A curriculum and assessment plan should not really be different as there should still be identified learning outcomes. So, the curriculum should still be developed with a set of learning outcomes that should be reached by the learner through proper training and education. So, the assessments should be aligned to the learning outcomes."*

Participant 12 added:

> *With the inclusion of VR, some but not all assessments can be amended. Like the use of presentations or discussions."*

Participant 9 alluded to the use of workplace practicals that can now be done in the virtual world.

> *"…instead of workplace assessments – you could develop simulated virtual assessment – this would be very beneficial for students who are unemployed and struggle with workplace evidence. This would require the curriculum and assessment plan to be amended."*

All participants were comfortable with students writing assessments using an online platform. Using software such as "proctoria" is popular for students to write secure online exams. As the bulk of participants have not yet experienced VR, they were unsure of how assessments in the VR world would take place.

The questionnaire then further focused on the **willingness of the QCTO** to adopt the use of VR in both training and assessments. Participant 1 said:

> *"I am sure that QCTO will embrace the initiative taken and realise things are changing from traditional learning to student-centered based training. Since we find ourselves in the 4th industrial revolution, we need to keep up with the changes and so should QCTO."*

Participant 4 added:

> *"I think it would take presenting a vast amount of evidence to get them to move from their existing views on curricula and assessment plans to those including VR. Once they, however, see the benefit of VR, they would* realise the *benefits both to themselves (quicker competencies) and the learners (more opportunities) ."*

The focus of the QCTO is to oversee the design, implementation, assessment, and certification of occupational qualifications. Many of the qualifications are more focused on trades and occupations, therefore participant 6 mentioned:

"I think that they most definitely would be as their focus to have programmes more aligned to what is happening in the industry and also wanting to ensure we have work-ready learners, this is an ideal initiative to have this happen."

Adding to the view of participant 6, participant 12 added:

"Yes, I would think that the QCTO would be very interested. These qualifications lead to trades and specific occupations and are more practically orientated. I would think that VR would be very relevant in this space."

Finally, the questionnaire asked for **recommendations** from the participants, who mentioned that it would be important to liaise with regulatory bodies such as the Department of Higher Education and Training when implementing VR into training and assessment. A further recommendation was to ensure that the development of VR training should be user-friendly. Finally, participant 9 alluded to assessments and said:

"With assessment you always need to have an end goal in mind. This is to reach the learning outcome based on VACS principles. The developer should make sure that there is no barrier caused for the learning to reach their successful completion of learning, based on the learning outcomes and curriculum. So, in essence the developer should still apply the same approach as with normal learning and that is to have an end goal in place that delivers an efficient, effective, and sufficient learner. Able to apply the new knowledge they have acquired."

7.6 Interviews

Figure 7.3 shows the designation and number of years' experience of participants who were interviewed.

Table 7.3: Biographical information of participants who were interviewed

	Designation	Data collection method	Number of years' experience	Gender	Origin
1	VR Chief Product	Interview	33	Male	Japan
2	VR CEO	Interview	45	Male	South Africa
3	VR Content Specialist	Interview	20	Female	Australia

The group of participants that were interviewed are all involved in the development of VR, the content thereof, the development of software, and practicing VR in an educational environment. The positions of the interviewees are as follows:

- Chief Product Officer of VR Educational Content, Shiga, Japan
- CEO of a VR company in Johannesburg, South Africa
- VR Creative Technologist, Sydney Australia

To address the main research problem, namely, “Due to a lack of virtual reality in training and development, the level of student engagement has become unacceptably low over the last five years (2018–2022) at a selected tertiary institution, Cape Town, South Africa”– interviews were used to address the main research question themes and sub-themes (Table 7.4). Interviews were conducted with three educational and VR specialists.

Due to the study occurring during the COVID-19 pandemic, the study adopted remote interviewing techniques by means of MS Teams. This was preferred method given the location and availability of the participants.

In-depth semi-structured interviews, as a qualitative research technique, were used to collect qualitative data from the participants (refer to Appendix B). This allowed participants to elaborate more in-depth on the questions posed to them. Open-ended, semi-structured interviews are an effective tool to use in the study as (i) data required for the study could be collected, (ii) participants’ thoughts could be explored, and (iii) data were collected on how the participants feel and what the beliefs are regarding a certain topic (Ruslin et al., 2022:2).

The researcher created a spreadsheet with the contact information of the participants. This log contains the name, workplace, contact number and dates of interaction with the three (3) participants. The researcher first had to find out which of the participants were available to take part in the research. The participants who agreed to be interviewed completed a letter of consent before the interview was scheduled. Participants were informed that the interview duration would be 30–45 minutes. No time limit was given per question and the interviewer managed the time limit during the interviews.

An interview guide (Appendix B) was developed in advance and tested as part of the pilot study. Although the interviewer followed the open-ended, semi-structured questions, probing questions were also asked to gain a deeper understanding of why the participants made certain statements.

The **pilot interview** was conducted with one (1) participant and allowed for the study to identify any difficulties with the structure and wording of the interview as well as seeing how comfortable participants would be with understanding the questions. No changes to the interview guide were necessary. However, during the actual interviews, it became clear that the researcher could not pose the questions as stipulated in the interview guide as the discussion lent itself to other related topics. It further happened that the interviewee would answer multiple questions in one response or under one theme, therefore the interviewer did not have to ask each individual question specifically, but rather ensured that a discussion around each theme was followed.

The researcher considered the main research question themes when posing the interview questions and added probing questions based on the responses from each interviewee. The illustration below indicates the research question themes derived from the literature for the interviews.

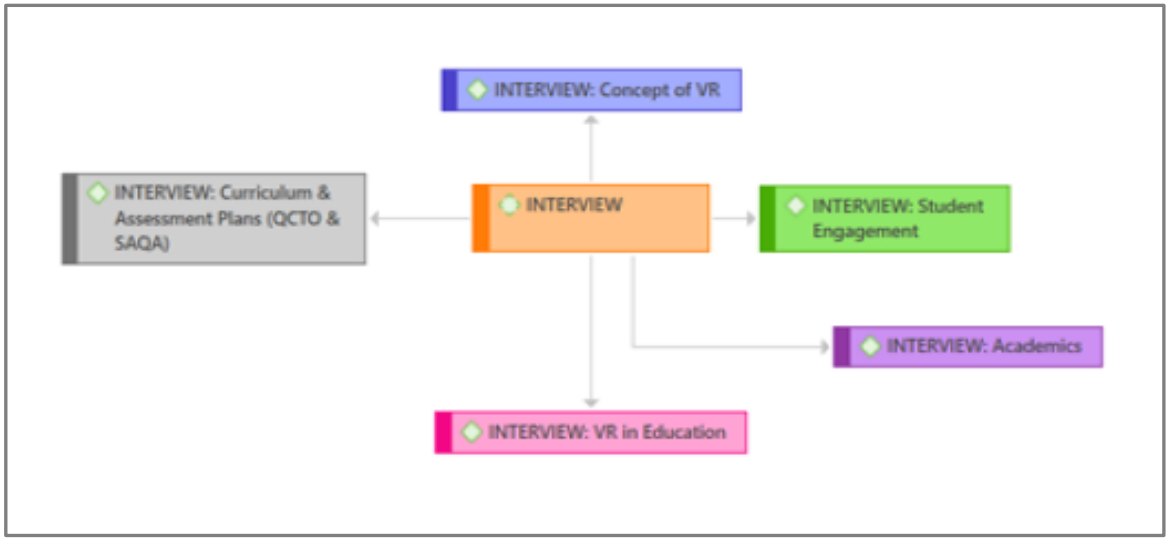

Figure 7.13: ATLAS.ti Network diagramme: Codes created for interviews (Source: ATLAS.ti, 2022)

It was important for the researcher to be prepared for each interview and do proper planning to consider the focus and scope of each research question (McGrath et al., 2019:2). In preparing for the interview, the researcher used the knowledge gained from Chapter 2's literature review to construct the interview questions. Each interview was conducted on MS Teams and recorded for transcribing purposes. Although rich and in-depth data were collected, it was a time-consuming process to code the data in ATLAS.ti.

7.6.1 Interview themes

Table 7.4 shows the research question themes that were posed to the interviewees. The individual interview questions can be viewed in Appendix B.

Table 7.4: Research themes linked to research questions

Research question themes	Specific interview questions
RQ1: Student engagement	**RSQ 1.1:** Your understanding the concept of student engagement
RQ2: VR being used in training and development	**RSQ 2.1:** Your understanding of the use of VR in training and development
RQ3: Preparedness of academic staff to use VR during training and development, including assessments	**RSQ 3.1:** It is expected that the future role of an academic staff member will include the use of VR as a means through which training will occur. How prepared are you for the future role as an academic staff member?

Research question themes	Specific interview questions
RQ4: To what extent would a curriculum and assessment plan be adapted to include VR that is acceptable by regulatory bodies?	**RSQ 4.1:** How acceptable are South Africa's regulatory bodies to include VR into their curriculum and assessment plans?

All participants gave their consent to be recorded and therefore the data obtained from the interviews were automatically transcribed by MS Teams. This evidence has been uploaded into ATLAS.ti to code according to the research question themes identified in the interview guide.

7.6.2 Summary of findings: Interview

With the transcript loaded into ATLAS.ti it was easy (yet time consuming) to code the data. Table 7.5 is an extract of the direct quotations coded in ATLAS.ti. The extracts are inserted in table format per theme. Five (5) themes evolved from the interviews.

Table 7.5: Summary of interview findings

Theme 1: Student Engagement	
ID	**Interviewee quotation**
29:1	When you have an engaged and motivated learner, that's when you know they're open and receptive to information and they're able to process things more readily. It removes that student affect right and allows for that learning to happen.
28:4	Education is a beacon in any country.
28:7	VR is transforming business and the economy, especially in soft skills training.
29:15	…but something that is abstract or conceptually difficult too picture. That's when you can use something like the VR.
29:17	Start learning to work with VR. Do what you can at this moment and be in a system and keep yourself updated, so that VR can grow along with you.
30.5	Students with learning difficulties, and those students often don't really participate in class but give them some technology, ask them to be creative, to build something. Suddenly, they're on top of the class running away with it, just being great to doing innovative stuff.
Theme 2: VR-Learning	
28:8–9	We've created a VR game to use in Education, for extra marks for students. So, it's basically an online platform to assist school students with their subjects in India. Not so big in South Africa, created a demo for South Africa, but it failed, due to the number of internet subscribers.
29:16	The challenge right now is that people are maybe trying to leapfrog too quickly with VR in education, and they hear a word like the Metaverse, and jump at the opportunity to change the world, but it does not work that way.
28:10–14	We created an experiment where a teacher is in the laboratory and the teacher basically instructs the student what you do. For example, take copper sulphate and iron. The teacher will instruct the student to grab the bottle of water, open the cap and pour in VR. Students enjoyed the experience.

	At the beginning the students will struggle, but once they find out the mechanics of operating and navigating in VR, it is easy.
28:15	Learner centeredness is important, both the learner and lecturer speak.
28:16–17	To support students, we have an activation team, so the activation team will help students in the experience. We will broadcast onto the television screen and then our team can see what they are seeing. Then we can see what users are struggling with, and I can immediately help them to solve that.
28:20	We assisted a company to train engineers or actual fitter and Turner's in VR. This gave students the opportunity to struggle and practice before being in the real life.
28:24	One player, one user VR experiences is out. So just before COVID hit, we started doing multiplier VR experiences. So, in a multiplier VR experience you can sort of solve that problem with content by simulating a classroom and a teacher presenting in multi-user experience. What it would have done in a classroom. So now you can now you can expand it to 3D. Or if you are a spectator and you can look around, but you can't necessarily move in VR space with fixed daily VR you can. You are in that space, and you can move in that space. You can create an Avatar and interact with other students in the class. So, if you talk the Avatar's lips move. If you are bringing more tools, for example eyes blink if you look at someone in the eyes. You can play videos there and you can do presentations. So almost everything that you can do in a classroom one can do in VR.
28:27–28	Certain South African Public Universities started implementing the concepts. University X have established a VR centre in 2020, followed by University Y (another SA public university) to establish a VR centre in 2021. University X tried to do create a Dome. Students will go into the Dome, and you see the VR stuff happening there. But it's almost like a 3D version of VR. It's a projection that's happening in there and then the aim of VR is not to have a single location for it, but the idea is someone have a headset that put it on, and they can use it anywhere in the world. So, for me, this concept has failed.
28:32–33	The input you have all the functionality of real laboratories without the chemicals and all that stuff. So, in the beginning it might cost more to develop, but it, but in the long term imagine a student can enter a lab anytime from anywhere at his own pace at these aren't. I'm going to mix chemicals together, learn what do learn, what's the wrong way to do without injured or nobody is going to make a fool of him if he struggles and he needs to do it 10 times.
29:4–6	…that kind of Eureka moment when a student grasped the concept in VR". And that's what I find interesting with the VR because it closes that loop between just reading and not really understanding to experiencing concepts and have a deeper understanding.
29:10	…using VR to understand more difficult concepts.
29:12–13	People didn't understand at that time how VR would enhance what you can teach. It gives you the ability to do things that you just physically can't do it. I mean you can take; you can take a student into a flower or into a plant into a combustion engine to see how things are moving.
29:21	Some learning concepts is difficult to explain, now with VR it's feasible, I bring it in, and I know that is going to have some impact on my learning.
THEME 3: Preparedness of academics	
30.1	Teachers love the idea of having VR as an engagement tool to increase student engagement.
28:18	What we found with adults being introduced to VR, that for some reason people in the computer industry of very hesitant to make fools of themselves in VR.
28:23	Facebook now launched 'Meta'. They changed their name to "Meta" and are focusing on the metaverse. They're focusing on connecting with other people and bringing things from the physical world into holograms and augmented realities. Friends can join as avatars.

29:2-3	I've been a teacher for over 30 years, so I would say, like most teachers, a little bit sceptical when you get into the new technology, right. We have seen VR affect learning positively rather than just be kind of a cool toy to play with.
29:11	Teachers asked, is this going to replace me?
29:14	It allows you places that you can't go and that gives you more power as a teacher.
30:8–12	Teachers are eager to learn and get their hands on new technology. IT teacher that's all into development and software will say it is hard to understand, it is to high end to bring that to the level of the students. "…then you do get the teachers who just think it's all a bit too hard". So those are the teachers we love to talk to him because we want to make it easy and enable teachers to use VR."
30.2	Academics need to learn and gain knowledge on VR technology. This is one of our core programmes that we deliver for learning institutions. We teach teachers first and then they can facilitate in VR.
THEME 4: VR Assessment & curriculum plans	
28:22	"…biggest problem with VR is to create or obtain content and assessments, to get content that that fits worth the curriculum".
29:7	Allow a student to engage with VR. Let them go ahead and, you know, just see what the results are from the assessment
29:8–9	In Lebanon there are a school that tested the student's assessment marks after engaging with VR. They used Physics as a subject. And you know the kind of conceptual understanding of physics was higher after using VR.
29:18	There is already international VR curriculum aligned materials.
30.3	Majority of curriculum aligned work comes from 360-degree images.
THEME 5: Regulatory bodies	
28:34	It's like computers and it's like smart phones. In the beginning people said there's no place for computers in classrooms. Now there are smartphones. There is too much politics and bureaucracy that influence regulatory bodies.
28:29–31	We have had interest from regulatory bodies, but I think the problem is that they want to approach it from an Academic perspective. SAQA and QCTO should combine learning with game development with, so it should be fun to do while learning so. If you take all the advantages that VR has, I cannot see that they can stay out of it for long a time.
29:19	VR is best utilised when it is aligned to the curriculum. It just makes it easier to add into a syllabus for an instructor.
30.16–17	The Department of Education is very strict on getting educational content based on our VR curriculum in Australia. The concern is around the security of the headset. For example, you have something that is very commercialised in the Oculus Quest and the Oculus and there's very little to no security for schools and cyber security is important. This is a big key issue at school currently.

To add to the research question themes of the interview process, the researcher posed a direct question to a regulatory specialist. Data were collected on how acceptable the regulatory bodies are to VR in education. Stemming from the evidence collected, it is clear that regulatory bodies within South Africa support VR, however, the challenge is to rapidly

build capacity in this area, especially in the quality assurance of learning and particularly the assessment (Naidoo, 2022).

7.7 Experiments

For this research study a true experiment design was used, which involved the manipulation of the independent variable. Table 7.6 provides the biographical information of the participants who took part in the true experiment.

Table 7.6: Biographical Information of participants who took part in the experiment

	Designation	Data collection method	Gender
1	Student 1	Control Group	Female
2	Student 2	Control Group	Female
3	Student 3	Control Group	Female
4	Student 4	Control Group	Male
5	Student 5	Control Group	Female
6	Student 6	Control Group	Male
7	Student 7	Control Group	Female
8	Student 8	Control Group	Male
9	Student 9	Control Group	Female
10	Student 10	Control Group	Female
11	Student 1	Experimental Group	Female
12	Student 2	Experimental Group	Female
13	Student 3	Experimental Group	Female
14	Student 4	Experimental Group	Female
15	Student 5	Experimental Group	Male
16	Student 6	Experimental Group	Male
17	Student 7	Experimental Group	Male
18	Student 8	Experimental Group	Female
19	Student 9	Experimental Group	Female
20	Student 10	Experimental Group	Female

The purpose of the third research instrument used—experiments—was to identify any differences in the level of student engagement during the training that took place with a control group and an experimental group. The study further focused on the pass percentage of both groups after completing an assessment.

The control group received training without the use of VR. It was an online live session that students attended. The experimental group received the same training but with the use of VR, making use of a VEATIVE headset with EduPro software.

7.7.1 Experimental group

Individual meetings were set up for participants to perform the experiment. Each participant in the experimental group received a short demonstration of how the VR controller works and what they will expect when putting on the headset. Students in the experiment group were provided with a VR headset and handheld controller. The handheld controller had a touch pad in the device and allowed for a wider variety of activities, such as drag and drop, dissect, assemble, and select. None of the participants had prior experience of being in a virtual world although all participants were aware of the virtual world.

The researcher was set up as an academic lecturer (teacher) on the VR-learning platform to create the classroom, add the content, create student logins, and view participation and assessment results. Sessions of 30 minutes were booked with the participants. Participants had to complete the training module in VR and thereafter had to complete an online assessment, also in VR.

Directly after the assessment, the researcher conducted a short interview to ask them questions relating to their experience with VR and how engaged they were in the immersed learning experience. The interview was conducted using MS Teams to be able to transcribe the evidence automatically and load it in ATLAS.ti.

7.7.2 Control group

An online facilitation session was booked with the control group. An introductory email was sent to the sample group, explaining the background and purpose of the study. Interested participants completed the letter of consent.

The invitation to the MS Teams online facilitation session was forwarded to the selected student. During the facilitation session, the lecturer taught the students a particular module, whereafter the students had to complete an assessment. The study created the assessment on Google Forms and the link to the assessment was forwarded to all students while being on the MS Teams live session. All students in the control group completed the assessment and thereafter the researcher marked the online assessments.

The researcher further asked the participants to answer an additional four questions pertaining to student engagement and the overall experience the students had. These questions are similar to the questions posed to the experimental group after the experiment.

7.7.3 Experiment themes

The purpose of conducting the true experiment was to test the level of student engagement during learning and assessment, as well as obtaining data on the pass rates from the control versus the experimental group.

In summary, two themes related to the research questions and aims were important to test, the first being *student engagement* and the second *assessing the pass rates* for students being in the immersive world as opposed to those students who received training via distance learning online.

7.7.4 Summary of findings: Experiment

The findings of the experimental and control group are presented below.

7.7.4.1 Experimental group

Immediately after the students in the experimental group concluded the VR-learning, the below questions were posed to them:

- What did they enjoy about this experience?
- How engage they felt during the VR-learning, making use of the below percentages:
    - Not engaged at all: 0%–20%
    - Somewhat engaged: 20%–40%
    - Engaged: 40%–60%, I was in the session, but could do other tasks as well, or think of other things as well
    - More engaged: 60%–80%, I was able to focus
    - Fully engaged 80%–100%, did not think of anything else. I was in the moment. No distractions
- What challenges did you experience while being in the immersive world?

The researcher thereafter recorded the assessment results and noted the duration of the learning and assessment.

Table 7.7: Summary of experimental groups' findings

Participant	% Level of engagement	What did you enjoy?	What frustrated you?	Duration of learning
Exp001	80–100	VR is very cool because it feels like you're right there. No distractions in terms of classmates.	Nothing, however, I felt a little anxious and obviously not knowing what to expect.	17 Minutes
Exp002	6–80	I would prefer virtual learning because I don't think there's there would be much difference.	It was a bit difficult at first, but then I got to learn how to use it.	13 Minutes

Participant	% Level of engagement	What did you enjoy?	What frustrated you?	Duration of learning
Exp003	40–60	I was excited in, nervous at the same time because I've never had this experience before since my very first time at the age of 43.	I started getting nauseas, as I progressed it just got worse.	16 Minutes
Exp004	80–100	It was quite amasing, and I think it's the first time that I've experienced learning like this. I prefer to learn this way; you are in the moment. It makes a lot more sense than reading in a book.	I think the most difficult thing I experienced was that I found sometimes I was too close to the screen that I see in VR. So, it felt like I had to stand up and move back.	12 Minutes
Exp005	60–80	I was maybe not initially open to the new way of learning, just for the mere fact that I'm used to reading a lot. However, in the end I felt that I remembered more than I would if I had read a book.	Afterwards, I felt a bit dizzy and disorientated. I was afraid to move around, because I was not sure if I would bump into things around me.	15 Minutes
Exp006	80–100	I enjoyed the visuals and hearing the person speak.	The navigation and using the pointer, but this can be because it is new for me.	17 Minutes
Exp007	60–80	I enjoyed seeing the learning as opposed to reading a book. I also enjoyed the fact that I could go back to a section to go over the work again.	As this was the first time, I found it difficult to navigate.	20 Minutes
Exp008	60–80	It was an amasing experience for me. I love learning this way.	I was unsure of the physical area, in which I can move in.	14 Minutes
Exp009	80–100	It felt so real. I was fully in the moment.	At times, I had difficulty navigating. But it could be because this is my first-time using VR.	16 Minutes
Exp010	80–100	Highly effective – this was great it is a much better way for me to learn.	No challenges experienced.	15 Minutes

Although a Likert scale is not part of a qualitative study, the study used this scale to answer one question to determine the level of engagement from the students. The purpose of the interview was to obtain descriptive data rather than numerical data. Opinions from the students were collected and the respondents reflected their level of student engagement while being in the immersive world.

A 5-point Likert scale were used with the following keys:

- Strongly disengaged
- Less disengaged
- Somewhat engaged
- Engaged
- Fully engaged

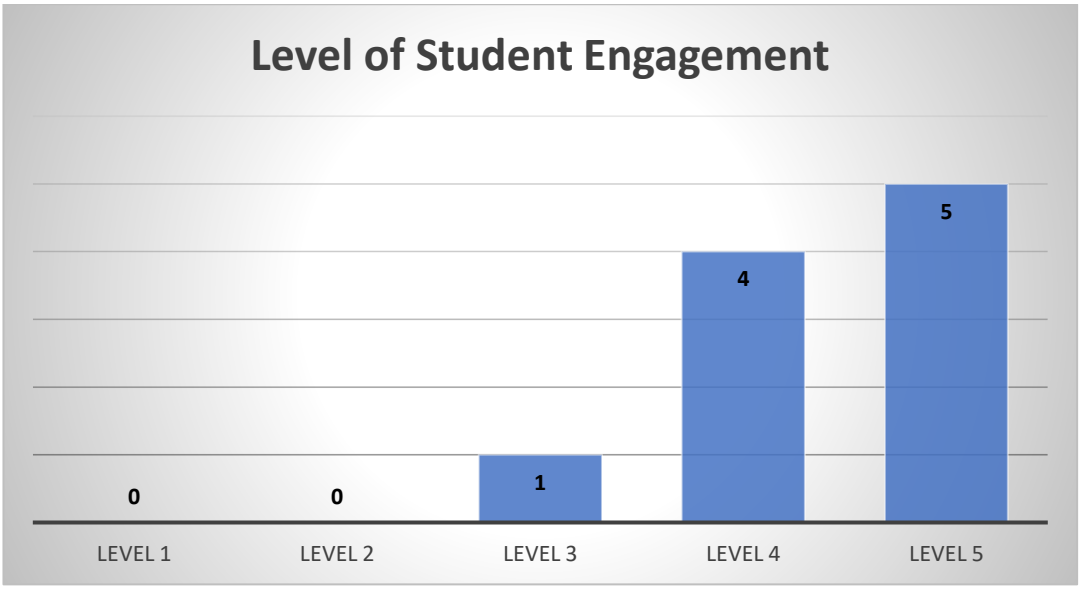

Figure 7.14: Level of student engagement
(Source: Author's own illustration)

Ten per cent (10%) of students felt that they were somewhat more engaged in learning in an immersive VR world as opposed to teacher centred learning/face-to-face or even distance learning, whereas 40% felt engaged and 50% responded to say they were fully engaged.

The average duration it took for students to complete the immersive studies (excluding the assessment) was 15 minutes.

The results from the VEATIVE VR software used produced the assessment feedback presented in Figure 7.15. The leaderboard presents the percentages obtained, showing the different levels of students who have (i) mastered the module, (ii) are in the learning phase and, (iii) are struggling with the module.

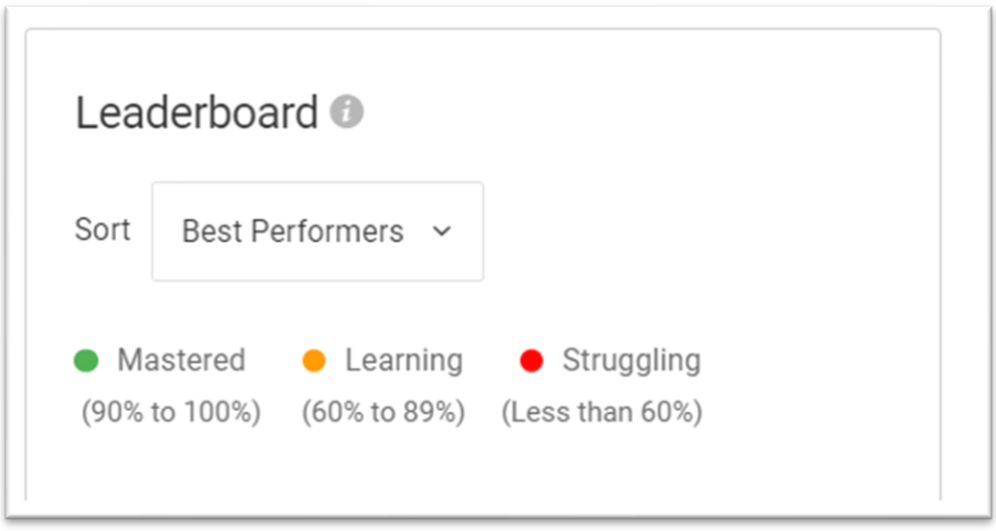

Figure 7.15: Leaderboard
(Source: Veative Group, 2023)

The score report of each student could be drawn from the system. Below is an example of one participant's report. From the report, the researcher could see the number of attempts, i.e., the number of times the student did the assessment. The report further provides information about the date and time the student completed the assessment, as well as the score the participant obtained resulting in the level of content proficiency.

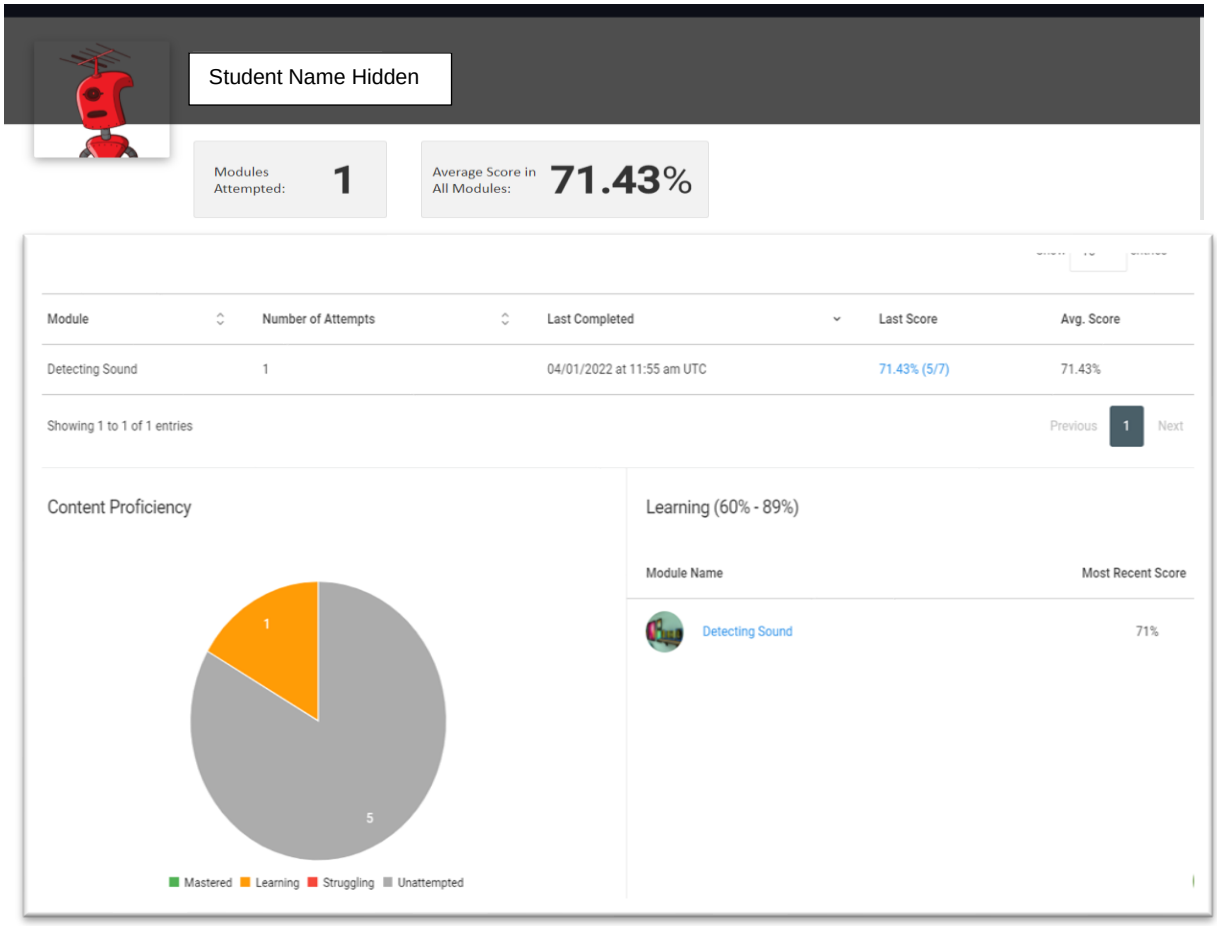

Figure 7.16: Experimental individual student's score and models completed (Source: Veative Group, 2023)

The overall pass rate of students in the experimental group was 80%.

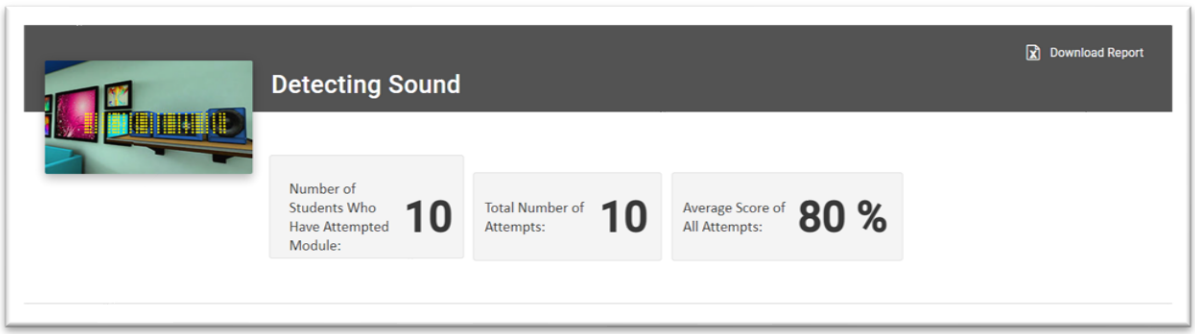

Figure 7.17: Experimental Group's assessment results (Source: Veative Group, 2023)

From the VR learner management system (LMS), the researcher was able to view:

- Student participation rates
- Inactive students
- Students who have either mastered the module (obtained between 90% and 100%) or learned (obtained between 60% and 89%)
- Students who obtained less than 60%, were in the struggling group

The VR LMS system further provided individual student scores, showing each question the student obtained correctly and the questions the student failed (Figure 7.10).

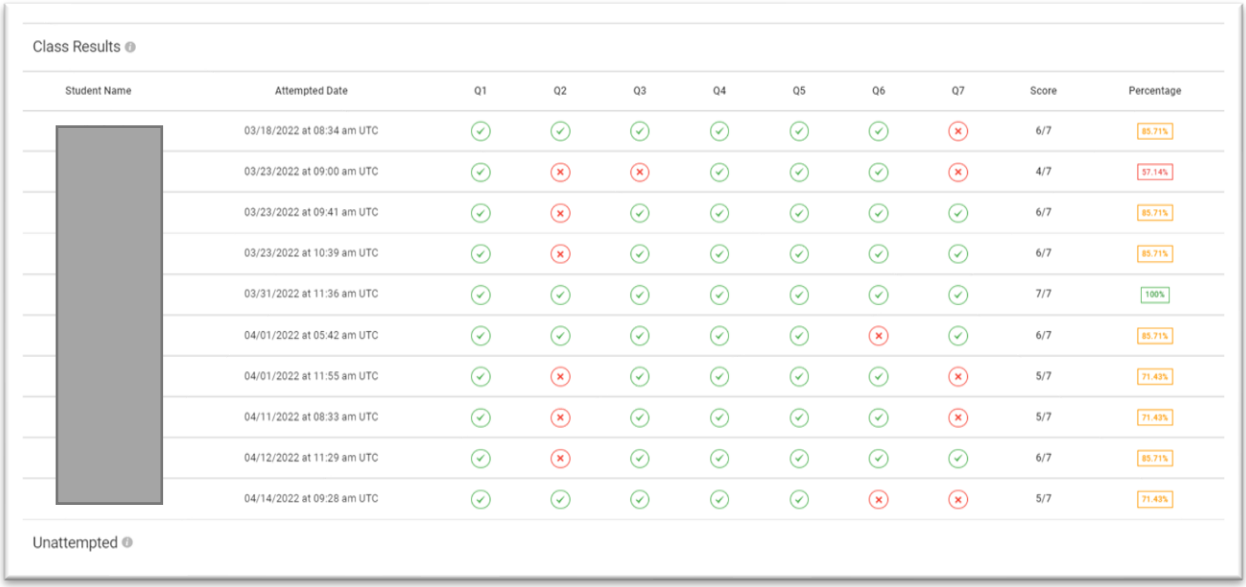

Figure 7.18: Experimental individual students' assessment results
(Source: Veative Group, 2023)

7.7.4.2 Control group

The results that the students obtained after completing the assessment are presented below.

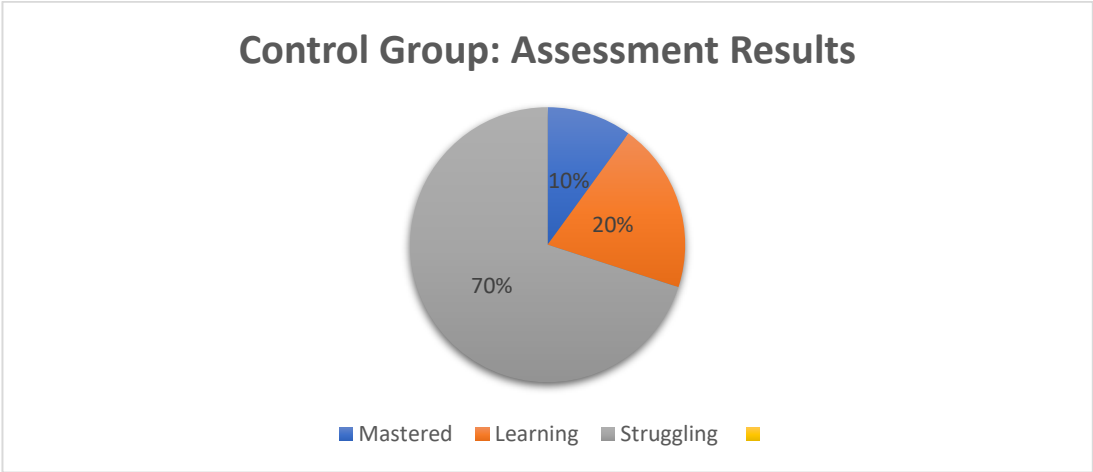

Figure 7.19: Control group's assessment results
(Source: Author's own illustration)

Table 7.8: Control group's pass rate and performance

Participant	Pass rate	Performance
1	100%	Mastered
2	71%	Learning
3	57%	Struggling
4	57%	Struggling
5	57%	Struggling
6	57%	Struggling
7	71%	Learning
8	29%	Struggling
9	57%	Struggling
10	14%	Struggling

The average pass rate of the control group was 57%. The time allocated for the distance online learning session was 25 minutes (excluding the assessment).

Immediately after the training and assessments were concluded, students received a link to a Google Form questionnaire they had to complete. An example of this questionnaire can be viewed in Appendix D. The question asked to the students is how engaged they felt throughout the training session, and how easy it was to recall the knowledge obtained to do the assessments. The feedback is presented below.

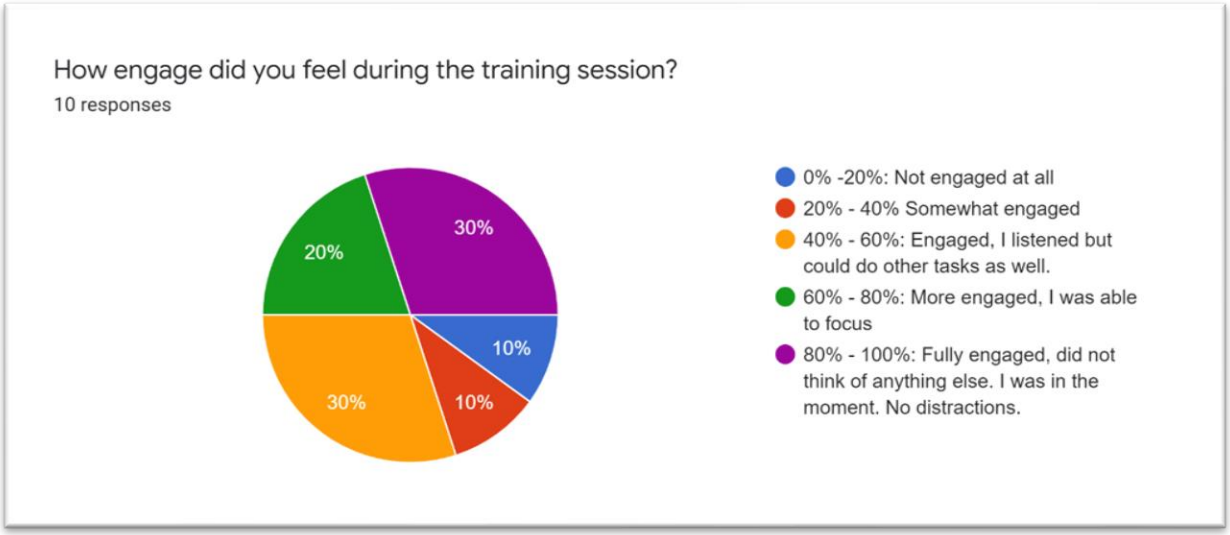

Figure 7.20: Control group's engagement level
(Source: Author's own illustration)

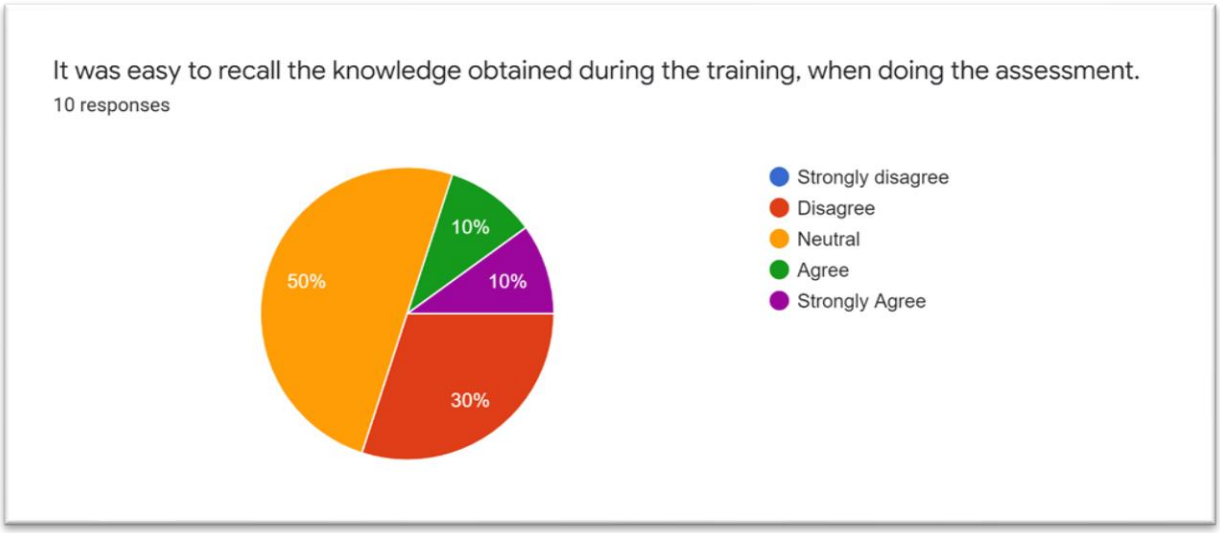

Figure 7.21: Control group's recalling of knowledge
(Source: Author's own illustration)

Table 7.9: Control Group's level of engagement

Participant	How engaged did you feel during the training session?	It was easy to recall the knowledge obtained during the training when doing the assessment.
1	40%–60%	Agree
2	60%–80%	Neutral
3	40%–60%	Disagree
4	80%–100%	Neutral
5	80%–100%	Strongly Agree
6	80%–100%	Neutral
7	0%–20%	Neutral
8	60%–80%	Neutral
9	40%–60%	Disagree
10	40%–60%	Disagree

7.7.5 Comparing the experimental group's results to the control group

As indicated, both experimental and control group's students completed the same training and assessment, with the difference that the experimental group had VR-learning and the control group had distance learning online.

Figure 7.22 presents a comparison of the engagement levels of both groups' results.

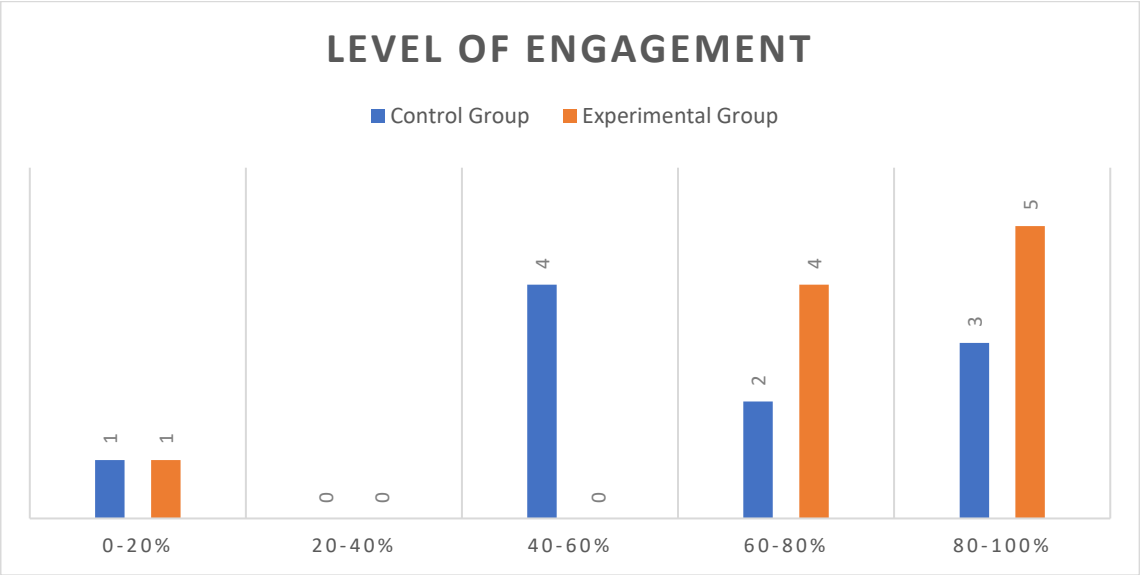

Figure 7.22: Comparing the engagement levels of the control and the experimental group

Table 7.10 indicates the engagement levels of the control and experimental groups in table format.

Table 7.10: Comparing engagement levels of the control and experimental group

Level of Engagement	Control Group	Experimental Group
0%–20%	1	1
20%–40%	0	0
40%–60%	4	0
60%–80%	2	4
80%–100%	3	5

Positive engagement is determined from a 60% and higher grading, therefore it can be concluded that five (5) students in the control group, compared to nine (9) students in the experimental group, were engaged in the learning. **This results in a 180% higher engagement level in students who learn through VR.**

The next element of comparison as presented in Table 7.11 is the duration of learning the module excluding the assessment time.

Table 7.11:Duration of learning

Duration of learning	Control Group	Experimental Group
Duration of learning	25 minutes	15 minutes

The results of the study confirmed that learning in **VR takes 1.6 times faster (or 40%) than studying via distance learning online.**

The final comparison made in the true experiment is the assessment results of both groups. Table 7.12 presents the results.

Table 7.12: Comparing the pass rates of the control and the experimental group's engagement levels

Participant	Control Group's pass rate	Experimental Group's pass rate
1	100%	85%
2	71%	57%
3	57%	85%
4	57%	85%
5	57%	100%
6	57'%	85%
7	71%	71%
8	29%	71%
9	57%	85%
10	14%	71%

The control group's pass percentage average is 57% compared to the experimental group's pass percentage, which is 80%. **This results in a 23% higher pass mark for the experimental group who received VR-learning.**

7.6 Summary

This chapter discussed the methodological qualitative research approach followed in the study. Responses from academics, students and leaders in the VR world have been collected. Using software like ATLAS.ti assisted the study with identifying themes from the data and enabled the researcher to run queries to make certain linkages.

The chapter commenced with a section outlining the research questions and methods employed for data collection, and then presenting the data collected by means of questionnaires, interviews, and experiments. The qualitative data offered the researcher a clear insight into what can transpire when VR is used in training. Through analysing the qualitative data, clear themes emerged. The researcher made use of direct quotes from participants to highlight certain perspectives. Using direct quotes provided rich and detailed insights into each of the participant's perspectives and experiences.

ATLAS.ti was used to assist the researcher with organising, coding, and analysing the large data sets. Various reports were presented, stemming from the analysis completed in ATLAS.ti. VR software was used for the experiment to draw data on pass rates, time spent in the immersive world and how engaged students are.

The research found that a positive relationship exists between student engagement and pass rates. The research furthermore found that immersed VR experiences are enjoyed by

students, and it stimulates the creativity of academics when preparing for teaching and learning. It is worth noting that the findings also revealed other benefits of teaching via a VR platform, such as a decrease in lecturing time.

The next chapter discusses the research results, and the literature review is triangulated with the research evidence.

CHAPTER 8: DISCUSSION OF RESEARCH RESULTS

8.1 Introduction

Chapter 8 provides a discussion and an interpretation of the findings presented in Chapter 7. This chapter commence with an interpretation of the outcomes of the questionnaires, followed by elaborating on the interviews, and finally, an explanation of the outcomes of the experiments conducted is given.

Departing from the theoretical principles on student engagement and virtual reality as presented in chapters 2 and 3, the main goal of this study was to develop a "VR-learning framework for improving student engagement". The proposed model aims to promote student engagement in HEIs.

Below, each research theme is discussed triangulated with the literature review (chapters 2, 3, 4 & 5) to determine the relationship with previous research conducted in this field.

8.2 Questionnaires

The aim of section 8.2 is to discuss the research findings based on the questionnaire data collected and analysed. The findings of the predictive validity of the questionnaire results provided a range of descriptive statistics, especially when the variables are considered, as presented in Chapter 7, section 7.5.

The biographical information of the respondents who completed the questionnaire, confirmed that participants are academics with experience in higher education (HE). More than 70% of the participants have been working in the educational sector for over 15 years, which was comforting for the researcher to take notice of, as these academics were able to share the experience they have gained throughout their years of facilitating and assessing students.

When analysing the age of the academics, the following can be reported:

- Twenty per cent (20%) of the respondents were 30-35 years of age at the time of the research study
- Null per cent (0%) were in 36-40-year age range
- Twenty per cent (20%) were 40-45-year age range
- Sixty per cent (60%) were in the 45-50-year age range

Although the participants' ages spanned from 30 to 50 years of age, the study found no differences in them accepting new emerging technologies for teaching and learning. In fact, the participants from all age groups are willing to explore teaching using virtual reality (VR).

This chapter discusses the research outcomes per theme.

8.2.1 Theme 1: Student engagement

The results of the questionnaire show that all participants were aware of the importance of **student engagement and the impact it has on students' pass rate.** All academics displayed a general understanding of the importance of student engagement.

The study indicates is a definitive relationship between student engagement and their participation levels, which, in effect, has a positive knock-on effect on the students' pass rates. This finding supports previous research conducted by PWC (2019), Kahu and Lodge (2018) and Bowden et al. (2019:4). The research report conducted by PWC alluded to the fact that an immersive experience is far more exciting than traditional workplace learning and therefore VR-learning can increase student engagement levels and recall of previous knowledge (PWC, 2019:17).

The questionnaire analysis was a significant predictor that students with a higher student engagement level are prone to be **critical thinkers** and are **more invested in their studies**. This perhaps is not surprising as Bowden et al. (2019:3) allude to the fact that HEIs need to begin measuring student engagement as it provides the opportunity for the institution to measure their teaching and learning quality and create critical thinkers. Critical thinking is one of the needed learning outcomes in HE in the 21st century (SAQA, 2021). Through VR-learning, students can experience the problem in front of their eyes, interpret and 'play-around' with the possible ideas and evaluate different solutions before making a final decision.

There was a thorough understanding shared between the participants with regards to the multidimensional levels of student engagement that exist, namely, **behavioural, emotional, and cognitive engagement**. The aim therefore for HEIs should be to create the climate in which a student can experience a combination of all three engagement levels. The literature supports this finding and note that all three engagement levels are important in a student's learning journey. By creating a climate that incorporate all three levels of engagements, HEIs can be able to create a more significant learning experience for students. Human Resource Developers need to seek ways of creating an environment that promotes engagement to support workplace learning.

As emphasised in the literature review, Nayir (2017:2) alludes to the fact that a student who demonstrates a high level of student engagement will most likely attend lectures, participate with enthusiasm, show interest in the subject, and meet or exceed the assignment requirements. Participants indicated that student engagement can be **tracked through the participation** in the courseware and the submission of formative and summative activities.

When teaching in VR, it is possible to track students' participation in the programme. This is made possible through an offline desktop application that are pulling statistics from the actual VR headset (Veative Group, 2023:1). To be able to track a student's participation is also important to the HRD practitioner for reasons of performance evaluations, resource allocations, employee development and compliance. It is important that the HRD practitioner meet the set training requirements as mandated by either regulatory bodies or industry standards.

Contrary to the notion that higher engagement leads to higher results, an argument was made by one participant who indicated that external unforeseen forces also play a role in the level of student engagement. Access to resources such as data, electricity, and the student's personal of family matters are examples of factors that can influence student engagement.

The study revealed that the **availability of data and an Internet connection** still appear to be a concern among academics. This is supported by the Mail & Guardian (2020) referring to the gap between the rich and the poor in South Africa in terms of the accessibility of technology. During the study, the researcher used a VR headset loaded with content that can be used offline, without any Internet connection required. This however is not the norm and for most VR headsets and programmes to run, data and an Internet connection is required. By recognising the impact of these external factors on student engagement, HEIs as well as HR practitioners should seek ways to address these barriers in order to create a learning environment that promotes engagement.

The results of the descriptive data further revealed that **interaction with other students is just important** as the interaction with technology. Additionally, it is evident from the literature and questionnaires that students prefer interacting with one another, especially when there is an expert facilitator asking probing questions.

Günüç and Kuzu (2014:15) also allude to the importance of the existence of a relationship between students engaging with one another on campus level, along with **engagement with technology**. It is important for HEIs and HR practitioners in the workplace to foster ways in which students can interact with one another, albeit frequently with online platforms while using emerging technologies such as VR to assist in learning. It can be deduced from the research results that a more blended learning approach to teaching and learning is favourable, thus taking the interaction with students and technology both into consideration when facilitating. Many HEIs has already adopted the blended learning approach.

8.2.2 Theme 2: VR-learning

Although the study confirmed that all academics displayed a fair understanding of what VR-learning is, not one of the participants have ever been in an immersive world to experience the full extent of what VR is and what it can do.

Surprisingly, there were participants who indicated that they are not **comfortable at this stage (when the research was conducted) to engage with VR** as they would need intense training, time to understand the design, and learn more about the features of what this device can do. It further needs to be incorporate in their current curriculum and lesson plans.

The participants were however comfortable to share their opinions on the **benefits of teaching** VR-learning. One participant mentioned that visual learning helps students to store information for a longer period as images are processed directly by their long-term memory to the brain. This corresponds with the literature and research conducted by many researchers, one of which is the bespoke PWC VR study conducted in 2019. The participants all agreed that the immersive nature of VR brings depth to educational content as it enables students to use their senses and explore, making it an ideal catalyst for curiosity in learning.

Another interestingly reveal made by the study is that academics are of the opinion that teaching in VR is much **more cost- and time-effective**, as academics do not have **to spend time** on preparing for lessons. Although there is validity to some point in the statements made by academics, the study inferred that due to the participants inexperience in using VR, the statement regarding the preparation of lessons is not accurate. The academic team will still be requested to be part of the design of the learning content, and this is time consuming.

On the other hand, an HEI could most likely purchase the VR-learning content with assessments, thereby freeing up some time for the academics. This type of learning will then further evolve in students taking charge of their own learning. The thought of students having autonomy over their own learning, made some academics anxious and a concern was raised whether there will still be a role for facilitating in future. Literature argues that there is still a definite role for academics to play, even with VR-learning. Menon and Castrillon (2019) state that with VR, the lecturer becomes the mentor guiding students throughout their learning journey and they therefore need to prepare themselves for the role as mentor. Veative Group (2023:1) also alluded to some actions overseen by the lecturer, for example, the lecturer has certain system rights and can therefore control the VR-learning and prevent students from proceeding with a further lesson, among others.

The discussion then moved towards the **cost of setting up a VR environment**. Some academics believe that as the number of students increase, VR will become a more cost-

effective way to teach students compared to class lectures. Literature supports the notion that the more students are trained, the more time will be saved, and therefore less money will be spent on facilitation (PWC, 2019:74). Aside from the actual facilitation cost, there are also other expenses saved, for example, students can do virtual field trips or visit museums without the actual expense of transport and paying venue fees, hence resulting in a cost saving resource.

8.2.3 Theme 3: Academics adopting VR

Literature refers to the alarming rate of students becoming disengaged in their studies. Academics expressed concern about some students merely being 'passengers' in their learning journey, showing little interest in their studies. Participants stressed that students should take ownership of their studies, as learning is a **dual process where both the student and the facilitator** need to ensure that student engagement levels are maintained.

Trowler (2010:38) emphasises the **contribution academics can make** in the student's study journey to increase student engagement. Through VR, it is possible for academics to be creative in how learning is facilitated and assessed. As indicated in literature, when teaching in VR, much can be done that would not be possible in traditional learning. Examples of dismantling objects and performing experiments in VR are discussed in literature.

Given the questionnaire responses, all academics are in agreement that a learner-centred approach to learning and teaching is the most effective. This is supported by the view of Barron (2006:5) in the literature. The use of VR-learning supports **a learner-centred approach**, as students can include their past experiences and ideas in the learning that takes place. Through VR, a learner-centred approach is possible, as students engage in learning in a practical manner, which assists with 'enforcing' students to bring their own knowledge, past experiences, and ideas to the fore.

On the other hand, participants expressed concerned about the time it will take away from their already busy schedules to learn a new tool. This has also been highlighted (in the literature in Chapter 4) as a concern raised by other academics who partook in VR studies. Academics need to be comfortable with moving around in immersive VR environments, be confident that learning outcomes will be achieved, and have a basic understanding of the VR LMS and headset.

The participants further had the opportunity to **offer advice to VR developers**. The participants felt strongly that academics need to be part of the VR content development process and that the development of content cannot happen in isolation. Collaboration between academic staff and the VR developer is needed to ensure optimal success in the VR

product presented. One participant mentioned that “it is key to include the lecturers in the UAT process”.

The overall findings show that academics are eager to adopt VR in teaching and learning. The students will find it easier to understand abstract concepts when it is presented in three dimensions. The implementation plan from HEIs need to be sound and properly planned out to embed confidence in the academic team and students.

8.2.4 The adoption of curriculum plans

In addition to the importance of student engagement, the design of the **curriculum** and learning outcomes is equally important, as this influences student engagement levels and pass rates Trowler (2010:7), while not underestimating the importance of how meaningful the teaching and learning is delivered.

This final theme in the questionnaire section focuses on how curriculum plans will have to be adapted to include VR-learning. Literature alludes to the various guidelines from regulatory bodies stating support for new initiatives in teaching and learning. The guidelines are clear that each institution can decide on the most effective mode of delivery they wish to adopt. This corresponds with the results obtained from the participants, who agreed that regulatory bodies will not be averse to the use of VR in their teaching and learning practices.

The overarching belief of participants, revealed by the study’s evidence, is that there will be little change in the actual curriculum plan when adopting VR-learning, as the stipulated learning outcomes must still be achieved. The biggest change will be the mode of learning and the actual assessment. VR assessments will assist HRD practitioners and HEIs to improve student engagement, and it will offer a more interactive experience for the student compared to traditional written assessments. The decision to incorporate VR into a curriculum depends on factors such as the practical component of a subject, the learning objective, and the expertise of the lecturer to develop the VR experience.

8.3 In-depth interviews

The study was fortunate to have interviewed national and international VR experts. As indicated in Table 7.2, the participants have collectively 120 years of experience in VR, specifically in the design, implementation, and learning theory.

The research questions guided the interview themes.

8.3.1 Theme 1: Student engagement

As a result of the highly specialised VR participants, the interview started off with a **discussion on significance of VR-learning and how it can be used as a catalyst to improve student**

engagement. The interviewees pointed out that VR-learning can positively transform any country's educational system. One participant alluded to the fact that education is the beacon of any country, hence increasing effort should be made to explore technology that can enhance students' learning journey. As supported in literature, the participants confirmed that VR is stimulating the interest of both students and academia, as more attention is being placed on the digital age and how education can benefit from these developments.

One participant further alluded to the fact that through VR-learning, students are engaged and motivated and therefore more receptive to information. The results further suggest that VR-learning can assist students with learning disabilities, as most often these students do not participate in class, and when they are introduced to technology, it is surprising to see the creativity that emerges.

8.3.2 Theme 2: VR-learning

One participant cautioned **not to leapfrog too quickly into VR Education**. It is important to first gain as much knowledge as possible on VR-learning before implementing a VR programme. The use of VR is a new concept to HEIs and therefore academic institutions often lack understanding of what is expected from the lecturer and the student, and what VR can do is often a grey area. Consequently, the study's findings have significant implications for HEIs. Decisions such as, will a VR laboratory be built, for which modules will VR be suitable, will a blended learning approach be used, and how many headsets should be made available, are some of the decisions an HEI will have to consider.

The participants shared how they have engaged with various tertiary institutions and corporate companies to introduce VR-learning to their students and staff. Again, it became clear that an implementation plan is of utmost importance. An institution should do in-depth research in VR before integrating VR into their curriculum. The VR experiences need to be functional and aligned with the learning outcomes. Experiences should be designed to provide the opportunity for HR students to engage with the course content in a meaningful manner.

It is recommended that HRD practitioners and HEIs have a well-designed implementation plan to support students and academics from the start-up phase of using this new technology. This will assist with the creation of an effective platform for VR-learning to promote student engagement.

VR developers further commented on how satisfying it is to introduce VR-learning to students with learning disabilities. One of the participants confirmed that once students who struggle to learn are in an immersive world, the student easily gains insight into the learning concept.

8.3.3 Theme 3: Academics adopting VR

The importance of **ensuring that lecturers receive proper VR training was a focus point for the participants**. Literature suggests that sufficient time should be allocated for effective training to take place. In addition to ensuring that sufficient time is spent on training, HEIs must further ensure that sufficient funding is allocated for training purposes, as many HEIs might spend their entire budget on purchasing VR content. HEIs need to ensure that the VR content aligns with the **curriculum set out** for each qualification or module. It is highly unlikely that VR will replace all learning content in a qualification; rather, it will complement and enhance existing learning content.

In this study, the researcher worked closely with an international VR company that produces VR content. VR developers need to work closely with educational institutions to discuss the curriculum of a qualification to determine the best-fit module (or modules) where VR can be used (Veative Group, 2022:1). VR is best used to simulate realistic scenarios in which students can safely learn and practice their skills.

An international participant directly involved in the development of VR content indicated how excited both students and lecturers become when they see the possibilities VR offers. The participant indicated that **lecturers enjoyed seeing higher pass rates** in the VR subjects they teach and are therefore prone to adopting VR in their teaching and learning practices. This finding is supported by a survey conducted by Liu et al. (2020:2) and confirmed in literature.

One of the participants, a well-known national guru in the field of VR, discussed with much excitement the **VR programmes he already developed** and how students respond and react when being in the immersive world. An international *digital study trends survey* confirmed in literature that students prefer digital learning rather than traditional learning (McGraw-Hill, 2016). VR provides an avenue for students to experience an active learning environment and can therefore potentially motivate students to become more engaged in their learning. In addition to the many benefits of VR, discussed in Chapter 3, the research findings also highlight the importance of creating a **safe environment** for students to perform a task in the immersive world. Aczel (2017:6) notes that with VR, a student is able perform a task more than once without the danger of potential physical harm.

Interaction with fellow students remain a focus point and this can be done by creating 3D virtual experiences where a student is for example only a spectator. This notion became increasingly popular during COVID-19 when a few institutions used a VR platform for students to create avatars and attend classes. Through the use of a VR platform, students were able to communicate with each other in an immersive world (Steed et al., 2016:67). This result

corresponds with literature and the discussion around a person's need to belong with reference to Maslow hierarchy of needs.

The participants also referred to the lessons learnt during the roll out of VR programmes. One of the participants indicated that the smaller number of **Internet subscribers** in South Africa caused a pilot VR game for assisting students in their studies to fail, yet in India, the programme was rolled out with resounding success because the number of Internet subscribers was not a problem at the relevant university. This is not surprising, as the participants who completed the questionnaire also alerted to the Internet challenge users in South-Africa may experience. Literature however opposes the notion that South Africans have difficulty with accessing the Internet. Internet access in South Africa is still not universal, and disparities exist among various population groups living in different geographical regions.

Similar to the outcomes of the questionnaire, the interviewees also shared the **concern of losing their job** as a result of the development of VR in teaching and learning. Two of the interviewees said that during the initial discussions of VR rollout at educational institutions, academics were concerned that VR would replace them. The focus should however rather be on how VR can be utilised as a learning tool to assist lecturer in their teaching. Stehlik (2018:1) alludes to the notion that VR has the potential to give the lecturer power to do things they were not be able to do normally in a class set-up.

Previous studies, including research conducted by Claes and Heymans (2008), confirmed the fear of academics losing their jobs, and stated this as a possible reason for poor VR adoption by academia. However, as we move towards innovation in teaching and learning, Menon and Castrillon (2019) underpin the importance for academics to be innovative, open for change, and adopting new technology.

8.3.4 The adoption of a revised curriculum

The literature review conducted for this study indicates that the **biggest challenge with VR-learning is to source or develop content that matches a curriculum.** This has been confirmed by the interviewee participants. The researcher was fortunate to have collaborated with VEATIVE labs in Japan, which has a content library of 650+ modules for STEM, educational tours, language learning and HEAL modules. A curriculum that includes VR-learning and assessments will enable students to engage in immersive learning outcomes and close the gap between knowledge and understanding. Immersive learning modules should be designed with both the student and the lecturer in mind. The participants regarded this as the most critical factor in the design of VR modules (Veative Group, 2022:1).

A further finding of the study focused on the **regulations** around incorporating VR in the current curriculum of a country. The participants expressed strong views. One respondent indicated that regulatory bodies have too much bureaucracy and influence in terms of how educational providers would like to deliver teaching. This statement was made by an international interviewee and can therefore not made appliable to South Africa's regulatory bodies. Regulations such as safety regulations, data protection, copyright and intellectual property regulations need to be considered by HDR practitioners and HEIs before implementing VR.

A concern was raised over the **security** of certain headsets, such as the Oculus Quest, where very little to no security resort under in the control of an educational institution. Literature confirms that the Oculus Quest 2 privacy is not secure. Data can be used to compromise a user's privacy (Hawthorne, 2022:1).

Another respondent indicated that it is best to start with framing interventions that make learning fun, and then develop the concept according to the regulators for approval. In the literature review, the study referred to SAQA developing a keen interest in how new technology can be incorporated in teaching and learning.

8.4 Experiments

The aim of this section is to present the research findings based on the experiment conducted with the control group and the experimental group of students. The study investigated whether the pass rates and student engagement at the selected private HEI were a significant predictor of using VR during teaching and learning. The relationship between pass rates and student engagement was a significant predictor in this study.

Specific emphasis was placed on differences in students' experience, time allocated to learning, and assessment results, with the control group receiving training without VR and the experimental group with VR.

Some students reported **discomfort using VR**. The most reported discomforts included headaches, nausea, dizziness, and blurred vision. This is supported by previous research conducted by Marks &Thomas (2022:1), who revealed that "there was a reasonable lack of acceptance of the technology with 93 students (31.5%) responding that they did not want to use the technology in future units of study".

From the negatively coded reflections completed in ATLAS.ti, the following three key themes were identified: (i) discomfort in using the technology, (ii) a sense that the quality of content did not enhance their learning, and that it was (iii) **difficult to navigate**". The results of this

study revealed that 20% of the students in the experimental group complained of dizziness. Some users also indicated that it was difficult for them to navigate their way in the immersed environment, which could simply be attributed to them being first time users of VR. However, VR designers or HRD lectures who will design the VR lessons should ensure that clear and simple interfaces with well-designed navigations are created within the immersive experience. In literature, Hicks (2016:1) notes that students can become frustrated when they experience difficulties in navigating through the immersive world while studying.

It is important that HRD practitioners and HEIs remind students to begin with short VR sessions before gradually building up to a longer time spent in VR. The literature confirms that as technology enhances, motion sickness and dizziness become less. Even though all participants in the experimental group were seated during the immersive experience, mixed messages are being send to the brain as one would move around in an immersive world and therefore the brain becomes confused, thereby causing motion sickness or dizziness (Checa & Bustillo, 2020:151).

It was surprising that participants who experienced some motion sickness, still reported a pleasant experience in the immersive world. One participant did not enjoy the experience at all but could see the value VR has for education.

Stemming from the data collected, students who completed their training in the immersive world indicated that they were more **engaged** than merely receiving training by means of distance learning online. Only one participant stated that she was not engaged at all—this is also the participant who felt nauseous from the start and had difficulty navigating in the virtual world. Fifty per cent (50%) of the students indicated that they were totally engaged while in the immersive world. This revealed the sense of being isolated in the moment. The literature refers to a fully engaged stage as having an engaging sensory experience in VR (Pirker (2017:30). One participant also enjoyed the VR training because there were no distractions in terms of other classmates. As referred to previously, the literature is cautious of the fact that students need socialisation with other students and need to feel a sense of belonging.

The study revealed that positive engagement is determined from a 60% and higher grading by the students during their interview. **The results indicated a significant 180% higher engagement level of students who learn through VR.**

With regards to the VR **online assessments** that were conducted, the students indicated that it was a safe place for them to fail. In the case where students answered a question incorrectly, the VR platform **immediately provided thorough and constructive feedback** as to where the student went wrong, and the student was given the option to review that section in the

material again. With the VEATIVE VR headset used in this study, the administrator/teacher facilitator can set the number of attempts the student can perform during an assessment. For this study, the researcher only awarded the students one assessment attempt. The results confirmed the author, Aczel's (2017:6) belief that through repetition, students feel safe, especially in an environment where a student is allowed to fail in an attempt without physical harm or damage done to them.

An important measurement was the **time difference** between the experimental group and the control group for students to complete the training. On average, it took students 15 minutes to complete the VR training as opposed to the 25 minutes it took with teaching the same module to students via distance learning online. This resulted in **40% time saving** when learning through VR. **Therefore, to train in VR, it takes 1.6 times faster compared to distance learning online.** This is not surprising, as literature has confirmed, through previous studies, that students study much faster in an immersive VR world. A study completed by PWC in 2019, confirmed that training can take four times faster in VR than classroom learning and 1.5 times faster than e-learning (also referred to as distance learning online) (PWC, 2019:36).

In this study, the differences in assessment results were further examined by analysing the data of both the control group and the experimental group of students. In total, 80% of students who completed the training and assessments in the virtual world instead of through distance learning online achieved a mark higher than 60%, which resulted in a *competent* judgement. The students who completed their training and assessment through distance learning online had a 57% pass rate. To summarise, the findings highlighted that students who completed the training and assessments in VR had a **23% higher pass rate.** This notion is supported by several authors in the literature (Pirker, 2017:48; Checa & Bustillo, 2020:3).

8.5 Summary

In general, the discussion of results presented in Chapter 8 stemmed from the descriptive data that focused on the influence of VR-learning on student engagement.

The result of the questionnaire indicated that academic staff members in HEIs are optimistic about the use of VR-learning, but they also have some concerns. The academic staff members alluded to the many benefits VR-learning can bring in a student's learning journey, such as the potential for higher marks, building critical thinkers, and increasing student participation in a course. Apart from the benefits, it is furthermore importance to ensure that a climate is created where a student's behavioural, emotional, and cognitive engagement are supported. The study also pointed to the need for students to still connect with fellow students and not feel isolated. With regards to the concerns, the academic staff were uncomfortable to adopt

VR-learning too fast as they are not yet trained on how the technology and headset function, nor have any of the academics ever been in an immersive virtual world. It was pointed out that HEIs should not leapfrog too quickly in adopting VR-learning, but that proper research should be done before deploying this mode of delivery.

The study further obtained data from interviews. The interviewees shared their common interest in VR-learning and discussed the many deployments of successful VR-learning they achieved at other HEIs. The interviewees are all subject matter experts in the VR field and have many years' experiences in building the software and developing the content. It is interesting to note that yet again, the interviewees (as in the case of the academics that completed the questionnaire) stressed the importance of adequately training lecturers and administrative staff who will work directly with students and assist them with VR-learning. From an institutional perspective, the concern regarding the setup cost was discussed.

Finally, the true experiment results revealed that students who were trained using VR are 180% more engaged in their studies. Not surprisingly, the time allocated to the actual training in VR was 40% faster than with distance learning online (e-learning). Students who completed the assessments in VR displayed a 23% higher achievement than the students in the control group.

CHAPTER 9: VR-LEARNING FRAMEWORK WITH RECOMMENDATIONS

9.1 Introduction

The aim of this chapter is to offer recommendations to University X based on the results and findings of the study. The research questions informing this study are discussed in sections 9.2–9.5. Section 9.2 highlights the main contribution of the study to the HR research field, as it illustrates a framework for improving student engagement using VR. The chapter concludes with explaining the limitations of the study, and recommendations are for future studies.

9.2 VR-learning framework

The main contribution of this study is a VR-learning framework for University X to incorporate VR into the HR curriculum to enhance the engagement levels of students.

This framework emerged from the behavioural, emotional, and cognitive needs of a student, which play an integral role in promoting student engagement. The learning theory informing the VR-learning framework is the **Cognitive Theory of Multimedia Learning**. Cognitivism focuses on the retainment of information that are presented in text, images, and audio where students can use their sensory modalities to learn (Bates, 2019).

The key components of the framework are presented in Figure 9.1. As illustrated in figure 9.1, the VR-learning framework comprises four phases, namely: (i) plan and prepare, (ii) rollout and implementation, (iii) data analysis and evaluation, and (iv) expected outcomes and follow-ups based on the framework.

The key components of this framework are built on a semantic relationship between:

- Blended learning (VR and DLO), which includes interactive and immersed experiences, combined with a
- well-designed VR assessment module, and
- data analysis and evaluation that can be conducted throughout the process.

With the VR-learning framework, it is expected, as confirmed by the literature review and research conducted, that students will display increased engagement towards their studies, and, as a result, it will have a positive effect on their pass rates.

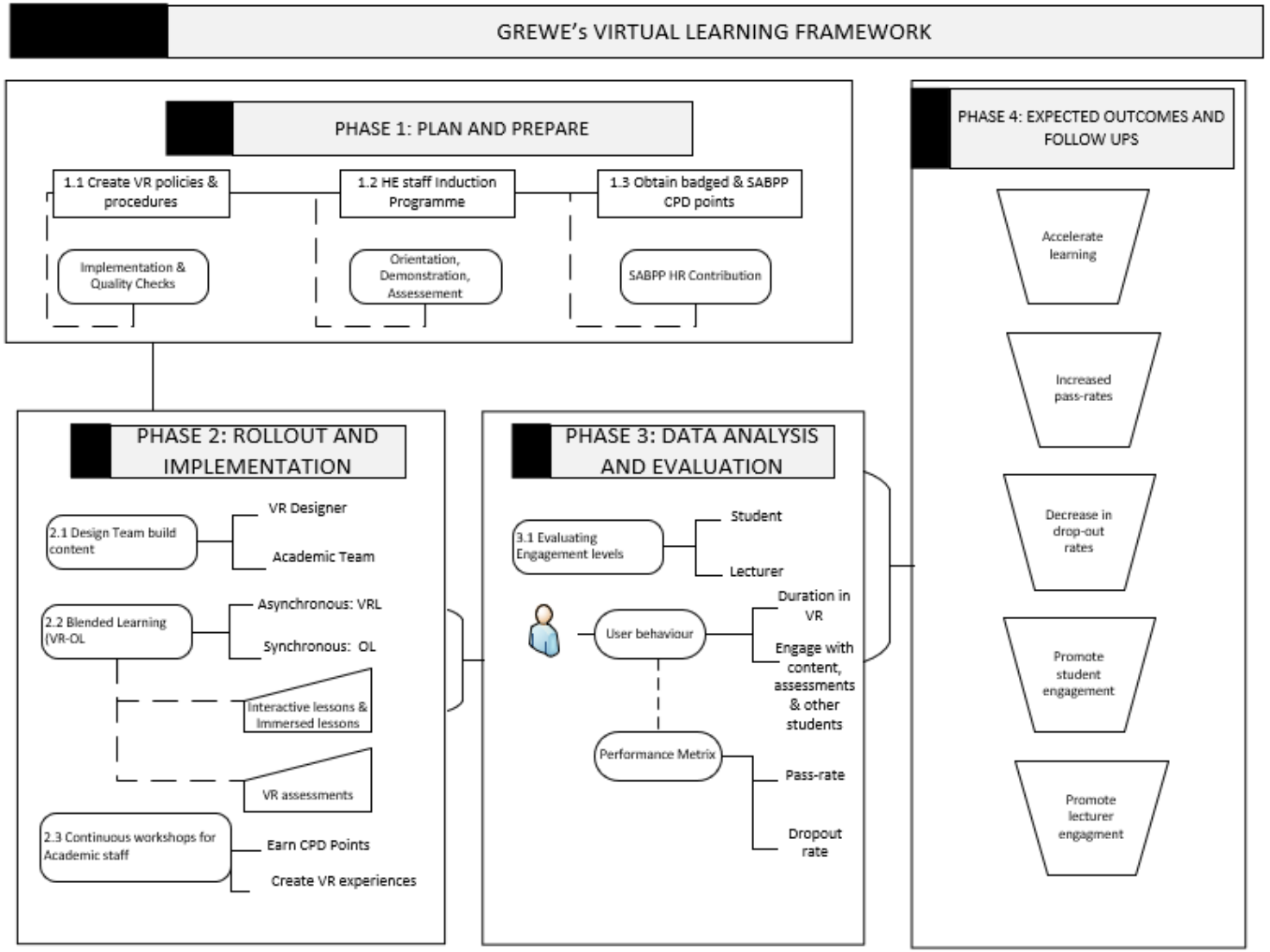

Figure 9.1: VR-learning framework

By implementing the proposed VR-learning framework depicted in figure 9.1, students will be offered a **more realistic experience of learning.** Passive learning, mostly related to the traditional classroom, will now be replaced by students who are engaged in an immersive world during teaching and learning.

By implementing the VR-learning framework, students will be able to:

- Explore immersive experiences
- Touch, feel and move objects
- Shrink and enlarge objects
- Move freely in the VR environment
- Have a safe environment in which mistakes can occur without serious consequences
- Restart the learning at any point to revisit topics
- Test a hypothesis
- Seek alternative approaches to a problem

9.3 Theme 1: Student engagement

The study focused on using VR as a learning tool to positively affect student engagement and pass rates. It has been confirmed by the research conducted and the literature that interest is increasing in HEIs to investigate the possibility of including virtual learning in teaching and learning practices. This study confirmed that using VR-learning, students' levels of engagement can be improved through a more interactive and immersed learning experience.

Despite the increased interest of HEIs and HRD practitioners in VR-learning, there is still some hesitation and/or debate over the (i) time a student spends in a virtual environment, (ii) the cost of setting up a VR-learning environment, and (iii) the readiness of academic staff members to adapt to a new, immersive way of teaching and learning.

Thus, to answer the research question, the study found that VR-learning does promote increased student engagement. However, VR as a learning tool on its own is not sufficient to teach an entire qualification. This is attributed to the high cost of developing VR content as well as the practicality of all learning being delivered through VR.

- Therefore, the intervention of combining distance learning online (DLO) with virtual learning has led to a new VR framework for teaching and learning, also referred to in this study as the VR distance online learning (VR-DLO) model.

As part of the design of the VR-learning framework, the study suggests that the framework (in the first phase, *plan and prepare*) include the following:

- The institution needs to ensure that **VR policies and procedures** are written and included in their quality management system. As part of the procedures, the user should not be longer than 20 minutes in an immersive world. Some side effects, such as dizziness, nausea and disorientation were reported. It is on this premises that the study recommends a blended approach to teaching and learning, where the existing online learning (live facilitated session) is used in cooperation with VR-learning. Thus, the student should be allowed to engage with his/or her studies on their own terms according to their needs at a specific time.

Besides the recommended workshops to capacitate academics to use VR technology in their teaching and learning practices, the study further suggests that the **policies and procedures** are implemented before the implementation of VR within an HEI or organisation.

Table 9.1: Policies and procedures to be implemented

Phases of implementation process	Policies and procedures to be adhered to
Pre-phase	• University X appoints a **VR expert** to project manage the implementation of the VR-DLO learning framework • Determine the number of VR headsets that will be purchased • Academic staff to be part of **planning and initiation** discussions with VR developers and in-house VR expert • **Feedback** from all stakeholders needs to be considered and academics will have the opportunity to ask questions throughout the process • Academic team decides on modules within the qualification that can be reverted to virtual reality learning (VRL) • Academic team to provide **story board.** Quality content will be an integral factor towards the success of VRL. Immersive session should not exceed 20 minutes • VR developers to **create content** • In-house VR expert to **create workshop material** for academics
Rollout and adoption	• **Pilot groups** consist of academic team members to iron out any teething problems that might exist • Monitor the performance analysis of students • Monitor the student and lecturer's engagement levels
Quality assurance (QA)	• Quality assurance for each process • Implement VR updates as they become available • Research to be conducted on new edtech technology as it becomes available

After implementation of the above-mentioned policies and procedures, a seamless integration to change to a blended learning approach that includes VR-learning is expected.

- **Induction programmes for academics** and HRD practitioners when implementing and rolling out VR-learning programmes.
- All HR students will first have to complete a **compulsory VR-DLO induction** programme. The purpose will be for students to have a seamless experience and not become frustrated when they have difficulty navigating in the virtual world. Evidence from this study has alerted the researcher to implement such an induction programme as there were reports from students who found it difficult to navigate or use the VR hand controls. The module will provide users with an (i) introduction to the learning objectives, (ii) orientation to the VR-learning environment, (iii) Immersive demonstrations and scenarios where users can obtain VR knowledge and skills. The module will be concluded by users conducting an (iv) assessment in VR.

As part of phase 2, the following *rollout and implementation* is recommended:

- Confirmed by the research conducted in this study, the VR-learning experience will be built in consultation with the academic team. VR designers will consult with the academic team to scope out the VR-learning design process. In some cases (depending on the VR module), it would be useful to **write a story board** to explain learning concepts. The design team will then be responsible collect the feedback from the academic team and design the VR architecture.
- As indicated in the VR-learning framework, **synchronous learning will take place during online live sessions and asynchronous sessions will include VR-learning components**, such as being in an immersive environment and being assessed within VR. By using a combination of the synchronous and asynchronous learning approach, lecturers can create interaction with students and give feedback in real-time. The benefit of VR-learning in an asynchronous learning environment is that the student has flexibility in the way he/or she learns. Students can go back to certain learning areas where they struggle to understanding concepts. Furthermore, conducting assessments within VR creates a safe environment for making mistakes. Combining online live sessions with VR-learning can also assist students who find learning with VR a challenge, as they will have the option of live lecturer support and guidance as well.

For phase 3 (*data analysis and evaluation),* the below is recommended:

- Lecturers will have the opportunity to monitor the progress of students. Data analytics within the VR LMS will enable a lecturer to follow the learning progression of the student within the VR environment. The lecturer will also be able to identify areas of learning where the student struggled by seeing the learning areas revisited by the student. The lecturer can then focus more on these learning areas during online

facilitation. The lecturer also can view on a desktop what the student is experiencing in VR when wearing a VR headset. This allows for further guidance and support for students who struggle to navigate in the VR environment. This study highlighted the frustration of certain users found it difficult to navigate in the VR environment, especially when they are first time-users. With the resource available, the lecturer can ease the experience for users who struggle.

- As part of the assessments, the lecturer will be able to see the time the student spends to complete the assessment in VR. The lecturer (or administrator) will also be able to set the allowed time duration of the test. The VR LMS will be able to report on each test answer and provide an overall mark for the student. This will assist lecturers with identifying which question/s the students struggled with so that additional learning support can be provided. The VR LMS will automatically grade the student as either *competent*, *not yet competent* or assign the status *incomplete* when a student has run out of time, for example.
- During the entire VR-learning process it is important to conduct quality assurance (QA) at various points to ensure increased student satisfaction in the process. The proposed framework has been coded to prompt quality assurance questions to lectures and students throughout the process to ensure that the VR-learning is valuable and that the students understand the learning outcomes. The VR-learning framework suggests a code for determining the level of engagement while being in a virtual environment. The metrics that will be used to determine the level of student engagement include the following: (i) number of logins, (ii) time spend in the VR-learning environment, (iii) did the student complete the assignment?, (iv) did the student engage with other students?, (v) did the student made use of the tutor forum?, and finally, (vi) did the student complete the participation questions? HRD practitioners and HEIs will benefit from this report as it can assist them in monitoring the students' progress and see whether the student reached the learning outcome. If the HRD practitioner, who works in the organisation, identify the learning gap, strategies to adapt the learning can be made.

Table 9.2 is an illustration of how student engagement will be categorised during coding.

Table 9.2: Student engagement activity versus engagement type

Engagement activity	Engagement type
Students participating in discussion questions and tutor forums	Cognitive
Students participating in VR-learning and assessments	Behavioural
Students collaborating with other students in immersive environment	Emotional

The study confirmed a strong relationship between student engagement and pass rates. This is supported by previous studies, for example Kuh et al. (2003), who revealed that students who are more engaged, achieve higher pass rates. These recommendations closely relate to the main research objective, namely, to increase student engagement and as a result thereof, the student's pass rates will increase. This phenomenon was confirmed in the literature (Chapter 3) and the data analysis (Chapter 7).

In phase 4, the study illustrates the desired outcomes of implementing the VR-learning framework. The expected outcomes of incorporating VR into an HR learning programme is as follows:

- Accelerated learning
- Increased pass rates
- Decrease in dropout rates
- An increase in student engagement
- An increase in lecturer engagement

9.4 Theme 2: Relevance of current teaching methods

In Chapter 2, the study confirmed that traditional learning refers to standing in front of a class facilitating, also referred to as contact learning or in-person learning. University X focuses primarily on (i) distance learning online (DLO) or (ii) online with live sessions (OL).

Distance learning online facilitates asynchronous learning whereby a student has the flexibility to study when convenient for the student. The study material and other related study resources are provided to the student online. Online live sessions on the other hand refer to synchronous learning with a facilitator and students log in to attend the live session. Students are able engage with the lecturer and fellow students. This is important to note in terms of addressing this theme.

As the study confirmed, most HEIs have only converted to online learning because of the COVID-19 pandemic. It is fortunate that University X has been offering online learning since 2012 and therefore online learning (be it distance learning online or online with live sessions) is not a new concept for the institution. It is on this premises that the researcher is confident that University X can easily adopt a blended learning approach of incorporating VR-learning with online learning.

Owing to the digital age, immersed technology such as VR provides the opportunity for teaching methods to change. Through VR, learning can be taken beyond the current distance learning online experience offered by University X.

Through adopting the VR-learning framework, students will demonstrate improved retention as they find themselves in immersed VR leaning environments. This creates the opportunity for University X's academic team to think differently about how they teach students and revolutionise the way of teaching.

The study therefore recommends the following:

- For University X to stay abreast of their competitors and aid in innovation diffusion, they should being engaging with VR-learning. Lecturers and HRD practitioners need to continually evaluate and adapt the way they teach students to ensure that the teaching methods remain relevant to the times students find themselves in.

It is important for HEIs and HRD practitioners to foster student engagement by integrating technology into teaching and learning.

9.5 Theme 3: Preparing academic staff members

The study's research results confirmed that no academic staff member of University X received prior training in VR, neither have they experienced being in an immersive world. This calls for extensive workshops to capacitate academic staff members in VR-learning, which will be built into the VR-learning framework. Table 9.3 is an example of the workshops to capacitate academic staff members.

Table 9.3: Workshop topics for academic staff members

Workshop topic	Mode of delivery
Why digital competencies, why now? Goals and objectives of implementing VRL-OL system	Online
Understanding the VR hardware - Headset - Hand controls - Safety tips	Contact session
VR-LMS system - Log-in - Navigation pane - Learning outcomes - Assessment uploads - Grading of students - Checking progress of students - Loading new learning content	Online
Assisting VR developers in designing a training programme	Online
Setting up assessments in VR	Online
Quality control – Dry run session 1, 2 and 3 (pilot programmes)	Online

It is important for academic staff member to be recognised for having completed courses, hence the VR-learning framework, as part of a building tool, will create badges automatically for lecturers who complete the workshops. This will result in the validation of, and transparency for recognising the learning that takes place. Awarding badges throughout the learning process will also be to the advantage of academics attending the workshops as it encourages engagement, and it could be used for **CPD points**. This is proposed to increase academic staff's motivation, confidence and commitment towards teaching and learning.

Resulting from the code within the VR framework that identifies engagement, a similar yet unique add-on feature to this intervention is that lecturers/academic staff's engagement level can also be tested. Table 9.4 indicates how academic staff's behaviour will be coded using artificial intelligence.

Table 9.4: Academic's engagement activity versus engagement type

Engagement activity	Engagement type
Academics involvement in VR design – developing of content	Emotional
Academics showing interest in the implementation of VR/attending meetings	Emotional
Academics adding new VR content to courses at post-mortem level	Behavioural
Academic attending VR workshops and earning badges towards CPD points	Cognitive

9.6 Theme 4: HR curriculum

The last research question focused on the incorporation of VR within the HR curriculum. Figure 9.2 illustrates the split between online learning and VR-learning that is proposed for the National Diploma in Human Resource Management qualification.

From figure 9.2, the researcher suggests that for this qualification, a split of 60% of the learning can take place via online live sessions and 40% through VR-learning. A detailed report on how each subject's mode of delivery (either VRL or DLO) was determined is provided in Appendix E. The researcher has scrutinised the curriculum of the National Diploma in Human Resource Management and Practice Support and identified assessment areas within a module that can be studied and assessed through VR-learning. The selection was based on the practically of the subject and where a student will be able to experience, create or practically perform a task.

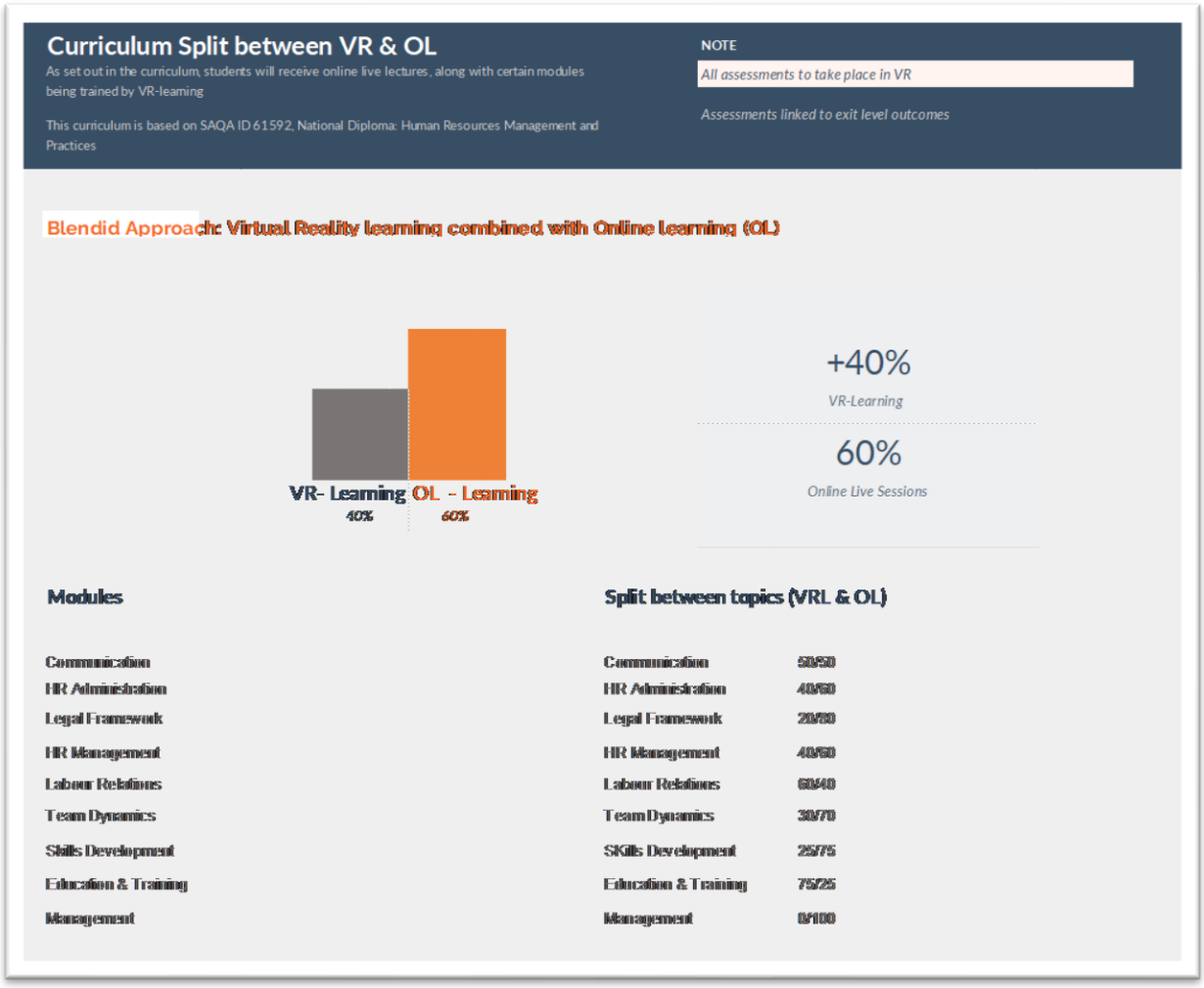

Figure 9.2: Curriculum split between VR and DLO

Another excellent feature of the proposed framework is that students will be able to conduct their **assessments in VR.** As a result, the lecturer can build the assessment structure in the VR LMS. Students will be able to:

- **Retake an assessment multiple times**, as set by the administrator. This is useful to use when students want to know how prepared they are for the summative assessment. The lecturer can decide if an assessment (as in this example where the assessment is open for multiple attempts) will be used for grading.
- Students can furthermore answer incorrectly for two or three times (as determined by the administrator) and then be **redirected to the literature** in the VR-learning environment. Thus, before continuing to the next learning concept. A student is 'forced' to ensure that a concept is understood.

An HR **curriculum plan** has been developed by the researcher to indicate how a VR-learning module should be delivered. The curriculum plan includes an overview of the module, listing the learning outcomes, the story board, and discussion questions that could be posed to

students after being in the immersive world. The marking rubric is also presented in the curriculum and assessment guide. This example can be found in Appendix F.

9.7 Summary

The objective of the study was to propose a VR-learning framework to improve student engagement. Overwhelming evidence obtained from this study shows the interest HEIs demonstrate towards VR-learning. It has been confirmed that VR-learning can increase student engagement and as a result, lead to increased pass rates. With edtech technology such as VR, HEIs can now offer enhanced student-centered training.

The chapter outlined the recommendations suggested by the researcher for the research questions posed. I main contribution of the study—the proposed framework for teaching and learning—which will increase student engagement levels, was highlighted.

The chapter explained the phases for the successful implementation of the proposed VR-learning framework to ensure increased student engagement and pass rates, and a decrease in dropout rates. The VR-learning framework supports reporting features, such as measuring student and lecturers' engagement levels, drawing up scorecards, and monitoring student participation levels as well as the duration a student has been in the immersed experience. The positive adoption of the VR-learning framework will largely depend on seamless user experience and therefore having a pilot group of academic staff members first testing all features within the framework, is recommended.

It is suggested that University X phase out the distance learning online mode of delivery and adopt a blended learning approach that includes VR-learning and online live sessions.

CHAPTER 10: CONCLUSION

10.1 Introduction

In this study, the positive role VR has on student engagement levels was explored. Through a qualitative research approach, rich data were collected and analysed to generate recommendations. In this final chapter, the focus is on the limitations of the study, the implications, and the suggestions for future research. Concluding remarks for each of the objectives of this study is presented. The chapter closes with stating the HR contribution of this study to the body of knowledge.

10.2 Link between research objectives and recommendations

Table 10.1 illustrates a synopsis of the how the research recommendations relate to the research objectives.

Table 10.1: Link between research objectives and recommendations

Research objectives	Research recommendations
To investigate the extent to which incorporating VR technology into teaching and learning improve HR students' level of engagement.	Adopt a blended learning model: VR-DLO. • All students complete a 'VR-DLO-Induction" programme • Academics work with VR developer to create content • Create an assessment platform within VR
To determine the extent that VR technology in teaching and learning increased **HR students' pass rates.**	Though the implementation of the VRL-DLO framework for teaching and learning, students pass rates will increase • A program will be written for the VR LMS using artificial intelligence to determine the **students' engagement levels**. As engagement levels increase, pass rates will also increase • Assessments can be done multiple times for practice purposes
To investigate the **relevance of current teaching and learning methods** of instruction in terms of engaging with HR students.	University X to **adopt the** VRL-DLO mode of delivery
To determine the **extent to which academic staff is capacitated** to use VR technology in their teaching and learning practices.	As part of the proposed VR-learning framework, facilitators will attend **workshops** **SABPP CPD points** can be earned The study presents a **VR curriculum** as an example of one of the modules of the qualification

10.3 Study limitations and suggestions for future research

The following limitations were identified:

i) The study focused on only one qualification within the School of Commerce at a selected private HEI. This was a limitation in the sense that the other faculties within University X did not form part of the study, and the results can therefore only be contextualised for the School of Commerce.

ii) The study furthermore focused only on students studying in the Human Resource Management field. This means the results of student engagement and pass rates are only applicable to students studying towards the Diploma in Human Resource Management.

iii) While the results of the study may be interesting, a wider population of VR experts working at HEIs nationally would have been preferred. Despite many means of correspondence, no response was received from national experts in the field of VR.

The study proposes the following research recommendations:

i) Because the adoption of VR-learning in South Africa is slow, it is recommended, for future research, that the HEIs (public or private) that have already adopted VR-learning be identified and asked to share their experiences about the implementation and rollout of VR-learning.

ii) Another recommendation for further research is to determine the long-term effects of VR on a user, especially the extent to which motion sickness can be eliminated when wearing a VR headset. This need was identified during the study when one student experienced excessive motion sickness while being in the immersive world.

iii) Studies on the accessibility of VR content specifically for HR-related topics can be conducted. The transferability of skills acquired while being in a virtual world and then practically applying it in the real world is unclear. Thus, how effective is the transfer of skills learnt in a non-real world, to that of a real-world scenario?

iv) The use of VR as a tool for recruitment and selection specifically within the HR field can be explored. Stemming from this, future research might then include exploring the rights of candidates who are recruited and assessed in a simulated environment.

10.4 Concluding remarks on the objectives of this study

Research objective 1: To investigate the extent to which incorporating VR technology into teaching and learning improve HR students' level of engagement

The study confirmed that, undoubtedly, VR can be used as a powerful tool to immerse students and provide them the opportunity to interactively learn in a non-real environment. University X can incorporate VR into their teaching and learning by creating experimental learning opportunities/environments for HR students. Examples of HR programmes to create in VR, include recruitment and selection, employee dress code, hazardous office places, and cultural adoption of staff, among many other opportunities. Staff will be able to practice in a safe environment, moving through different scenarios.

Academic staff will have to work closely with the VR developer when creating engaging content to capture the attention of the student. The rule of thumb in VR is to create content that is condensed, factual and easy to read. In figure 5.1, the flowcharts of design content and an immersive experience have been illustrated.

Through the incorporation of VR, University X can create assessments for the VR platform that can be either for individual work or group work. Through group work, collaboration is enhanced, which, in return, increases student engagement. Through the VR LMS, marking can further be promoted, freeing up time for the lecturer.

Research objective 2: To determine the extent that VR technology in teaching and learning increased HR students' pass rates

Student engagement is linked to academic performance such as pass rates. Through immersive practical experiences, students can apply what they have learnt in a safe environment. A student could fail several times (depending on the settings the lecturer adds to the LMS) before submitting the correct answer. This builds confidence and allows for the student to revisit learning areas.

It is however important to note that the extent to which VR-learning can increase pass rates may vary depending on the subject field and specific VR technology used. A more immersed environment (also referred to as fully immersed VR environment) will engage the student more, and this will increase the pass rate more. For this study, the experimental group of students were fully immersed, being provided with a VR headset and hand controls.

The study disclosed that students who learn within a virtual environment has a 23% higher pass rate than those who received facilitation through distance learning online.

Research objective 3: To investigate the relevance of current teaching and learning methods of instruction in terms of engaging with HR students

The study disclosed that although the interest of HEIs to adopt VR is increasing, the technology can be expensive, and many institutions do not have the skilled workforce to roll out VR into their programmes. The availability of VR content for HE institutions, especially for HR subjects, is limited. Academic staff are also concerned that this technology may cause job losses. These concerns can mainly be attributed to a lack of awareness and understanding of VR's potential benefits in teaching and learning.

The challenge for HEIs to implement VR is the distinctiveness of the high degree of standardisation and regulation embedded in these processes. A change in curriculum can be a complicated processes as it has been developed and refined over time to meet the needs of the students, the institution, and the HR body of knowledge. This can add an additional layer of complexity when having to deal with regulatory bodies to approve a curriculum.

The study confirms the relevance for University X to continue teaching through distance learning online, however, it needs to be combined with VR-learning, as both modes (VR and DLO) of delivery can complement one another. Both modes provide flexibility, accessibility, and are cost-effective. When distance online learning is combined with virtual learning, simulations and assessments can take place in a safe and controlled environment. VR will furthermore enable students to access real-world environments that are otherwise impossible to access. With these unique advantages of both modes of delivery, the study suggests that University X incorporates VR-learning into their current mode of delivery, which is distance learning online. VR on its own as a learning modality cannot be used to teach an entire qualification. VR is mostly suited to train practical concepts where scenarios can be created.

Research objective 4: To determine the extent to which academic staff have been capacitated to use VR-learning in their teaching and learning practices

Despite the various potentials of VR presented above, its expansion into HE is still slow. Literature confirms that this is attributed to the high cost of purchasing the resources, the little HR-related content available, and the lack of VR experts in HEIs. Despite these concerns, there are many academics who are eager to experiment with teaching through VR. All the academic staff who participated in the study did not have any experience in using VR. It was comforting for the researcher that no scepticism about VR-learning was noted at University X; however, literature informed the study that there do exist academics who are scared by the idea of implementing VR in learning, as they feel their jobs can become redundant, but might simply be attributed to them not being familiar with VR technology.

The study recommends an initial induction programme for academia, as well as continuous workshops whereby HR academics can earn SABPP CPD points when completing certain milestones.

Research objective 5: To develop a VR-learning framework that complies with regulatory bodies' criteria

The doctoral contribution of this study is the VR-learning framework designed by making use of the cognitive theory of multimedia learning. Refer to section 9.2 for an extensive explanation of this framework.

Research objective 6: To propose recommendations for the adoption of VR-learning in teaching and learning at University X, Cape Town, South Africa

The various recommendations already proposed in this chapter are summarised below. The study suggests the following for University X:

- Adopt the VR-learning framework, also referred to as the VR-DLO framework, created during this research. Synchronous learning will take place during online live sessions and asynchronous sessions will include VR-learning components.
- Appoint a VR developer who works with academia to write VR content. The content needs to be immersed, factual and to the point.
- During all phases, ensure that evaluation and testing are done to avoid technical issues during deployment. Students tend to become annoyed easily with technical errors and could lose interest in the VR-DLO mode of delivery.
- Create policies and procedures related to VR.
- Implement a compulsory induction programme for both students and academia.
- Design workshops for academics in such a way that after successful completion of modules, SABPP CPD points can be earned.
- Design a user-friendly LMS.
- Write code for the LMS that will include data analysis (engagement of students, engagement of lecturers, user behaviour, performance.

10.5 Research study contribution to the HR body of knowledge

As VR gains wider acceptance in HRIS and organisations, learning and development initiatives will gradually become an integral part of teaching. This study explored and discussed the benefits and challenges of utilising VR as a learning tool and examined participants to develop a VR-learning framework, thereby making a novel contribution to the HR body of knowledge.

With an increase in online learning, the possibility of using VR as a learning tool for HR professionals are valuable as it will assist organisations with developing their employees' skills and knowledge through an immersive yet interactive learning experience that promotes engagement. By embedding VR into the HR curriculum of a qualification, it will enhance the effectiveness and delivery of the qualification. HRD professionals traditionally stood in front of a class lecturing, but now, through the new contribution of a VR-learning framework, more engaging and interactive learning experiences can be created. As a result, the time spent in class as well as the training cost can be reduced.

VR has been embedded into an HR curriculum with the aim of increasing student engagement. As a result, the study further contributes to the SABPP's HR competency: *citizenship for the future: innovation, technology, and sustainability*. Therefore, VR can be used as a new learning and development tool in future for HRD interventions in an organisation. The more HEIs and organisations adopt VR-learning into their programmes, the easier it will become to develop content, navigate through the immersive experiences, and students will become more comfortable to be assessed in an immersive world.

10.6 Conclusion

In conclusion, this research study investigated the profound role that VR plays in increasing student engagement levels. Based on the research conducted, the researcher developed a VR-learning framework that has the potential to increase HR students' engagement at University X.

The VR-learning framework was designed to address the research problem, namely that poor student engagement levels influence students' academic achievements. As part of the research problem, the study investigated traditional teaching methods often associated with low student engagement levels. The VR-learning framework was built on the cognitive theory of multimedia learning.

Through immersive and interactive learning experiences for students, the VR-learning framework will provide engaging yet thorough learning experiences and enhance student engagement levels. The VR-learning framework also provides lecturers the opportunity to gain insight into VR through continuous workshops whereby HR lecturers can earn SABPP CPD points.

The VR-learning framework will support the SABPP's HR standards and HR Competency Model by providing a platform to enhance HR students and the overall HR profession's emerging technology skills. Lifelong learning is further promoted by offering continuous CPD workshops for HR students and lecturers. This study relates directly to the SABPP's

competency: *citizenship for the future: innovation, technology, and sustainability*. It is the responsibility of HR practitioners to look for opportunities to gain exposure to modern trends.

A qualitative research methodology was used in this study, with an interpretivist paradigm and an inductive approach. The sample size comprised 38 participants and data were collected by means of open-ended questionnaires, semi-structured interviews and a true experiment with both an experimental group and a control group of students.

The research results revealed that the students exposed to immersive learning environments were 180% more engaged than students who only received training in a more traditional manner (namely distance learning online). The study further found a 40% time saving when learning through VR. Therefore, when compared, training in VR takes 1.6 times faster than distance learning online. Students who were trained and assessed within VR achieved 23% higher marks compared to students who were trained and assessed via distance learning online.

The study recommends that University X deploy a blended learning approach which includes both distance learning online and VR-learning. The two methods complement one another well in being flexible, engaging, and facilitating fast leaning for students. Overall, combining VR and distance learning online resulted in a VR-DLO framework designed by the researcher as the main contribution of this study to the HR body of knowledge.

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APPENDIX A: CPUT ETHICAL CLEARANCE

Cape Peninsula University of Technology

P.O. Box 1906 • Bellville 7535 South Africa •Tel: +27 21 4603291 • Email: fbmsethics@cput.ac.za
Symphony Road Bellville 7535

Office of the Chairperson Research Ethics Committee	Faculty: BUSINESS AND MANAGEMENT SCIENCES

At a meeting of the Faculty's Research Ethics Committee on 30 April 2019, Ethics Approval was granted to Martha Hendrika Grewe (200711466) for research activities of Doctor of Hum. Resources at Cape Peninsula University of Technology.

Title of dissertation/thesis/project:	A PROPOSED FRAMEWORK FOR IMPROVING STUDENT ENGAGEMENT BY MEANS OF VIRTUAL REALITY AT A SELECTED TERTIARY INSTITUTION, CAPE TOWN, SOUTH AFRICA Lead Researcher/Supervisor: Prof A A Rust

Comments:

Decision: Approved

	7 May 2019
Signed: Chairperson: Research Ethics Committee	Date

Clearance Certificate No | FOBREC642

APPENDIX B: DATA COLLECTION INSTRUMENT: INTERVIEWS WITH VR SPECIALIST

Background and explanation	Thank you for completing the "Research Participation Informed Consent Form (Appendix A)" and thereby agreeing to participate in this study. I am a candidate doctoral student conducting research into how "Student Engagement can be increased with the use of Virtual Reality in Training and Development".
The research problem statement	**Main problem statement** Due to a lack of using VR technology in teaching and learning, the level of HR student engagement has decreased over the last three years (2018–2020) at University X, Cape Town, South Africa. **Sub-problem statement 1** Due to the main problem, HR students' pass rates dropped by 15% over the last three years (2018–2020) at University X, Cape Town, South Africa. **Sub-problem statement 2** Due to the main problem, the current teaching and learning methods of instruction over the last three years (2018–2020) have plateaued at University X, Cape Town, South Africa. **Sub-problem statement 3** Due to the main problem, academic staff have not been equipped to use virtual reality technology in their teaching and learning practices over the last three years (2018–2020) at University X, Cape Town, South Africa.
The aim of the study	The aim of the study is to investigate how virtual reality can be incorporated into training and development, to ensure that student engagement levels increase.
Data collection	Data will be collected using open-ended questionnaires, in-depth individual interviews as well as an experiment that will be conducted on students. This specific document only relates to VR educational experts who are invited for the online interview.
Regarding the use of your data, the following conditions apply:	Your data will be used for scientific purposes, including publication. Only the researchers have access to the data. Your data will be handled and stored confidentially. This means that your data cannot be traced back to you. Specifically, the researcher will use a code number instead of your name to save your data. The code number and other personally identifiable information, such as names, will be saved separately from each other in a secure location. After publication, only the data that is necessary for the verification of the study results will be kept and stored safely for a minimum of 3 years and deleted once it is no longer needed.

<table>
<tr><td></td><td>You have the right to withhold any responses you have provided from subsequent analysis. This means we will not use your data for this or any follow-up research, nor will the researcher share it anonymously for open science purposes. You can decide to withdraw your data until the study results are accepted for publication, or until the data is cleared of any and all identifying information, such that no one will be able to trace you.

If you have any further questions or complaints about this study, you may contact the researcher, Ms. Maritsa Grewe on email address Maritsa.Grewe@outlook.com or the research Supervisor, Professor B. Rust on email address RustB@Cput.ac.za.

Please answer the questions below:

Key:
<table><tr><td>IQ</td><td>Interview Question</td></tr><tr><td>ISQ</td><td>Interview Specific Question</td></tr><tr><td>IQ</td><td>Individual Question</td></tr></table></td></tr>
<tr><td>RQ1: Student Engagement</td><td>RSQ 1.1: Understanding the concept of Student Engagement:

IQ 1: Please provide some background information in terms of your experience with VR and learning.

IQ 2: In your view, what are the distinguishing factors that differentiate traditional learning from learning through virtual reality?

IQ 3: In your expert opinion, to what extent do you believe virtual reality can impact student engagement?</td></tr>
<tr><td>RQ2: VR being used in training and development</td><td>RSQ 2.1: Your understanding of the use of VR in Training and Development:

IQ 4: What is the common misunderstanding regarding VR, in your opinion?

IQ 5: To what extent can VR enhance students' academic performance? Please provide a rationale for your answer.

IQ 6: How is VR contributing to the advancement of teaching and learning, and why do you think it has lasting potential?

IQ 7: Tell me how would virtual reality change the world of work?

IQ 8: From your perspective, what impact does virtual reality have on education in South Africa?

IQ 9: Can you provide some instances of practical applications and corresponding immersive experiences enabled by VR technology?</td></tr>
<tr><td>RQ3: Preparedness of academic staff to use VR during training and development, including assessments.</td><td>RSQ 3.1: It is expected that the future role of an Academic Staff member will include the use of VR as a means through which training will occur. How prepared are you for the future role as an Academic staff member?

IQ 10: What are some of the main challenges academic staff encounter when being introduced to VR?

IQ 11: What are the biggest benefits to using VR for the students and the tutors?</td></tr>
</table>

RQ4: To what extend would a curriculum plan be adapted to include VR that is acceptable for South Africa Quality Assurance (SAQA)?	RSQ 4.1: How acceptable are South Africa's regulatory bodies to include vr into their curriculum? IQ 12: What is the current progress, if any, regarding the integration of virtual reality technology in the curriculum of educational institutions?

Thank you for your time and participation.

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APPENDIX C: DATA COLLECTION INSTRUMENT: QUESTIONNAIRE FOR ACADEMIC STAFF MEMBERS

Background and explanation	Thank you for completing the "Research Participation Informed Consent Form (Appendix A)" and thereby agreeing to participate in this study. I am a candidate doctoral student conducting research into how "Student Engagement can be increased with the use of Virtual Reality in Training and Development".
The research problem statement	**Main problem statement** Due to a lack of using VR technology in teaching and learning, the level of HR student engagement has decreased over the last three years (2018–2020) at University X, Cape Town, South Africa. **Sub-problem statement 1** Due to the main problem, HR students' pass rates dropped by 15% over the last three years (2018–2020) at University X, Cape Town, South Africa. **Sub-problem statement 2** Due to the main problem, the current teaching and learning methods of instruction over the last three years (2018–2020) have plateaued at University X, Cape Town, South Africa. **Sub-problem statement 3** Due to the main problem, academic staff have not been equipped to use virtual reality technology in their teaching and learning practices over the last three years (2018–2020) at University X, Cape Town, South Africa.
The aim of the study	The aim of the study is to investigate how virtual reality can be incorporated into training and development, to ensure that student engagement levels rise.
Data collection	Data will be collected using questionnaires, in-depth individual questionnaires, focus group questionnaires as well as an experiment that will be done by students. This specific document only relates to academic staff who will be requested to complete this questionnaire.
Regarding the use of your data, the following conditions apply	Your data will be used for scientific purposes, including publication. Only the researchers have access to the data.

Your data will be handled and stored confidentially. This means that your data cannot be traced back to you. Specifically, the researcher will use a code number instead of your name to save your data.

The code number and other personally identifiable information, such as names, will be saved separately from each other in a secure location.

After publication, only the data that is necessary for the verification of the study results will be kept and stored safely for a minimum of 3 years and deleted once it is no longer needed.

You have the right to withhold any responses you have provided from subsequent analysis. This means we will not use your data for this or any follow-up research, nor will the researcher share it anonymously for open science purposes. You can decide to withdraw your data until the study results are accepted for publication, or until the data is cleared of all identifying information, such that no one will be able to trace you.

If you have any further questions or complaints about this study, you may contact the researcher, Ms. Maritsa Grewe on email address Maritsa.Grewe@outlook.com or the research Supervisor, Professor B. Rust on email address RustB@Cput.ac.za .

Please answer the questions below:

Key:

RQ	Research Question
RSQ	Research Specific Question
IQ	Individual Question

RQ1: Student Engagement

RSQ 1.1: Understanding the concept of Student Engagement

IQ 1: What is your understanding of the concept 'student engagement' as it relates to learning?

IQ 2: In your opinion, why is it important to keep students engaged during learning?

IQ 3: Are you concerned with student engagement as an academic, i.e., is it important to you? Elaborate on your answer.

IQ 4: In your opinion, can pass rates and throughput rates be related to student engagement? Provide reasons for your answer.

RSQ 1.2: The tracking of Student Engagement during facilitation

IQ 5: How do you track student engagement in your class?

IQ 6: Do you think the method you have described in IQ 5, is effective? In other words, does it have a positive knock-on effect on how the student performs in class?

IQ 7: In your opinion, which is more important: integration (students are busy with the physical experience of training) with educational technology (in the classroom/or remote) or interaction (students mix with other students and the lecturer)?

IQ 8: What factors do you believe can influence student engagement?

IQ 9: In your opinion, do you agree with the statement. Elaborate on your answer. In the classrooms, there should be mostly interaction between students (the lecturer only serves as a “guide” to the conversation).

IQ 10: Training through the use of Virtual Reality platforms will increase student’s creativity and result in a higher pass rate. Do you agree with this statement? Please provide details for your answer.

RSQ 1.3: Methods to increase student engagement

IQ 11: Please expound on the actions you would take in response to observing students’ disengagement during a virtual reality learning session.

IQ 12: In your opinion, whose responsibility is it to maintain good student engagement?

IQ 13: In your opinion, do you think that visual features are important during training?

IQ 14: In your opinion, which is more important in learning: listening or doing? Explain your answer.

IQ 15: Do you agree or disagree with this statement, please elaborate on your answer: “The only source of knowledge is experience”.

RQ2: VR being used in Training and Development	**RSQ 2.1: Your understanding of the use of VR in Training and Development**

IQ 16: Have you had any experience with incorporating virtual reality in an educational setting?

IQ 17: How comfortable would you be in training students in a virtual environment?

RSQ 2.2: Benefits of using VR in Training and Development

IQ 18: Can you envisage using virtual reality in your online classroom? Is this something that interests you?

IQ 19: In your opinion, what would the benefits to your students be when lecturing in a virtual environment?

IQ 20: In your opinion, what would the benefits to you, as the lecturer be when teaching in a virtual environment?

RSQ 2.3: Challenges experienced by Academic Staff when using VR hardware and software

IQ 21: For desktop virtual experiences all students would need access to their own personal computers or laptops. Would you say that most of your students have access to PC's and laptops?

IQ 22: Can you describe the challenges that you foresee will occur when facilitating in a virtual reality environment?

RQ3: Preparedness of academic staff to use VR during training and development, including assessments

RSQ 3.1: It is expected that the future role of an Academic Staff member will include the use of VR as a means through which training will occur. How prepared are you for the future role as an Academic staff member?

IQ 22: Are you willing to learn more about the use of Virtual Reality for the purpose of training with this tool?

IQ 23: We have seen that in a time of a pandemic where no students could attend classes, lecturers had to convert to online training. How easy was the change for you to make?

IQ 24: We have seen that in a time of a pandemic where no students could attend classes, lecturers had to convert to online training. How easy was the change for you to make? Same as previous question?

IQ 25: How would you explain the difference between a teacher-centred approach of lecturing and a learner-centred approach of lecturing?

IQ 26: In your opinion which one is more effective in lecturing: a teacher-centred approach or a learner-centred approach? Please elaborate on your answer.

RSQ 1.2: EVALUATING THE comfort LEVEL OF ACADEMIC STAFF training in a virtual environment

IQ 27: Have you ever engaged with VR in training and development?

IQ 28: If you get the opportunity, would you train using VR? Give a reason(s) for your answer.

IQ 29: In your opinion, would you feel it will be easier or more complex to facilitate in a virtual environment? Elaborate on your answer.

IQ 30: If you can give advice to a VR educational developer, what would it be?

RSQ 1.3: THE IMPORTANCE OF GETTING trained in using VR in training and development

IQ 31: In your opinion, what are the challenges that prohibit you from learning more about the use of new technologies that can be used in training and development?

IQ 32: In your opinion, can these challenges be overcome by creating training sessions for a common understanding about how to apply VR in lectures?

IQ 33: Are you aware of the current trends in the development of educational technology? Please elaborate.

RQ4: To what extend would a curriculum plan be adapted to include VR that is acceptable for South Africa Quality Assurance (SAQA)?

RSQ 4.1: the South African QUALIFICATION AUTHORITY (SAQA) AND ASSESSMENTS

IQ 34: In your opinion, how would a curriculum and assessment plan, that includes VR, differ from a normal SAQA and assessment plan?

IQ 35: In your opinion, how comfortable are you in letting students write assessments in a virtual environment?

RSQ 4.2: CREATING a new set of VR curriculum and assessment guides

IQ 36: In your opinion, do you feel SAQA is open to receive amended curriculum and assessment plans that includes the use of VR?

IQ 37: In your opinion, would you think that the Quality Council of Trades and Occupation (QCTO) would be open to receive amended curriculum and assessment plans that includes the use of VR?

IQ 38: Would you have any recommendations you can provide to this study in how to successfully apply VR in training and assessments?

Thank you for your time and participation.

ooOOoo

APPENDIX D: CONTROL GROUP

Control Group Questionnaire after session

Researcher: M.Grewe

How engage did you feel during the training session?

- 0% -20%: Not engaged at all
- 20% - 40% Somewhat engaged
- 40% - 60%: Engaged, I listened but could do other tasks as well.
- 60% - 80%: More engaged, I was able to focus
- 80% - 100%: Fully engaged, did not think of anything else. I was in the moment. No distractions.
- Other...

It was easy to recall the knowledge obtained during the training, when doing the assessment.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

APPENDIX E: VR–DLO SPLIT OF TOPICS

VR–Learning			Online Learning		
Topic	**Module**	**Unit**	**Topic**	**Module**	**Unit**
Lead discussions and chair meetings.	1	12433	Generate a variety of workplace reports.	1	12433
Deliver presentations.	1	12433	Written and oral communication techniques.	1	12433
Lead and function effectively in a team and as an individual.	1	10044	Identify and explain a generic communications model.	1	10044
Formulate and use learning strategies.	1	115791	Analyse, interpret and implement a generic communication strategy.	1	10044
Lead and function effectively in a team and as an individual.	1	115791	Use and apply occupational and vocational learning materials and resources.	1	115791
Identify characteristics of workplace.	1	115791	Conduct research and submit recommendations.	1	115791
Develop an office supply budget	2	100528	Implement a plan to control the distribution of office supplies.	2	110528
Organise the collation of information required for human resources management.	2	10171	Implement control measures with individuals.	2	110528
Organise, control and monitor the storing, recording, maintenance and retrieval of collated info.	2	10171	Advise and inform the organisation by providing human resource information for the use of others.	2	10171
Describe the types of allowances and deductions as per applicable legislation.	2	7882	Explain the consequences of not complying with requirements.	2	7882
Describe the sources of relevant payroll information.	2	7882	Describe the impact on the organisation and employees if the payroll is not done accurately and timeously.	2	7882
Calculate gross pay accurately from information available.	2	7882	Stress the importance of always maintaining confidentiality & security of payroll information.	2	7882
Calculate statutory and voluntary deductions accurately from relevant documentations.	2	7882	Describe the impact if the payroll does not confirm to requirements.	2	7882
Calculate payment due to individual employees.	2	7882	Prepare salaries and wages for payment by cash, cheque or bank transfer within agreed deadlines.	2	7882
Deal with salary and wage queries promptly and courteously.	2	7882	Keep records and salary system in accordance with organisational requirements.	2	7882
Determine the minimum legal conditions of employment.	3	11907	Examine salary and payroll expenses against budgets.	2	7882

Provide advice on the application of substantive conditions.	3	11909
List (comprehensively) the key elements of the Employment Equity legislation.	3	116927
Plan and prepare for recruitment and selection.	4	12140
Recruit applicants.	4	12140
Select staff.	4	12140
Ensure that the induction documentation and materials are current, relevant and complete.	4	7848
Ensure that work routines are described accurately.	4	7848
Ensure that internal procedures are described.	4	7848
Encourage new staff to ask questions and seek clarification, where necessary.	4	7848
Advise and assist new staff constructively in the initial performance of allocated work activities.	4	7848
Determine whether or not the new employee has been properly integrated into the organisation.	4	7848
Develop structures and procedures to resolve employee grievances.	5	12139
Implement structures and procedures to resolve employee grievances.	5	12139
Monitor the application of the grievance procedures and adjust when required.	5	12139
Evaluate, analyse and address grievance patterns.	5	12139
Conduct and manage the hearing.	5	10985
Implement procedure to handle non-dismissible offences.	5	10985

Prepare and balance employee records for tax purposes from salary records.	2	7882
Update and maintain employee records.	2	7882
Describe briefly how performance or systems would be adapted.	2	7882
Analyse the conditions of employment within the organisation.	3	11907
Draft an employment contract.	3	11907
Demonstrate an understanding of the purpose and application of the Basic Conditions of Employment.	3	114274
Describe the regulation relating to working time and leave as set out in the Basic Conditions.	3	114274
Describe the particulars relating to employment, remuneration and termination of employment.	3	114274
Demonstrate an understanding of the monitoring, enforcement and legal proceedings as set out.	3	114274
Demonstrate an understanding of the creation of the CCMA, its origins, functions and powers.	3	114273
Demonstrate an understanding of the creation and the functioning of a Bargaining Council.	3	114273
Demonstrate an understanding of Collective Agreements, their origins, structures and legal standing.	3	114273
Demonstrate an understanding of extending Collective Agreements to non-parties.	3	114273
Identify rights and obligations in terms of statutes, contracts and agreements.	3	11909
Ensure compliance with statutory and other conditions of employment.	3	11909
Present an understanding of the link between employment equity and the business strategy.	3	116927
Determine whether the appropriate relationships exist	3	116927

Hear pleadings.	5	10985
Take a decision as to sanction.	5	10985
Inform employee of and record decisions.	5	10985
Ensure that proceedings and decisions are recorded	5	10985
Supervise and monitor a business project team.	5	10148
Report progress on a business project.	6	10148
Identify and rectify problems occurring in a business project.	6	10148
Recognise areas in need of change.	6	15214
Make recommendations for change.	6	15214
Implement change.	6	15214
Establish performance standards and monitoring systems.	6	15230
Prepare for performance review of team member.	6	15230
Conduct performance review interview.	6	15230
Conduct an analysis to identify and define the skills requirements of the organisation.	7	15217
Analyse current skills and develop skills profile of the organisation.	7	15217
Define training and development needs and establish priorities.	7	15217
Define training and development needs and establish priorities.	7	15217
Plan and prepare for facilitation.	8	117871
Facilitate learning.	8	117871

between Employment Equity and factors impacting on it.		
Identify non-compliance with employment equity strategy and purpose.	3	116927
Explain the importance of inducting new staff into the organisation.	4	7848
Distinguish the induction of new employees from the induction of relocated staff.	4	7848
Describe how the induction program can be used to elevate existing staff into mentorship roles.	4	7848
Allocate parts of the induction process to existing staff.	4	7848
Ensure that the induction documentation and materials are current, relevant and complete.	4	7848
Suggest ways to improve the existing induction programme.	4	7848
Analyse the current situation.	4	12138
Determine and describe agreed short and long-term organisational objectives.	4	12138
Define the gap and make recommendations for bridging the gap.	4	12138
Produce a written report of the results.	4	12138
Identify the root causes for unacceptable levels of productivity within the organisation.	4	114882
Identify priority areas for productivity improvement.	4	114882
Develop a productivity improvement strategy.	4	114882
Develop plans for implementing the strategy in the identified priority areas.	4	114882
Identify and classify transgression.	5	12139
Implement procedure to handle non-dismissible offences.	5	11286
Implement procedure to handle dismissible offences.	5	11286
Represent employee at disciplinary hearing.	5	11286

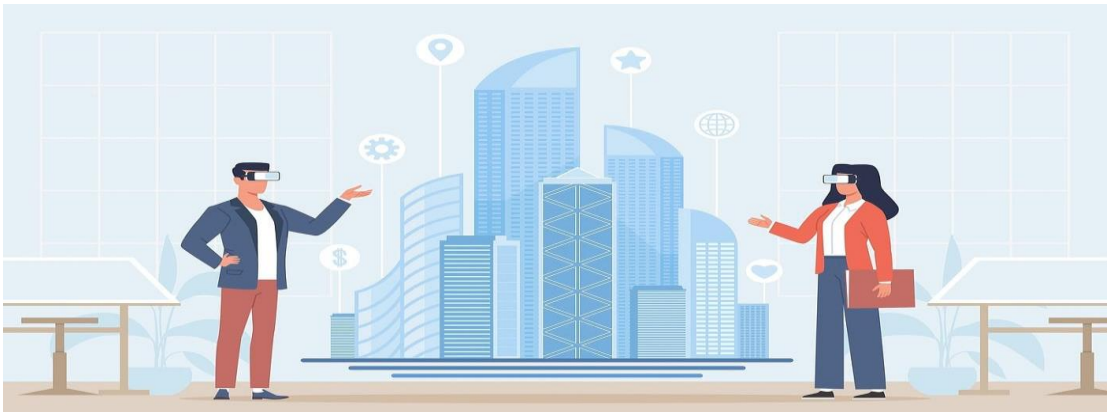
Evaluate learning and facilitation.	8	117871
Demonstrate understanding of outcomes-based assessment.	8	115753
Prepare for assessments.	8	115753
Conduct assessments.	8	115753
Provide feedback on assessments.	8	115753
Review assessments.	8	115753

Design a framework to collate data on quantifiable and qualitative factors.	5	114886
Measure the quantifiable factors that influence labour productivity.	5	114886
Assess the qualitative factors that influence labour productivity.	5	114886
Assess labour effectiveness.	5	114886
Develop the vision for the function.	6	264398
Describe the leader's role within the function in relation to the vision.	6	264398
Improve own leadership within the function.	6	264398
Discuss and explain the appropriateness of the various organisational structures.	6	10148
Set up, run and close a business project.	6	10148
Describe the code of conduct.	6	15229
Communicate the code of conduct.	6	15229
Apply the code of conduct.	6	15229
Identify Best Practice guidelines.	6	15215
Analyse current operating practices against identified Best Practices.	6	15215
Draw up plan for implementing Best Practice.	6	15215
Draw up plan for implementing Best Practice.	6	15215
Set goals and objectives.	6	15220
Establish performance standards.	6	15220
Set up monitoring systems.	6	15220
Monitor and measure the achievement of objectives.	6	15220
Provide information and advice on legislation related to skills development.	7	15221
Provide information and advice concerning learning and assessment.	7	15221
Provide information and advice concerning learning and assessment.	7	15221

				Plan and organise the analysis process.	7	15218
				Conduct the analysis.	7	15218
				Develop and verify a matrix of outcomes.	7	15218
				Identify and prioritise Learners' learning requirements and the collation of information required for Human Resources management.	7	15232
				Plan and organise learning interventions.	7	15232
				Co-ordinate learning interventions.	7	15232
				Co-ordinate learning interventions.	7	15232
				Assist in the identification and interpretation of quality assurance.	7	15228
				Plan and prepare to assist in the design and establishment of a quality management system.	7	15228
				Assist in the design of a quality management system for skills development practices.	7	15228
				Assist in the development of effectiveness indicators for skills development practices.	7	15228
				Assist in the establishment of a quality management system for skills development practices.	7	15228
				Assist in the implementation and improvement of a quality management system for skills development.	7	15228
				Investigate and analyse the status of the learning culture within the organisation.	8	252041
				Develop strategies for the promotion of a learning culture within the organisation.	8	252041
				Implement strategies to promote a learning culture.	8	252041
				Monitor own activity in dealing with clients of an SMME.	9	115830
				Analyse and record business performance and activity.	9	115830
				Maintain capability in own elective/specialist area.	9	115830
				Develop professional business advisory practice to adapt to technical and environmental change.	9	115830

				Explain the purpose of visionary thinking in a leadership context.	9	120311
				Analyse current context and trends to develop strategy.	9	120311
				Compile scenario plans, procedure to handle dismissible offences.	9	120311
				Apply selected scenarios into strategic and business planning processes.	9	120311
				Evaluate scenario planning.	9	120311
				Explain the role of a strategic plan in the achievement of an organisation’s mandate.	9	259143
				Explain the role of a strategic human resource plan in enabling an organisation to reach its deliverables.	9	259143
				Discuss the importance of integrated human resource planning.	9	259143
				Develop a human resource intervention to meet changing or emerging needs.	9	259143

APPENDIX F: VR HR CURRICULUM



Module 4: Plan and Prepare for Recruitment and Selection

Both recruitment and selection are the two (2) phases of the employment process. It is the procedure that companies must go through before employing an employee. It is the company's responsibility to keep up to date with the current employment law. Recruitment and selection define the search of finding an eligible candidate for the job role.

After completing this section, the learner will be able to plan and prepare for recruitment and selection, by successfully completing the following:

Learning Outcomes

- Obtaining and completing **information** of the relevant position. (SO1, AC1).
- Selecting/**designing a selection procedure** and ensuring it is appropriate for the specific position and in line with organisational and legal requirements. (SO1, AC2).
- Confirming the selection procedure to be a **validated procedure**. (SO1, AC3).
- Identifying, budgeting, preparing, and managing resources and methods needed for recruitment and ensuring the resources are available, **within budget** and fit for the purpose needed. (SO1, AC4).
- Developing the selection criteria and control procedures in line with organisational and **legal requirements** and avoiding partiality or bias. (SO1, AC5).

Immersive Experience

Students can choose an industry and position for which they would like to recruit a candidate in. Thereafter, the student will be allowed to create an avatar, to best fit the look and feel of the industry chosen. Based on the industry the student chosen, the VR software will take the students to a similar workspace for conduct the selection and recruitment process.

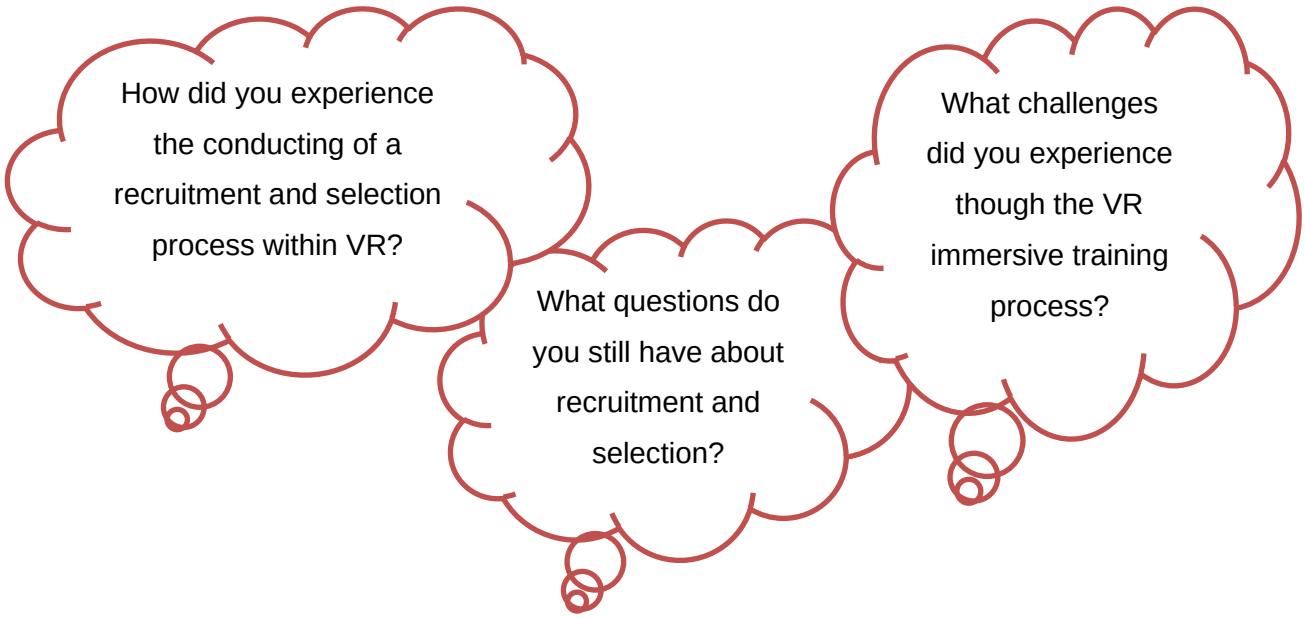
Within the immersive environment, students will receive CVs of several candidates, on which an initial screening must be done.

The student will choose 3 candidates to go through to the recruitment process. From there the students will have to choose the most appropriate questions from a list and pose it to the candidates. The programme has been set up to allow for the candidates to answer to the questions. After the recruitment process, students will be able to move around in the immersive office to allow the candidates to see and feel the office culture and picture themselves in the role without having to be physically present.

On completion of the recruitment process students will do the selection of the candidate that best fir the role, this will be done in line with legal requirements and within budget.

Throughout this process an assessor will observe the student, after which a judgement will be made on the student's competency regarding how the student performed the selection and recruitment of staff.

After the VR Session – discussion questions



MARKING RUBRIC

Assessors are to use the rubric tool to an assessment tool to indicate the level of competency.

	Needs Improvement (1)	Developing (2)	Sufficient (3)	Above Average (4)
Obtaining and completing information of the relevant position (SO1, AC1)				
Selecting/designing a selection procedure and ensuring it is appropriate for the specific position and in line with organisational and legal requirements (SO1, AC2)				
Confirming the selection procedure to be a validated procedure (SO1, AC3)				
Identifying, budgeting, preparing, and managing resources and methods needed for recruitment and ensuring the resources are available, within budget and fit for the purpose needed (SO1, AC4)				
Developing the selection criteria and control procedures in line with organisational and legal requirements and avoiding partiality or bias (SO1, AC5)				