The effectiveness of virtual reality in the clinical psychology context: A critical review

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SUMMARY

The effectiveness of virtual reality in the clinical psychology context: A critical review

Keywords: effectiveness, clinical psychology context, critical review, cybertherapy, virtual reality.

Technological advancements have given rise to countless new forms of innovative technologies, among which is virtual reality. Virtual reality refers to a computer-simulated environment in which the impression is created that one is totally immersed in that environment and experiencing it as a reality. As it has become increasingly popular, it is being used in multiple contexts, including that of clinical psychology, where it falls under the concept of cybertherapy, known as the use of technology in facilitating therapeutic outcomes. Over the years, virtual reality has been applied to numerous psychological disorders, where it has become known as "virtual reality exposure therapy" and has sparked further interest and an increase in research. However, in South Africa, cybertherapy remains limited to standard forms of technologies, rarely used in practice, creating both a gap and an opportunity for virtual reality exposure therapy within the South African clinical psychology context.

A critical literature review has been conducted to critically examine the existing literature on virtual reality in the clinical psychology context to determine the effectiveness thereof. The need for this research study emerged as a result of literature suggesting that future research should be conducted to determine the overall effectiveness of virtual reality within the clinical psychology context. The research study was also seen as an opportunity to contribute to the body of knowledge and create awareness in the scientific and academic community, from which clinicians too can benefit.

By synthesising and analysing the literature, the reader is provided, in a clear and understandable manner, with a collective of what has been researched. All the literature in this critical review were retrieved from peer-reviewed studies published in English, which,

scientifically, either evaluated or commented on the effectiveness of virtual reality exposure therapy interventions. After the successful appraisal of the identified literature, the final pool consisted of nine studies that were included in the thematic analysis. Two themes that emerged from the analysis were “effectiveness for psychological disorders” (effectiveness of virtual reality, equivalent effectiveness, symptom reduction, less effective, longevity of effects) and “exclusive characteristics of virtual reality exposure therapy influencing its effectiveness” (variability and control, adapting virtual reality exposure therapy for increased effectiveness). The findings of this research study can be used to inform researchers and clinicians of the current state of virtual reality exposure therapy. In addition, the research study can create awareness among South African researchers and clinicians in the field and inform decisions regarding adopting technology such as this within the context of clinical psychology.

PREFACE

This mini-dissertation adheres to all the rules and regulations for using the article model as stated by the A-rules of the North-West University. Moreover, the entirety of this mini-dissertation (including Section 2) adheres to the guidelines established by the American Psychological Association (APA, 6th edition). It is intended for Section 2 of this mini-dissertation to be submitted to the *Journal of Cybertherapy*, which is an accredited journal. The table of contents indicates a chronological order of page numbers, where Section 1 starts on page 1 and continues to the complete reference list at the end. Dr Hoffman is a skilful language and technical editor, who is registered with the South African Translators' Institute (SATI). She ensured that the quality of the language and layout, adheres to the North-West University's expectations.

The researcher obtained ethics approval from the North-West University Health Research Ethics Committee for conducting this critical review (see Addendum A). The whole mini-dissertation was submitted to Turnitin to determine similarities in relation to other works, which, in turn, provided the North-West University with a report stating that this was indeed within the norms of acceptable similarities (4%).

PERMISSION LETTER FROM SUPERVISOR

I, Prof Werner de Klerk, herewith grant permission for Francois Liebenberg to submit this mini-dissertation (final copy) for Degree purposes.



7/12/2020

Prof Werner de Klerk

Programme Administrator (Research Psychology)

Associate Professor / Research Psychologist

School of Psychosocial Health

North-West University

Potchefstroom

DECLARATION

I, Francois Liebenberg declare that this research study, *The effectiveness of virtual reality in the clinical psychology context: A critical review,* is original work done by myself. This research study forms part of my master's degree in Clinical Psychology done at the North-West University in Potchefstroom. All parties required to provide consent in conducting this research study have done so and all reference material has been acknowledged appropriately.



Student number: 26906074 13/10/2020

STRUCTURE OF RESEARCH MINI-DISSERTATION

Three sections are included in this mini-dissertation. Section 1 provides the reader with an in-depth description of the relevant concepts discussed in this research study in order to give the reader a better understanding of the context in which they are discussed (pages 2-25). Section 2 contains the article, which comprises the methodology used, the findings and a discussion of the findings, the limitations of the research study and the conclusion (pages 26-60). Section 3 is the final section that serves as a personal reflection, where the researcher describes his experiences in conducting the research study and refers to further applications of the research study (pages 61-68).

SECTION 1: INTRODUCTION

Introduction

It is the aim of this section of the mini-dissertation to present the reader with sufficient context about the components related to this critical literature review study. These components include discussing what virtual reality (VR) is, how it works and how it has developed into securing a place in the clinical psychology context known as cybertherapy. The problem statement, the aim of the research study, the research method, ethics and scientific rigour are other aspects related to this research study that are discussed in this section of the mini-dissertation.

Evolution of Virtual Reality

Despite VR seeming like a concept appropriate for today's technologically advanced generation, it may be surprising to learn that it has been envisioned in an essay by Ivan Sutherland, *The Ultimate Display*, more than half a century ago (Cummings & Bailenson, 2016). The idea was to create a technological display that replicated our reality, utilising as many senses as possible (Anthes, García-Hernández, Wiedemann, & Kranzlmüller, 2016). However, the term "virtual reality" was not introduced until 1989. A man named Jaron Lanier coined the term, which sparked interest in scientific communities to invest in research concerning VR (Anthes et al., 2016). Unfortunately, the build-up died down after a few years, as the public was not convinced about VR due to its technologically handicapped state in 1995, and it was rated as a failure (Anthes et al., 2016). Even though VR did not live up to its imagined standards at the time, its potential was not forgotten and was still pursued despite its technological shortcomings (Steuer, 1992).

As the technology progressed and more possibilities emerged for the field, defining VR has caused some challenges within scientific communities since its conception, as it could be defined from different perspectives (Steuer, 1992). While definitions of VR and the

descriptions of its components were not inaccurate, several difficulties arose when it was noticed that many of the definitions for VR seemed to have become centred on the hardware. This led authors such as Steuer (1992) to argue that VR needed to be represented as an experience rather than just a combination of technological devices. VR can therefore be viewed from both a technological and an experiential perspective (Steuer, 1992). These views will be discussed respectively.

From a technological and hardware perspective, VR has mainly been referred to as a technological system consisting of a computer, a head-mounted display, motion-tracking equipment and other sensory-enabling devices, such as headphones, utilising software to generate a virtual environment (Diemer, Lohkamp, Muhlberger, & Zwanzger, 2016; Opris et al., 2012; Steuer, 1992). A head-mounted display can be described as a device used to facilitate immersion into the computer-generated environment (Cummings & Bailenson, 2016). It enables the user to have spatial awareness of 3D stimuli replicating the real world (software), such as towns, stores and home environments, while using a motion sensor and a wide field or view to be able to detect the user's position within the virtual environment (Diemer et al., 2016; Muratore, Tuena, Pedroli, Cipresso, & Riva, 2019; Opris et al., 2012).

Transitioning to the experience the individual has while using the technology described above, essential constructs of the virtual experience are emphasised, namely immersion, presence and interactivity (Cummings & Bailenson, 2016; Mütterlein, 2018; Steuer, 1992). According to Cummings and Bailenson (2016), the terms "presence" and "immersion" are sometimes used interchangeably; however, in discussing VR, distinguishing between them becomes important. Presence can be defined as a subjective or psychological experience of feeling as if one is part of the environment, whereas immersion refers to the ability of technology to create a representable version of reality to facilitate presence (Cummings & Bailenson, 2016; Gibson, 1979; Steuer, 1992). Steuer (1992) has noted,

however, that an individual's awareness also contributes to the extent to which they will experience presence and immersion in virtual environments. Interactivity refers to the extent to which the user can influence or change the virtual environment (Steuer, 1992). According to Mütterlein (2018) and work by Costa, Carvalho, Ribeiro, and Nardi (2018), these constructs form the foundations of VR and contribute to a complete and successful experience thereof. Finally, after VR has been described from both a technological and an experiential perspective, a more inclusive definition can be derived: a computer-generated world aimed to create a sense of presence and immersion using audio-visual stimuli and other sensory cues to represent reality in a convincing manner (Costa et al., 2018; Cummings & Bailenson, 2016; Steuer, 1992).

As revolutionary technological advancements in the past two decades have given birth to the internet and a barrage of smart devices ranging from televisions and phones to wearable equipment, as well as high-end video games, it should be no surprise that a renewed curiosity was sparked in VR (Anthes et al., 2016; Brigham, 2017; Rizzo & Koenig, 2017). Thus, over the years, VR has developed from a vision of science fiction into an affordable consumer product due to rapid advancements in the information technology sectors and a dramatic increase in demand from consumers and various entertainment industries (Anthes et al., 2016).

In terms of the application of VR to the clinical context, Anthes et al. (2016) mention that in the early years of VR, it lost some momentum, mainly due to the discrepancy between what had been envisioned for the application of VR and what was technologically possible. The desired outcomes could not have been achieved, as computers were too slow, graphics were crude and VR had unfriendly user interfaces and uncomfortable hardware that ultimately impaired the user's ability to apply it effectively and without using extended amounts of effort (Anthes et al., 2016). Luckily, with continuously developing technology

offering faster computers, improved graphical fidelity and more user-friendly interfaces as well as the introduction of ever-evolving sensory processing technologies, VR finally became ready to represent more accurately what it was originally intended to do (Cummings & Bailenson, 2016; Steuer, 1992). Thus, the disparity between what had been envisioned and what was technologically possible became smaller and smaller, which enabled clinicians and researchers to resume and expand applications of VR in multiple disciplines (Anthes et al., 2016; Steuer, 1992). VR has increasingly been used for training and education purposes in the medical field as well as neuroscience and neuropsychology, where different cognitive functions can be assessed and rehabilitated (Dunleavy, Dede, & Mitchell, 2009; Laver, George, Thomas, Deutsch, & Crotty, 2015; Merabet & Sánchez, 2009; Riva, 2009). VR eventually found its way into the clinical psychology context, introduced in the early 1990s, to simulate conditions resembling exposure therapy for specific phobias and cognitive therapy (Brown et al., 1998; Botella, 2004; Cromby et al., 1996; Hoffman, 2004; Lamson, 1994; Pugnetti et al., 1995; Rizzo, 1994; Rizzo & Koenig, 2017; Rothbaum et al., 1995; Spagnolli, Bracken, & Orso, 2014; Vally, 2006). Clinicians showing interest in VR believed that the technology offered new, innovative approaches to achieve outcomes not supported by typical traditional methods (Anthes et al., 2016; Rizzo & Koenig, 2017). Thus, the use of VR for therapeutic purposes became part of the field known as cybertherapy (Manhal-Baugus, 2001; Spagnolli et al., 2014; Vally, 2006).

Cybertherapy

Cybertherapy can be defined as an environment where psychotherapy is being facilitated or supported by using various types of technologies, such as email, videoconferencing, online chat platforms and VR, to induce a specific psychological response or facilitate rehabilitation, provided by a licenced mental health professional (Manhal-Baugus, 2001; Spagnolli, Bracken, & Orso, 2014; Vally, 2006). Typically, cybertherapy has

some advantages but is also accompanied by some unique challenges. Firstly, by utilising technology, more widespread psychological services can be delivered to individuals who have limited mobility due to medical conditions or who live in remote regions (Botella, Garcia-Palacios, Ban˜os, & Quero, 2009; Fogg 2002). On the other hand, concerns regarding patient confidentiality, issues regarding the privacy of the therapist and the view that the experience may be too impersonal and cold have arisen (Castelnuovo, Gaggioli, & Riva, 2001; Evans, 2014).

Despite the obvious concerns of therapists, many therapists recently had to transition rapidly from traditional face-to-face therapy sessions to some form of virtual platform (irrespective of their attitude towards it) due to the global health crisis – the COVID-19 pandemic (Békés & Aafjes-van Doorn, 2020). Through the availability of technology, this not only enabled healthcare workers to provide services during the crisis but also allowed them to receive psychological support (Liu et al., 2020). This rapid adaptation has potentially changed therapists' attitudes towards cybertherapy and might open new possibilities for the field (Békés & Aafjes-van Doorn, 2020).

Even though various types of mediums fall under the category of cybertherapy, there are significant characteristics that distinguish the ways in which these mediums are applied within the context of psychology (Spagnolli et al., 2014). In cases such as the internet, email and other mediums, they are only used to provide a setting for interaction to take place, whereas other, more advanced and complex systems (e.g. VR) want to achieve a psychological goal with its application and clinical treatment (Spagnolli et al., 2014).

When applied to the clinical psychology context, VR can be described as providing the patient with an experience representing the real world by manipulating and controlling the environment in order for an emotional state to be simulated and, thus, treated (Costa et al., 2018; Spagnolli et al., 2014). Furthermore, VR environments can be used to facilitate

relaxation, induce a positive emotional state and reduce overall stress (Repetto et al., 2013). Over the years, the presence of VR in the clinical psychology context has evolved tremendously, especially when referring to exposure therapy (Botella, Fernández-Álvarez, Guillén, García-Palacios, & Baños, 2017). Thus, "virtual reality exposure therapy/treatment" (VRET) has become a popular term (Miloff et al., 2019; Powers & Emmelkamp, 2008; Repetto et al., 2011). Others have referred to it as "virtual reality exposure" (VRE) (Reger et al., 2016) and even "clinical VR" (Rizzo & Koenig, 2017). Countless studies have applied VR interventions to various psychological conditions in order to enhance the field, but psychological conditions that are the most prevalent include anxiety disorders such as specific phobias (Bordnick et al., 2013; Morina et al., 2015; Opris et al., 2012; Parsons & Rizzo, 2008; Powers & Emmelkamp, 2008), post-traumatic stress disorder (PTSD) (Bordnick et al., 2013; Wiederhold et al., 2002), depression (Falconer et al., 2016) and even eating disorders with reference to body image disturbances (Riva, 2011).

According to Rizzo and Koenig (2017), an abundance of research has been conducted on VRET over the years, and the field is still growing. This investment has afforded the benefits and advantages VR offers in comparison to more traditional forms of treatment (Repetto et al., 2011). One of these advantages is the high degree of control VR allows over the generated environment (Botella et al., 2017; Repetto et al., 2013). For example, the therapist can decide exactly when to activate or deactivate the stimulus and determine to what intensity it is experienced by the patient (Repetto et al., 2013). Moreover, it also creates new exposure possibilities that would otherwise be dangerous, too costly or impossible (e.g. not having to expose a driving-phobic patient to public roads or heights where the outcome of such exercises can be unpredictable) (Botella et al., 2017). VR can also be considered for patients who are non-responsive to traditional treatment methods of exposure therapy, such as in-vivo exposure therapy (iVET) and imagery exposure (Repetto et al., 2013). It was also

found that some patients were reluctant to be exposed to the feared object in real life and others were unable to recreate the feared object in their minds, thus not rendering exposure therapy as a viable option (Botella et al., 2017; Repetto et al., 2013).

Furthermore, most exposure exercises come with time constraints and additional costs, as well as risking the therapist-client relationship being exposed by leaving the office space or hospital setting (Repetto et al., 2013). Also, according to Repetto et al. (2013), various biological components have been involved when measuring the state of anxiety induced by VR in patients, such as heart rate and galvanic skin responses. Therefore, when used for relaxation, VR provides the opportunity to use biofeedback training, which is a technique that is used to teach people how to regulate their physiological responses based on readings from the equipment.

As mentioned before, cybertherapy has been utilised especially during the COVID-19 health crisis, where VR has been used for therapeutic purposes due to the psychological impact the pandemic has on individuals (Gao, Lee, McDonough, & Albers 2020; Liu et al., 2020; Riva et al., 2020). VR has been used in a research study to promote the physical and mental health of elderly people during the COVID-19 pandemic (Gao et al., 2020). Furthermore, VR has also been used to help reduce the burden of depression and anxiety caused by the COVID-19 pandemic and the guidelines on social distancing and quarantine provided by the World Health Organisation (Riva et al., 2020). While it is clear that VR, in general, and cybertherapy are no longer foreign or futuristic concepts in countries such as the United States of America and European countries, it would seem that widespread acceptance and application thereof have yet to be embraced by other parts of the world, such as South Africa (Evans, 2014; Rizzo & Koenig, 2017; Vally, 2006).

Cybertherapy in South Africa

One of the earliest introductions of VR to the South African context is where VR systems were utilised in providing training for safety protocols in the mining industry (Squelch, 2001). At the time, it was widely accepted that VR was an effective tool for providing training in numerous fields; it was thus proposed for use in the South African mining context and indicated significant potential (Squelch, 2001). In South Africa, the application of cybertherapy has been limited to the internet, email and other online platforms (Vally, 2006). A more recent research study, reviewing the use of cybertherapy by 92 South African psychologists, suggests that its use has increased but is still limited and mainly used for communication, training purposes (for the therapist) and accessing information (Evans, 2014). Furthermore, there are still strong reservations regarding the use of videoconferencing as a means of providing therapy, as some concerns regarding privacy and boundaries as well as issues in maintaining the therapeutic relationship prevail (Evans, 2014). This research study also found that 86% of the psychologists participating in the study had never used a more common form of videoconferencing, such as Skype, in their practices (Evans, 2014). In addition, in the same research study, VR was referred to only as another example of what constitutes cybertherapy, but it was not described further and its presence in South Africa was not mentioned (Evans, 2014). This can be suggestive that the use of VR for therapeutic purposes is uncommon and available research on VR in the South African clinical psychology context is still scarce, although it is not surprising given the history of VR (Evans, 2014).

Problem Statement

Even though the widespread implementation of VR has been proposed in other parts of the world, developing countries, such as South Africa, may need more time and resources (Rizzo & Koenig, 2017; Vally, 2006). Therefore, Vally (2006) and Evans (2014) suggest that

new developments in the field of cybertherapy should be considered and that the applicability of VR should be investigated within the South African context. Authors Rizzo and Koenig (2017) pose the question of whether VR is ready for mainstream implementation within the clinical psychology context. They concluded that it was, but noted that while it had taken the field of psychology 125 years to develop its theories and explanations of human behaviour to date, clinicians would also need more time and research to unravel the behaviour of people in virtual environments (Rizzo & Koenig, 2017). In conclusion, Rizzo and Koenig (2017) and Mclay et al. (2017) emphasise that more research is still required to investigate the effectiveness of its application, its long-term effects and its generalisability to real-life situations. Taking all the above into account, it can be beneficial to introduce clinicians in South Africa to the growing field of cybertherapy and the recent developments of VR and the effectiveness thereof, especially in an ever-evolving technological world, where its use is growing more prevalent (Evans, 2014).

For these reasons, the current research study will critically review the literature in order to determine whether VR used in the clinical psychology context is effective or not. Therefore, the research question to be answered in this critical review study is as follows: *Does the literature support the notion of virtual reality being effective in the clinical psychology context?*

Aim

The aim of this critical review study is threefold in nature. Firstly, the research study aims to critically examine the existing literature regarding VR in the clinical psychology context with the purpose of getting an overview of the effectiveness thereof. Secondly, the research study aims to provide current practitioners of VR in the clinical psychology context with a greater understanding of how VR has been applied and for what psychological conditions it is effective, while also potentially outlining any areas of improvement. Thirdly,

the critical review study aims to inform clinicians whether VR should be considered in the South African clinical psychology context.

Method of Investigation

Approach and Design

The primary researcher and reviewer (Francois Liebenberg) used a critical review approach (cf. De Klerk & Pretorius, 2019) as research design to conduct the research study. By using a critical review approach, the researcher was able to retrieve all the relevant scientific literature regarding VR in the clinical psychology context, analyse and synthesise the data appropriately and then critically and comprehensively discuss what the literature indicates regarding the effectiveness of VR in clinical psychology. To conduct the critical review, the primary researcher made use of the six steps put forth by Carnwell and Daly (2001), namely *defining the purpose of the review, defining the scope for the review, identifying the sources of relevant information, reviewing the literature, writing the review* and *applying the literature to the proposed research study.*

Defining the purpose of the review. The purpose of this critical review was to critically examine existing scientific literature on VR in the clinical psychology context for the sake of getting an overview of the effectiveness thereof. These findings may prove useful to clinicians worldwide as well as those in the clinical context of South Africa where VR can be considered to be implemented as an effective form of treatment.

Defining the scope of the review. The scope of this critical review included existing literature published in accredited journals regarding the use of VR in the clinical psychology context and where the effectiveness thereof was either the focus of the study or was discussed. According to Pautasso (2013), the optimal timeframe of published literature to use for a critical review is 10 years in order to review more relevant publications. Furthermore, when it comes to VR therapy, Riva (2009) states that 10 years ago, VR was still mainly being

investigated and being applied in laboratories. However, Rizzo and Koenig (2017) indicate that since 2008, VR therapy has been applied to the clinical context in a significant way due to technological requirements being met. Therefore, in order for literary studies to be included in this critical review study, they should have been published between the timeframe of 2008 and 2019. The inclusion and exclusion criteria are discussed in more detail below.

Literature where VR has been used as therapy in a clinical psychology context or where its effectiveness was discussed with reference to the clinical psychology context was included. Literature that was excluded consisted of studies that applied VR to contexts other than the clinical psychology context or where the participants were not diagnosed with a psychological disorder or where VR had been used as an assisted form of therapy in conjunction with an existing therapeutic method. In order for the study to be included, an additional specific condition was set, namely that VR should have been applied to an individual who had been diagnosed with a psychological disorder. Lastly, in terms of the type of study included in this critical review, English full-text, peer-reviewed, quantitative, qualitative or mixed-method review studies published in journals as well as PhD theses and master's dissertations or mini-dissertations all formed part of the literature. Non-peer-reviewed studies and studies published in languages other than English were excluded from this critical review study.

Identifying and selecting sources. The primary researcher conducted a computerised search using keywords that were most suitable in answering the research question (cf. Carnwell & Daly, 2001). In consultation with Nestus Venter (North-West University librarian [specialist]), the primary researcher used the keywords of this research study on the website of the North-West University library to identify the relevant sources of information in the following databases: Academic Search Premier, ScienceDirect, PsycINFO, Business Source Premier, MEDLINE, CINAHL with Full Text, Applied Science & Technology Source,

Health Source – Nursing/Academic Edition, SPORTDiscus with Full Text, Directory of Open Access Journals, Cochrane Database of Systematic Reviews Library, Information Science & Technology Abstracts, PsycARTICLES, OAIster, SciELO and Springer Nature eBooks. Having identified the appropriate sources and the inclusion and exclusion criteria, the search for literature commenced and resulted in 136 articles.

Reviewing the literature. It has been noted that critical review studies lack formal guidelines on how to review publications in a structured manner. An analytical structure resembling SALSA (**s**earch, **a**ppraisa**l**, **s**ynthesis and **a**nalysis) was used as there are no formal guidelines for quality appraisals in critical reviews in terms of search methods, synthesis and analysis (Grant & Booth, 2009; Puks, 2016).

From the 136 studies identified in the initial search, the primary researcher read through the titles and abstracts of each, while applying the inclusion and exclusion criteria to determine the relevance of each study in answering the research question. As a result, 30 studies met the inclusion criteria when looking only at the title and abstract and were deemed appropriate to go to the next stage of appraisal. In the next stage, the primary researcher read through the whole text of all 30 articles, keeping in mind the inclusion and exclusion criteria. From those 30 articles, it was found that 21 studies were to be excluded from the critical review study, resulting in the total number of studies included in this critical review being nine. Once the literature had been appraised, the researcher included those nine studies in the final data pool to be analysed and synthesised.

Thereafter, the primary researcher commenced with the fourth step in conducting the critical review, that is, reviewing the literature by reading through the included studies. The primary researcher read through the content of all nine studies included to get a better understanding of why and how those studies had been conducted. This led him to the process of synthesis and analysis, which comprised transferring the data to a data extraction table and

then analysing the nine included studies by means of thematic analysis. The sections of each study that were included in the data extraction table are as follows: authors and title, methods, sample, findings or results and conclusions, recommendations and limitations (see data extraction table in Section 2 of this mini-dissertation).

The primary researcher then followed the six steps put forth by Clarke and Braun (2013) and other works to conduct thematic analysis, where the extracted data were synthesised and analysed. This was done by retrieving relevant data from the literature, structuring the data in a simple and understandable way, forming codes and themes and then drawing conclusions (Clarke & Braun, 2013). Braun and Clarke (2006) introduced six steps on how to conduct thematic analysis. First, the primary researcher familiarised himself with the data by thoroughly reading through the literature, looking specifically at the method, sample, findings and conclusions of each study, as these aspects were the most useful in answering the research question. Second, the primary researcher identified possible codes by compiling a list of key areas that were of importance and related to the research question. Then the primary researcher identified a pattern in the codes that aided in answering the research question and grouped together the codes that identified the themes. The next step involved reviewing the themes identified by the primary researcher by comparing them to the text or data that were being analysed in order to be thorough in the identification process. Furthermore, in order to determine the most appropriate themes, the primary researcher consulted the work of Vaismoradi, Jones, Turunen, and Snelgrove (2016). This additional method provided the primary researcher with more insight into how themes should be properly identified when conducting an analysis. The fifth step involved defining the identified themes. Lastly, the themes extracted from the text or data were put forth in such a way that the research question could be answered and that the reader could clearly recognise

that the themes were representative of the text or data collected, thereby finalising the analysis process (Braun & Clarke, 2006).

Writing the review, and applying the literature to the research study. The aspects that aided the primary researcher most in answering the research question were presented in a clear, logical and organised manner. This was made possible by utilising a visual method such as a table. Even though it was mentioned that the aspects from each study that were investigated were indeed the method, sample, findings and conclusion, the primary researcher was also interested in what clinical condition participants had been treated for, what type of software was being used with the VR system during the intervention or therapy, and whether or not it was an effective intervention. These factors guided the primary researcher in writing the review, which ensured that the data extracted were conveyed in an understandable manner that answered the research question. After the analysis, the meaning of the findings was discussed, including the future of VR in the clinical psychology context.

Ethics

In this research study, ethical issues were minimal, since the research study aimed to review and put forth the effectiveness of VR therapy as indicated by existing literature and not to compare, promote or devalue any existing therapeutic methods with or over VR. However, possible ethical risks that were considered included that if the effectiveness of VR therapy were not supported, the use thereof could have been reduced, which could have influenced the number of sales of VR equipment for therapeutic purposes.

Ethical approval was obtained from the Health Research Ethics Committee of the North-West University (NWU-00469-19-A1). Throughout the research process, the ethical responsibility in the critical review involved following the process of rigour (see the section on scientific rigour). Furthermore, ethical guidelines were ensured by following procedures set out by Wager and Wiffen (2011). To increase the transparency of the research, the critical

review and the work within were done exclusively by the primary researcher or reviewer and his research supervisor and secondary researcher or reviewer (Professor Werner de Klerk), who has been acknowledged (cf. Wager & Wiffen, 2011).

The primary reviewer (writer) is registered as a master's student within the MA Clinical Psychology Programme at the North-West University. Moreover, the writer has undergone the needed ethical training as required by the North-West University. Professor Werner de Klerk is the second reviewer, who assisted in monitoring the critical review procedure of the primary reviewer and acted as the co-analyst of the data. Professor De Klerk has knowledge and experience in thematic analysis and the critical review process (see publication by De Klerk & Pretorius, 2019).

The primary reviewer ensured that plagiarism was avoided and, following the guidelines of the American Psychological Association, sixth edition, the works of other authors were referenced both in the text and in reference lists throughout the mini-dissertation. The primary reviewer used his own research funding for the critical review research study; thus, the primary reviewer was neutral and not influenced by competing interests (cf. Wager & Wiffen, 2011). The accuracy of the research process was ensured, and because the primary reviewer did not attempt to direct the findings in a particular direction, the extraction of data was truthful throughout the research process (cf. Wager & Wiffen, 2011).

Scientific Rigour

According to Gnyawali and Song (2016), scientific rigour is necessary for any research study to be precise, thorough and detailed to convey findings more accurately. In this research study, both the primary and the secondary reviewer were thorough and detailed in commencing the research study and adhered to all the specific processes initially outlined to ensure credibility, confirmability and transferability.

Credibility

The primary and the secondary reviewer confirm that the findings of this research study represent facts and information reflective of the literature reviewed. To ensure an accurate representation of the literature, there was thorough engagement with the literature to allow the researchers a better understanding of what each study offered in terms of the effectiveness of VR in their respective contexts. Furthermore, detailed notes were created to record selecting and analysing the studies as initially suggested for this research study, and a continued review of progress took place between the primary and the secondary reviewer.

Confirmability

For this research study, confirmability was ensured by following the steps put forth by Carnwell and Daly (2001) in conducting a critical review. Literature was searched for in the identified databases, search results were diligently worked through to determine relevant studies for review, and the texts of the literature were thoroughly examined and thematically analysed.

Dependability

The primary reviewer used dependable steps in conducting this review study (e.g. SALSA) and the six steps for conducting thematic analysis as suggested by Clarke and Braun (2013).

Transferability

In the themes identified during the analysis of the literature, the contexts were unique and studies had been conducted under different circumstances. Even though the inclusion and exclusion criteria were specific, they did allow diverse studies to be included. Thus, when it

came to the interpretation of the findings of these studies, it was imperative to preserve their intended meaning, as in the context of the original study.

Conclusion

For years, VR has been considered a highly expensive and complex exercise, and therefore, widespread implementation of VR was considered impossible (Rizzo & Koenig, 2017). However, not only has the development of technology transformed the possibilities of the application of VR and produced smaller, more user-friendly devices, but it has also become much more affordable (Rizzo & Koenig, 2017). Despite the existence of valid reservations and limitations when it comes to the use of VR and cybertherapy, VR has proved to yield potential by being applied to various psychological conditions over the years and is considered by authors Rizzo and Koenig (2017) to become more relevant in the future of research and practice in the clinical psychology context.

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SECTION 2: ARTICLE

The article (as part of this mini-dissertation) will be submitted to the *Journal of Cybertherapy and Rehabilitation* for possible publication. Thus, a summary of the author guidelines for this specific journal is provided first, followed by the article.

Instructions for Authors

Manuscript Style

The language of the journal is English. Submissions should follow American Psychological Association (APA) format.

Format

The original manuscript should be double-spaced and formatted for A4 paper (.27in. x 11.69 in.; 21cm. x 29.7cm.) with adequate and consistent margins on all pages.

The title page, abstract, references, appendixes, author note, content footnotes, tables, figure captions, and figures must be on separate pages (with only one table or figure per page). They should be ordered in sequence, with the text pages between the abstract and the references.

Is the author note typed on the title page, which is removed by the journal editor before review? Are all other pages free of author identification? Does each page have the paper title at the top?

All pages (except figure pages) should be numbered in sequence, starting with the title page.

Title Page and Abstract

The title should be 10 to 12 words. The byline reflects the institution or institutions where the work was conducted. The abstract must be between 100-150 words. Up to five keywords may be included after the abstract.

Headings

The levels of headings should accurately reflect the organization of the paper, and all headings of the same level must appear in the same format. An example can be found at: http://www.imieurope.eu/downloads/JCR_spring_2008.pdf

Abbreviations

Any unnecessary abbreviations should be eliminated and any necessary ones must be explained when they first appear. Abbreviations in tables and figures need to be explained in the table notes and figure captions or legend.

References

References must follow APA format. Please be sure references are cited both in text and in the reference list. Text citations and reference list entries should agree both in spelling and in date, and journal titles in the reference list must be spelled out fully. References (both in the parenthetical text citations and in the reference list) are to be ordered alphabetically by the authors' surnames. Inclusive page numbers for all articles or chapters in books must be provided in the reference list.

Notes and Footnotes

The departmental affiliation should be given for each author in the author note. The author note includes both the author's current affiliation if it is different from the byline

affiliation and a current address for correspondence. The author note must disclose special circumstances about the article (portions presented at a meeting, student paper as basis for the article, report of a longitudinal study, relationship that may be perceived as a conflict of interest). Footnotes should be avoided unless absolutely necessary. Are essential footnotes indicated by superscript figures in the text and collected on a separate sheet at the end of the manuscript? In the text, all footnotes are to be indicated and correctly located.

Tables and Figures

Every table column must have a heading. Are the elements in the figures large enough to remain legible after the figure has been reduced to no larger than 11 cm? Lettering in a figure should not vary by more than 4-point sizes of type. Each figure must be labeled with the correct figure number, caption, and short article title. Minimum file resolution (dots per inch) for printing:

• line art (graphs, drawings) = 1,200 dpi

• halftones (photos) = 300 dpi

• combo line/halftone = 600 dpi

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Article

Running Head: EFFECTIVENSS OF VRET

The effectiveness of virtual reality in the clinical psychology context: A critical review

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Abstract

In South Africa, there is a lack of research on virtual reality in the clinical psychology context, creating the opportunity to contribute to the body of knowledge. A critical literature review has been conducted to examine existing literature to determine whether virtual reality in the clinical psychology context is effective. A computerized search that included various databases for peer-reviewed literature on virtual reality was conducted. A method resembling SALSA (**s**earch, **a**ppraisa**l**, **s**ynthesis and **a**nalysis) was used in the search and analysis process. A sample of nine published works was included in this critical review. The data were thematically analyzed, producing the following themes: "effectiveness for psychological disorders" (symptom reduction, less effective) and "exclusive characteristics of virtual reality exposure therapy". The research study concluded that virtual reality exposure therapy was just as or equally effective as the traditional exposure methods available; however, it did have its own shortcomings.

Keywords: clinical psychology context, critical review, effectiveness, South Africa, virtual reality

Introduction

In an age where technology is advancing at an ever-increasing rate, it should be no surprise to learn that it has strengthened its grip on the world (Tham et al., 2018). From high-speed processing computers and revolutionary machinery to intelligent robots, technology has introduced new possibilities for humanity across multiple disciplines, including biology, neuroscience and even education (Li, 2005; Lu, Li, Chen, Kim, & Serikawa, 2018; Pantelidis, 2010; Park, 2009). Virtual reality (VR) makes up part of the technology that has revolutionized the technological industry and continues to demonstrate how the implementation of technology within a variety of disciplines can be successful (Hoffman, 2004; Rizzo & Koenig, 2017).

Background

According to Hoffman (2004), VR refers to a computer-simulated environment in which the impression is created that one is totally immersed in that environment and experiencing it as reality. The user's surroundings are entirely replaced with a computer-generated environment, and the connection the user has with the physical or the true reality is completely displaced (Brigham, 2017). Ellis (1994) and Hoffman (2004) indicate that VR is a technological tool that creates the illusion that an alternative or computer-generated environment is present, with which the user can then interact.

Written work by Rizzo and Koenig (2017) provides a more up-to-date explanation of how VR works as well as the basic equipment involved. They explain that users are fitted with a head-mounted display that presents 3D computer visuals and has advanced sensors that track body movement. Specialized interfacing devices are used to keep what the user is seeing and how they are moving in sync (Rizzo & Koenig, 2017). The head-mounted display provides the visual stimuli or virtual environment the user will experience visually, and the

user is equipped with headphones providing 3D auditory stimulation (Hoffman, 2004; Rizzo & Koenig, 2017). VR thus succeeds in utilizing the user's senses (sight and hearing) so as to create the illusion of being fully immersed in a computer-generated reality (Brigham, 2017; Ellis, 1994; Hoffman, 2004).

Interestingly, Brigham (2017) reports that VR tried to make an impression on the market more than 20 years ago but failed due to its causing motion sickness, or what is now referred to as "cybersickness" (Segal, Bhatia, & Drapeau, 2011). It is only recently that the issue of cybersickness has been resolved, sparking renewed curiosity in the field of VR (Brigham, 2017). VR gained popularity in 2014, following the success of the Oculus Rift VR device. Furthermore, VR has had an impact on the gaming industry, as Sony PlayStation officially launched its version of the VR gaming system (Brigham, 2017). Additionally, VR has extensively been used for entertainment purposes, as the developers of smartphones have been increasing their investment in VR technology to be compatible with mobile devices (Brigham, 2017). Moving beyond leisure and entertainment, the application of VR is increasing in the medical field, neuroscience and even the clinical psychology context (Botella et al., 2004; Hoffman, 2004; Laver, George, Thomas, Deutsch, & Crotty, 2015; Merabet & Sánchez, 2009).

VR within the Clinical Psychology Context

As the critical review study will be focusing on VR within the clinical psychology context as well as the effectiveness thereof, it is important to understand what is meant by these terms, and they will be discussed respectively. The clinical psychology context, for the sake of this research study, is defined as an environment where patients or clients who are diagnosed with a psychological disorder seek or receive psychological treatment from a registered mental health practitioner (Ramani & Leinster, 2008). VR has been used to assist

in therapy, and in some cases, it is even employed as the primary method of therapy. By delivering promising results in the clinical context, new areas of research interest have been identified. Thus, VR forms part of cybertherapy, where various types of technologies, such as online chat platforms, email, videoconferencing and VR, are used by a mental health professional to conduct psychotherapy in order to facilitate rehabilitation or encourage a psychological response (Manhal-Baugus, 2001; Spagnolli, Bracken & Orso, 2014; Vally, 2006).

The implementation of VR holds the potential to benefit the field of psychology and therapy (Hoffman, 2004). Until today, VR has been used as therapy for many psychological disorders worldwide, including anxiety disorders (Krijn, Emmelkamp, Olafsson, & Biemond, 2004), specific phobias, post-traumatic stress disorder (PTSD) (Wiederhold et al., 2002), nicotine addiction (Lee et al., 2004), body image disturbances (Riva, 2008), autism (Babu, Oza, & Lahiri, 2018; Parsons & Cobb, 2011; Powers & Emmelkamp, 2008; Strickland, 1997) and eating disorders (Riva, Manzoni, Villani, Gaggioli, & Molinari, 2008). Effectiveness can be defined as having a successful outcome after implementing an intervention (Plug, Louw, Gouws, & Meyer, 1997). By conceptualizing effectiveness within a clinical context, the definition of a psychological disorder will be used as a reference, as it provides important features that need to be present for it to be recognized as a psychological disorder (Barlow, Durand, Du Plessis, & Visser, 2017). A psychological disorder in this sense is a pattern of dysfunctional behavior that is accompanied by disorder-specific symptoms that induce significant distress within the individual (Barlow et al., 2017). By taking the above-mentioned definitions of effectiveness and a psychological disorder into account, for the purpose of the study, effectiveness within a clinical context is explained as when a patient's or client's behavior is not dysfunctional anymore or when the patient indicates fewer symptoms related to their disorder and experiences significantly less distress due to their

disorder (Barlow et al., 2017; Kiluk, Fitzmaurice, Strain, & Weiss, 2019; Nasrallah, Targum, Tandon, McCombs, & Ross, 2005).

Even though VR has been called effective in the use of multiple psychological disorders (Rizzo & Koenig, 2017), this article has been written with the hope of providing more information on the degree to which and in what way VR interventions are effective in the reviewed studies.

Problem Statement

As stated above, VR has been implemented worldwide across multiple disciplines, and more specifically, within the clinical psychology context. Furthermore, Hoffman (2004) suggests that future research should be conducted to determine the overall effectiveness of VR in a clinical psychology context (clinical VR). Rizzo and Koenig (2017) state that the future of clinical VR is now and that it is ready for its heyday due to the increase in popularity and advances in technology and success in the field of clinical psychology. Furthermore, Rizzo and Koenig (2017) mention that VR will become a very important tool for psychologists as well as researchers, as it will make a substantial difference, both in practice and in research. Finally, Rizzo and Koenig (2017) and Mclay et al. (2017) emphasize that more research is required to investigate the effectiveness of the application of VR, its long-term effects and its generalizability to real-life situations, despite there being an abundance of research. For these reasons, this research study has focused on critically reviewing the literature to determine whether clinical psychology VR is effective.

Therefore, the research question to be answered in this critical review study is as follows: *Does the literature support the notion of virtual reality being effective in the clinical psychology context?*

Method

Critical Review Procedure

For this critical review, the following databases were used to retrieve suitable literature: Academic Search Premier, ScienceDirect, PsycINFO, Business Source Premier, MEDLINE, CINAHL with Full Text, Applied Science & Technology Source, Health Source: Nursing/Academic Edition, SPORTDiscus with Full Text, Directory of Open Access Journals, Cochrane Database of Systematic Reviews Library, Information Science & Technology Abstracts, PsycARTICLES, OAIster, SciELO and Springer Nature eBooks. The search for literature was conducted independently by the primary reviewer (the first author), while the secondary reviewer (second author) monitored the review process and assisted with the extraction of the data.

An analytical structure resembling SALSA (**s**earch, **a**ppraisa**l**, **s**ynthesis and **a**nalysis) was used to examine the effectiveness of VR in the clinical psychology context, as there were no formal guidelines for quality appraisals in critical reviews in terms of search methods, synthesis and analysis (Grant & Booth, 2009). The following keywords were used in the search: 'virtual reality therapy', 'effectiveness', 'success', 'efficacy', 'benefit', 'advantage', 'value', 'usefulness', 'constructiveness', 'efficiency' and 'clinical context'. To include as many possible studies, Boolean characters such as AND and OR were used in the search. The services of a librarian from the North-West University was utilized to further support the process.

Studies were included if they were entries from 2008 to 2019, full-text journal studies, peer-reviewed articles, theses or dissertations, reviews or quantitative, qualitative or mixed-method studies that were written in English. Moreover, these studies should be on VR having been applied to a person who had a psychological disorder or VR having been used as

therapy in a clinical psychology context or where its effectiveness was discussed with reference to the clinical psychology context. A specific condition that determined whether studies were included was that VR could not have been used as an assisted form of therapy in conjunction with an existing therapeutic method.

The search yielded 136 studies, of which only nine were included. The search and appraisal process is depicted in Figure 1 and the data extracted from these studies are presented in Table 1.

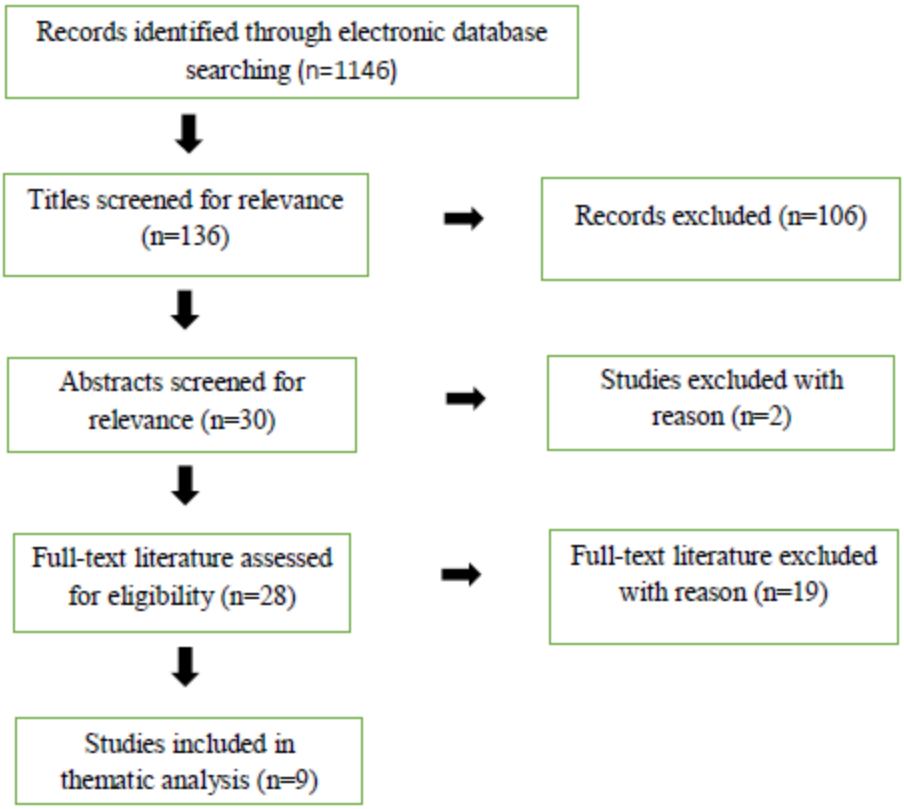


Figure 1: Search flow chart

Table 1: *Data Extraction Table*

Author(s) and Title	Method	Sample	Results / Findings	Other
Botella, Fernández-Álvarez, Guillén, García-Palacios, and Baños (2017) Recent progress in virtual reality exposure therapy for phobias: A systematic review	*Aim*: Review the evidence of VRET for phobias, describe the challenges it faces and its role in psychology in the future. *Design*: Systematic review.	Eleven studies were included from 2012 to 2017, of which were randomized control trials (RCTs), systematic and narrative reviews, meta-analysis, protocols and other sources of evidence.	VR is as effective as traditional methods for treating phobias and can improve treatment in the future. Promotes introducing alternative means of addressing metal illness, not replacing existing methods.	*Limitations*: Studies included had small sample sizes, and no protocol was used for this systematic review. Research was conducted in controlled research environments and not in clinical contexts. Furthermore, there were data missing from the articles that were used in the review. The quality of each study used was not evaluated individually, but a general quality appraisal was used. *Recommendations*: Carry out effectiveness and cost-effectiveness studies in hospitals and private practices.
Costa, Carvalho, Ribeiro, and Nardi (2018) Virtual reality exposure therapy for fear of driving: Analysis of clinical characteristics, physiological response, and sense of presence	*Aim*: Monitoring physiological responses, sense of presence and distress levels of women with driving phobia using virtual environment driving simulator. *Design*: One group, pretest-posttest design. *VR intervention*: Eight 50-minute VR sessions with driving and traffic scenarios increasing in difficulty. *Psychological and physiological measures were used*: Mini International Neuropsychiatric Interview (MINI), Structured Clinical Interview for DSM-IV Axis II (SCID-II), Beck Depression Inventory (BDI), Hamilton Anxiety Scale (HAS-A), State Trait Anxiety Inventory (STAI), Driving Cognitions Questionnaire (DCQ), Igroup Presence Questionnaire (IPQ), Subjective Units of Distress	Convenience sampling, distribution of posters at the outpatient Institute for Psychiatry at the University Federal of Rio de Janeiro, driving schools and social media. Eight women between the ages of 18 and 60, diagnosed with driving phobia.	*Mood scales:* No relevant change in already low baseline scores for BDI; noteworthy reduction in state-anxiety scores. Driving cognitions decreased but not significantly. *Quality of life:* General increase and statistical significance for vitality and health. *Sense of presence:* Immersion present. *SUDS and physiological data:* Decrease in heart rate and discomfort.	*Limitations*: Small sample size, presence of non-parametric statistical methods and a lack of respiratory and neurological measures. *Recommendations*: Improve future software apparatus in future studies. Investigate the effects of cognitive restructuring techniques during VR interventions.

Author(s) and Title	Method	Sample	Results / Findings	Other
	Scale (SUDS), Medical Outcome Survey SF-36 (MOS S- 36) and Heart Rate Monitoring (HRM).		VR useful to assist and facilitate in-vivo exposure therapy (iVET), but not enough for independent treatment.	
Kampmann et al. (2016) Exposure to virtual social interactions in the treatment of social anxiety disorder: A randomized controlled trial	*Aim*: To determine the effects of pure VR interventions on social anxiety. *Design*: RCT. *VR software:* Vizard v3.0 software. *VR intervention*: Ten 90-minute VR sessions, twice a week, designed to invoke anxiety in participants with social anxiety disorder. *Screening and diagnostic measures*: Social Interaction Anxiety Scale (SIAS). *Primary outcome measures*: Liebowitz Social Anxiety Self-Report Scale (LSAS-SR), Fear of Negative Evaluation Scale – Brief Form (FNE-B). *Secondary outcome measures*: Measured speech duration and performance as part of behavior assessment task to determine avoidance levels. Personality Disorder Belief Questionnaire was administered to assess for avoidant personality disorder-related beliefs. Subjective quality of life using Eurohis Quality of Life Scale 8 item index.	Online newspaper and other advertisements. Recruited 60 participants between the ages of 18 and 65 diagnosed with social anxiety disorder (SAD) and randomly assigned to three groups.	VRET offers significant therapeutic benefit for participants with SAD, with no significant difference compared to iVET.	*Limitations*: Non-identical social situations exposure exercises for groups. Less variety of social situations for VRET compared to iVET. *Recommendations*: Improve psychological and technological features of VR intervention.
McLay et al. (2012) Development and testing of virtual reality exposure therapy for	*Aim:* The development and testing of an alternative method of active-duty soldiers receiving VRET treatment.	Forty-two active-duty soldiers diagnosed with PTSD were included, of which 20 completed treatment.	Significant symptom reduction of PTSD, anxiety and depression.	*Limitations*: Not randomized, and a lack of a control group.

Author(s) and Title	Method	Sample	Results / Findings	Other
post-traumatic stress disorder in active duty service members who served in Iraq and Afghanistan	*Design:* Open-label, treatment-development study. *VR software:* Virtual Iraq software. *Primary outcome measure:* PTSD checklist military version (PCL-M). *Secondary outcome measure:* Patient Health Questionnaire (PHQ-9) and Beck Anxiety Inventory (BAI).		Promising treatment for VRET in active-duty soldiers.	*Recommendations:* Determine cost effectiveness of VR and which aspects of VR enhance results.
McLay et al. (2017) A randomized, head-to-head study of virtual reality exposure therapy for posttraumatic stress disorder	*Aim*: To assess the clinical effectiveness of VR and determine whether VR itself plays a significant role in treatment. *Design*: Randomized, head-to-head trial. *VR software:* Virtual Iraq and Virtual Afghanistan designed by the University of Southern California Institute for Creative Technology, and software from Virtual Reality Medical Center. *VR intervention*: Two 90-minute VR sessions for nine weeks, including introduction to exposure therapy, each participant describing their trauma experiences and eventually being repeatedly exposed to virtual versions of their experiences. *Measures*: Clinician-Administered PTSD Scale (CAPS) was administered three times; once prior to, one week after and three months after the VR intervention.	A total of 153 participants diagnosed with PTSD between the ages of 18 and 60 were included in this study and randomly assigned to two treatments – VRET and/or Cue Exposure Therapy (CET).	Treatments for both groups reduced CAPS scores, but no significant short-term differences were found between them. Effects of both interventions were still present during the three-month follow-up period, and again no noticeable difference between VRET and CET. Significant improvement of participants' conditions and a reduction in PTSD symptoms were noted. However, VR does not offer an advantage to treatment, as similar results were obtained in the CET group.	*Limitations*: Sample response rate lower than civilian response rate, possibly obscuring potential advantages of VR. Some participants could cross over between treatments and receive both treatments if one method failed. Non-traditional CET was used in this study, which included a computer. It was not studied independently. The same therapist administered both treatments, introducing provider and patient fatigue. *Recommendations*: More accurately determine suitability for interventions. Suggest performing larger studies that use various follow-up treatments in case of the failure of others.

Author(s) and Title	Method	Sample	Results / Findings	Other
Miloff (2019) Automated virtual reality exposure therapy for spider phobia vs. in-vivo one-session treatment: A randomized non-inferiority trial	*Aim*: To compare the efficacy of a stand-alone VR exposure therapy session with one session of traditional in-vivo treatment of spider phobia. *Design*: Parallel group randomized non-inferiority design. *VR software:* Virtual Reality Immersive Method for Spider (Phobia) Exposure Therapy (VIMSE). *VR intervention*: Participants in one group received an automated, three-hour-long single session of VRET, where the participants were exposed to a variety of virtual spiders. The other group also had a three-hour-long one-session treatment (OST) of iVET, where different-sized real spiders were used. *Primary outcome measures*: Behavioral Approach Test (BAT) was administered one-week post-treatment and again at the three- and 12-month follow-ups. *Secondary outcome measures:* The Spider Phobia Questionnaire (SPQ) and Fear of Spiders Questionnaire (FSQ) were administered as self-report measures before treatment. *Other measures*: The Generalized Anxiety Disorder Assessment (GAD-7), PHQ-9 and the Brunnsviken Brief Quality of Life Inventory (BBQ) were also administered before treatment. Also, the Negative Effects Questionnaire (NEQ-32) and the Igroup Presence Questionnaire (IPQ).	A total of 100 participants diagnosed with spider phobia (mean age 34 and 80% female) were randomly assigned to either a VRET or an OST group.	Strong reductions in SPQ and FSQ for both VRET and OST. No significant difference between VRET and OST in PHQ-9, GAD-7 and BBQ. Strong reductions in spider phobia symptoms and behavioral avoidance in both groups. VRET inferior to OST after a one-week follow-up. Single-session VRET can benefit spider-phobic patients. VR can be effective in reducing fear of spiders.	*Limitations*: Not all participants were able to follow up by completing the primary outcome measure. The therapists trained to conduct OST were not assessed before they administered treatment. Unable to determine how post-treatment self-exposure contributed to outcomes. VR lacked the engagement of a therapist. *Recommendations*: Recognize limitations of non-inferiority trials (biocreep).

Author(s) and Title	Method	Sample	Results / Findings	Other
Shiban, Pauli, and Mühlberger (2013) Effect of multiple context exposure on renewal in spider phobia	*Aim:* To determine the role of multiple-context exposure (MCE) in the renewal of fear using VR exposure. *VR software:* Cybersession was used and generated by Stream Source Engine (Valve Corporation, Bellevue, Washington, USA). *VR intervention:* Participants were divided into either a single-context exposure (SCE) group or a MCE group, where they were exposed to four VR sessions (5 minutes each) where a spider was presented in the same or in different contexts respectfully. *Psychological measures*: Structured Clinical Interview for DSM-IV (SCID), Symptoms Checklist (SCL) and Behavior Avoidance Test (BAT). *Biological measures*: Electrodermal activity recorded using a varioport system (Becker MEditec, Karlsruhe, Germany).	Recruited via advertisements. Forty participants between the ages of 18 and 58 meeting the criteria for spider phobia were equally and randomly divided into two groups.	Fear ratings decreased for both groups but more in the SCE group. However, fear returned in MCE groups to a lesser degree. Higher BAT scores for SCE than MCE. MCE reduced renewal of fear after exposure treatment. VR is an effective method for reducing phobic fear of spiders.	*Limitations*: No group representing iVET. Only manipulated the color of the MCE to represent a different context. *Recommendations*: Future studies should compare MCE and SCE to determine the effects thereof when measuring phobias. Furthermore, more complex contexts should be used in the MCE.
Reger et al. (2016) Randomized controlled trial of prolonged exposure using imaginal exposure vs. virtual reality exposure in active duty soldiers with deployment-related posttraumatic stress disorder (PTSD)	*Aim:* To evaluate the effectiveness of VRE and prolonged exposure (PE) for soldiers with PTSD. *Design:* RCT. *VR software:* Virtual Iraq or Virtual Afghanistan system. *VR intervention:* Participants were exposed to a virtual version of a traumatic memory, using a head-mounted display for 30 to 45 minutes,	A total of 162 participants were active-duty soldiers who met the criteria for PTSD. They were randomized to either the VRE group, the PE group or the waiting-list group.	The largest decrease in CAPS scores was from the two treatment groups. Lower CAPS scores for PE than VRE were noted after treatment. At follow-up, CAPS scores showed VRE inferior to PE. Post-treatment assessment revealed no statistically significant difference between VRE and PE. However, at	*Limitations*: Other VR treatment results may not be generalizable to protocols used in this study. Generalizability of results not guaranteed to soldiers exposed to other types of deployment-related trauma. Mainly male participants.

Author(s) and Title	Method	Sample	Results / Findings	Other
	controlled and customized by the therapist. Ten 90-minute sessions took place. *Measures*: Symptoms were assessed at the baseline, mid-treatment, post-treatment and the three- and six-month follow-ups. *Primary outcome measures:* Clinician-Administered PTSD Scale (CAPS). *Secondary measures:* PTSD Checklist, Civilian version, Beck Depression Inventory-II, BAI, Stigma Scale for Receiving Psychological Help (SSRPH) and Inventory of Attitudes towards Seeking Mental Health Services (IASMHS)		the three-month and six-month follow-up, the PE group yielded a bigger decrease in PTSD symptoms than VRE.	Time spent in the waiting-list group was less than the duration of treatment for the two other active groups. *Recommendations*: Studies should evaluate and compare VR protocols with standard care practices of PTSD. Future studies should apply and assess VRE and PE in female soldiers.
Repetto et al. (2013) Virtual reality and mobile phones in the treatment of generalized anxiety disorders: A phase-2 clinical trial	*Aim*: Investigating the efficacy of a universal VR system treating general anxiety disorder using biofeedback. *Design*: Phase 2 clinical trial; a between-subjects study. *VR software:* Environments created by ESIEA INTREPID using the 3DVIA 4.1 Virtools toolkit by Dassault Systèmes. *VR intervention*: Participants explored an island where scenes such as campfires, ocean waves and waterfalls were used as relaxing VR experiences, after being exposed to individual stressors. Participants used mobile phones as a means of continued use of the software at their home	A total of 25 individuals diagnosed with general anxiety disorder, 18 to 50 years of age, were randomly assigned to three groups: VR+Mobile (VRM) without biofeedback, VRM with biofeedback (VRMB) and a waiting-list control group.	Significant reduction noted in physiological (heart rate) and self-assessed anxiety in both groups. However, significant reduction in STAI and BAI scores was only found in the VRMB group, where the VRM group only indicated reduced BAI scores. Concludes that VR is effective in treating general anxiety disorder. Addition of mobile devices beneficial for more sustainable and readily available use.	*Limitations*: Small sample size. *Recommendations*: Include use of mobile phones and physiological data to improve effectiveness of VR intervention.

Author(s) and Title	Method	Sample	Results / Findings	Other
	environment to practice relaxation skills. Additionally, participants' heart rate influenced VR environments (e.g. low heart rate, slow movement of beach waves). *Psychological Measures*: BAI State-Trait Anxiety Inventory From Y-2 and Hamilton Anxiety Rating Scale. *Physiological measures:* Galvanic Skin Response and Heart Rate Sensor Module.			

Analysis and Synthesis

All the data that were determined to have the potential to contribute to answering the research question were included in the thematic analysis. By repetitively reading through and interpreting the data, the data were captured collectively, which provided the data set used to identify codes and themes.

Findings and Discussion

It should be noted that some studies refer to their VR intervention as "virtual reality exposure (VRE)" or "virtual reality exposure therapy (VRET)", which refer to the same concept. For the sake of consistency, the term "VRET" will be used in this research study to discuss the findings. Furthermore, this research study is only presenting what has been found in the literature and it is not the intention of the researcher to compare VRET to other therapeutic methods. However, the effectiveness of VRET has been described with reference to the active treatment group in the reviewed studies, which provides appropriate context to what extent VR has been found to be effective or not. Two broad themes emerged from the nine studies included in this critical review, namely "effectiveness for psychological disorders" and "exclusive characteristics of VRET influencing its effectiveness". Three studies have applied VR to PTSD (Mclay et al., 2012; Mclay et al., 2017; Reger et al., 2016), four to specific phobias (Botella et al., 2017; Costa et al., 2018; Miloff et al., 2019; Shiban et al., 2013), one to SAD (Kampmann et al., 2016) and one to generalized anxiety disorder (Repetto et al., 2011).

Theme 1: Effectiveness for Psychological Disorders

This theme focuses on deductions regarding the effectiveness of VRET as an intervention or treatment for different psychological disorders, the degree to which it has reduced symptoms of the respective groups of disorders it has been applied to, how effective VR has been in relation to traditional exposure methods and the longevity of its effects. These

points have thus formed the subthemes within the first main theme and will be discussed accordingly.

Effectiveness of VRET. Botella et al. (2017) examined the effectiveness of VRET for the treatment of specific phobias and found that VR was an effective treatment, concluding that it was a good choice for conducting exposure therapy. Furthermore, for groups of participants with social anxiety disorder, agoraphobia, small animal phobia, acrophobia and fear of flying, VRET was found to be significantly more effective than the treatments in the control groups (Botella et al., 2017). When it comes to treating spider phobia, Shiban et al. (2012) found that VR was effective. Furthermore, when applying VR to social anxiety disorder, Kampmann et al. (2016) found VRET to be effective when applied independently for social fears in multiple contexts and without an added cognitive component. Results also indicated an improvement from pre- to post-treatment in terms of anxiety, avoidance, speech duration, perceived stress and beliefs associated with avoidant personality disorder (Kampmann et al., 2016).

A behavioral assessment task was introduced (virtual speech activity), and a significant increase in how long the participants were able to talk in front of virtual people was measured at the end of the treatment, compared to before treatment (Kampmann et al., 2016). Moreover, Kampmann et al. (2016) mentioned that VRET was effective as a treatment on its own and that verbal interaction among individuals with SAD was successful. They also mentioned that VRET could create exposure situations that translated the effects learned or experienced into everyday-life situations (Kampmann et al., 2016). Likewise, Mclay et al. (2012) examined the use of VRET for active-duty military soldiers with PTSD, where it was found that VRET was effective for this specific population.

Equivalent effectiveness. Among the studies reviewed, all of them gave a strong indication that VRET was either just as effective as traditional exposure methods, or there was no significant difference between the effectiveness of VRET versus traditional exposure methods when applied to phobias and PTSD. VRET is regarded as an effective alternative form of treatment for phobias, according to Botella et al. (2017), who also suggest that VRET is not intended to be a new form of therapy but rather a method to revolutionize and enhance the field of clinical psychology and is considered to be a pioneering treatment for psychological disorders. Furthermore, the aim of VRET is to match that of traditional methods, while also bringing new advantages with it, possibly enhancing treatment outcomes (Botella et al., 2017). Moreover, a study conducted by Milof et al. (2019) found one session of VRET to be as effective as the other active control group also providing one iVET session for participants with a fear of spiders. It was found that there was no significant difference between the primary outcomes measured for VRET and the other treatment group, as well as no significant difference on other outcome measures such as the BBQ, the PHQ 9 and the GAD-7 (Miloff et al., 2019). Miloff et al. (2019) conclude by stating that one session of VRET is equivalent (with no significant difference) to one session of traditional iVET, which is the gold standard of exposure therapy.

In another study looking at PTSD, no statistically significant difference was found between the secondary outcome measures (PTSD Checklist, Civilian version, Beck Depression Inventory, BAI-II) for prolonged exposure and VRE (Reger et al., 2016). However, a study by Mclay et al. (2017) found that VRET provided no significant short-term advantages over the other treatment group (cue exposure therapy) and was able to achieve similar outcomes. They also found that VRET did not have an advantage over traditional evidence-based therapies appearing to yield similar results, especially for the military

population (Mclay et al., 2017). Thus, they concluded that there was no noticeable advantage that VRET provided to participants that prolonged exposure could not (Mclay et al., 2017).

As mentioned before, participants receiving VRET were able to endure a virtual speech for longer after treatment; however, their performance was no different from the waiting-list control group (Kampmann et al., 2016). After the three-month follow-up, there was no significant difference for both VRET and iVET compared to before and after the treatment had been concluded (Kampmann et al., 2016). Moreover, Kampmann et al. (2016) noticed that the scores on the LSAS-LR (Social Anxiety Scale Self-Report) had decreased for both treatments (VRET and iVET).

Symptom reduction. A study conducted by Costa et al. (2018) investigated VRET in participants with a fear of driving. They found that the participants' state anxiety scores were significantly reduced, and although they still reported fear of driving, they admitted to being more open to reducing their avoidance of feared situations (Costa, 2018). Other results indicated that VRET significantly reduced the heart rate and state anxiety of participants with general anxiety disorder after each session, leading to better clinical outcomes (Repetto et al., 2011). Moreover, it was found that the group receiving VRET with a mobile phone resulted in a significant reduction of their BAI and STAI-Y2 scores (Repetto et al., 2011). Another study conducted by Miloff et al. (2019) on participants with spider phobia found that a single VRET session significantly reduced self-reported fear of spiders and led to less avoidance. They concluded that a single-session VRET could benefit people with spider phobia, which was in line with similar findings for 20 years that VRET yielded positive treatment effects for specific phobias (Miloff et al., 2019). According to Shiban et al. (2012), ratings for fear of spiders also decreased as a result of VRET.

In a study by Mclay et al. (2012), the effectiveness of VRET was examined on active-duty military participants diagnosed with PTSD. After treatment, 15 participants no longer met the criteria for PTSD and about half of the patients showed improvement on the PTSD checklist military version (PCL-M) scores between the pre- and post-treatment (Mclay et al., 2012). It was found that participants' anxiety and depression scores too had been reduced after the VRET treatment (Mclay et al., 2012). Another study where VRET had been applied to participants with PTSD found significant improvement in the VRET group, where significant symptoms reduction was noted (Mclay et al., 2017). Moreover, VRE led to a reduction in CAPS scores, indicating a statistically significant decrease in PTSD and symptoms of depression, as well as a reliable change in slightly more than half of the participants (Reger et al., 2016).

Less effective. There were instances where the VRET that had been applied to psychological disorders was found to be less effective than the other active or comparison groups. However, some of these findings were exceptions to an overall ruling where VRET had indeed been found to be effective. Some of the studies blamed their small sample sizes, specific protocols followed or lack of variability in virtual contexts for their VRET intervention being less effective. Even though VRET proved effective for most of the anxiety disorders pointed out, in one study, it was deemed less effective for panic disorder (Botella et al., 2017).

Furthermore, it was found that even though VRET decreased dysfunctional thoughts when it came to fear of driving, it was not statistically significant (Costa, et al., 2018). In terms of clinical improvement, the participants did demonstrate change in all three groups of the study – VRET, iVET and the waiting list – with no significant differences (Kampmann et al., 2016). This means that the VRET intervention did not clinically improve the participants' SAD symptoms. VRET was less effective for SAD than the other active comparison group

(iVET) (Kampmann et al., 2016). Furthermore, when it came to the fear of being negatively evaluated, no significant difference was reported between VRET and the waiting-list control group, thus indicating the effects of the VRET interventions were equal to those of receiving no treatment (Kampmann et al., 2016). Therefore, VRET did not effectively reduce what was considered to be a key mechanism in social anxiety disorder (fear of negative evaluation) (Kampmann et al., 2016). When looking at the anxiety and depression scores, VRET did not seem to have an effect, as the difference between VRET and the waiting-list group was not significant enough (Kampmann et al., 2016). In the study of Reger et al. (2016), it was found that VRET was less effective than traditional exposure methods (e.g. prolonged exposure), and more symptoms of PTSD persisted in the participants who were part of the VRET group after treatment. Reger et al. (2016) concluded that VRET was not superior to prolonged exposure therapy. In a study by Mclay et al. (2012), reviewing the effectiveness of VR in active-duty soldiers diagnosed with PTSD, it was found that 25% of the participants saw little or no change. In one study by Miloff et al. (2019), it was found that the VRET intervention did not improve scores on the SPQ and FSQ as effectively as traditional methods (e.g. iVET) would have.

Longevity of effects. Even though it was mentioned that VRET reduced avoidant personality disorder-related beliefs, it was found that it lost its effectiveness at the three-month follow-up (Kampmann et al., 2016). Furthermore, at the three-month follow-up, participants started losing what they had gained during VRET; however, perceived stress when being exposed to social situations remained reduced (Kampmann et al., 2016). Additionally, there was no significant difference for participants meeting the criteria for spider phobia at the three- to 12-month follow-up, but yielded results only after the 12-month follow-up (Miloff et al., 2019). Some improvement was found when there was no significant increase in symptoms of fear (Miloff et al., 2019). In one study, the effects of VRET for

participants with PTSD lasted for at least three months after the treatment had concluded, where 76% of active-duty soldiers benefitted from the treatment at the three-month follow-up and no longer met the criteria for PTSD (Mclay et al., 2012). One month after the follow-up, PTSD symptoms remerged (as indicated by their CAPS scores) in those participants who had received VR treatment in relation to the other active treatment group (prolonged exposure); the same results were found after the 12- to 36-weeks follow-up (Reger et al., 2016). This led to VR ultimately being less effective at post-treatment (Reger et al., 2016). Moreover, it was found that being exposed to spiders in different contexts prevented participants' fear from returning for longer in relation to only being exposed to spiders in one context (Shiban et al., 2012).

Theme 2: Exclusive Characteristics of VRET Influencing its Effectiveness

The literature provided some characteristics of VRET that would distinguish it from traditional exposure treatments, accommodating for instances where traditional exposure therapy is not feasible or rejected by mental health users. Furthermore, the data also revealed some insight into what might be hindering the effectiveness of VRET in some instances and how it could be adapted to improve its effectiveness. Therefore, two subthemes were identified: "variability and control" and **"**adapting VRET for increased effectiveness". The characteristics of VR that contribute to its effectiveness include the ability to create exposure scenarios in different contexts and being able to include more variety and complexity within these exposure scenarios (Botella et al., 2017; Shiban et al., 2013).

Variability and control. VRET allows the therapist to manipulate the virtual scenario by deciding when and how to introduce the feared stimulus and what the context surrounding the stimulus will be like, which ultimately enhances the exposure experiences (Botella et al., 2017). Botella et al. (2017) further state that the sense of presence created by VRET is effective at inducing appropriate anxiety and fear, which is required when conducting

exposure therapy. The sense of presence is an important feature when it comes to exposure therapy, as being engaged with the virtual environment allows for increased attention during exposure and, therefore, better outcomes in treatment (Botella et al., 2017). Another important aspect of successful exposure therapy is for the feared stimulus to be perceived in heterogenous environments (Botella et al., 2017). With that said, not only is VRET able to recreate the feared stimulus (e.g. a spider), but it is also capable of producing said stimulus in more than one context (Botella et al., 2017). It was found that this increased the extent to which results of treatment using VRET could be generalized and applied to real-life situations, leading Botella et al. (2017) to conclude that VRET is a good option and indeed useful when conducting exposure therapy when it comes to phobias, due to the high degree of control the therapist has over the virtual environment. This has been corroborated by Shiban et al. (2012), who found that novel environments were able to produce results more representable to real-life situations and reduced scores on the BAT. Thus, neither the therapist nor the client needs to change their location when conducting exposure exercises while using VRET, whereas using traditional exposure methods would be time consuming and expensive if the context should change (Botella et al., 2017).

Another study of Kampmann et al. (2016), focusing on SAD, commented on how exposing participants to their feared stimulus or situation within multiple contexts increased treatment outcomes and its potential for results to be generalizable to real-world situations. Furthermore, VRET evades some general complications when using traditional exposure methods for SAD (e.g. need for human resources and short duration of social interactions), whereas with VRET, there are less treatment costs involved, therapists are enabled to control the content, duration and difficulty of social interactions, and privacy and confidentiality are ensured (Kampmann et al., 2016).

Adapting VRET for increased effectiveness. Botella et al. (2017) gave attention to the prospect of enhancing therapeutic outcomes, which, with the help of McGuire, Lewin, and Storch (2014), they defined as "greater reductions in symptom severity, greater response rates at post treatment and follow-up assessments, significant improvement in other treatment or outcomes obtained in less time" (p. 16). Given this definition, it appears that VRET does have potential to effectively reduce symptoms associated with PTSD, anxiety and depression, social anxiety disorder, agoraphobia, small animal phobia, fear of heights (acrophobia), fear of flying (aviophobia), fear of driving and even some elements of general anxiety disorder. However, when it comes to the longevity of some of these effects, VRET seems to fall short, as after the three-month follow-up or longer, effects fade away and some symptoms return.

Furthermore, a study by Costa et al. (2018) note that using VRET independently may not be sufficient to treat driving phobia, but it could be useful to manage and facilitate the patient's entry into iVET. Mclay et al. (2017) state that using VRET on its own may not lead to a dramatic improvement in symptoms of PTSD and could be more beneficial in populations other than active-duty military soldiers with PTSD because of the difference in the participants' context (e.g. no ongoing exposure to the trauma like still being an active soldier).

With participants with general anxiety disorder, the VRET intervention was assisted by the use of mobile phones to facilitate continued treatment remotely (Repetto et al., 2011). It was found that this inclusion created a form of sustainability of treatment, indicating that it could be beneficial to employ alternative technologies or methods alongside VRET (Repetto et al., 2011). In terms of using VRET for SAD, Kampmann et al. (2016), suggest that by expanding on the complexity of dialogue, tailoring the virtual environment to personally relevant situations, creating more unpredictable social interaction and including more social scenarios and more facial expressions in virtual characters, VRET could be more effective.

Lastly, according to Kampmann et al. (2016), when participants were asked which type of exposure method they preferred, they specified that VRET was preferred, possibly indicating that VRET might be a bridge for individuals to be gradually accustomed to the exposure experience, especially for those unwilling to participate in iVET.

An additional way of increasing therapeutic outcomes can be to use medications called "cognitive enhancers" that increase neural circuity, which assists in extinguishing fear during exposure treatment. Furthermore, due to the level of control VRET provides, Botella et al. (2017) suggested that VRET would be a good option to use when investigating exposure therapy and its key mechanisms and processes in research endeavors. Lastly, Botella et al. (2017) mention the prospect of using the gaming elements associated with VR and incorporating them into VRET interventions, making it more appealing for audiences, specifically children (Fleming et al., 2016). This opportunity creates potential for VRET to be used in the treatment of childhood disorders as well and may be researched in future.

Implications of Findings for the South African Context

There is no question that VRET has had great success in entering the field of clinical psychology over the years as it has made its presence known in recent years to garner significant amounts of attention and investment. As mentioned before, the field of cybertherapy has been growing in South Africa in recent years. However, to the knowledge of the primary researcher, VR has not been used in the clinical psychology context in South Africa yet, or at least, no official record thereof could be found. Given the findings of this research study, VRET possesses unique characteristics that could be taken advantage of by South African researchers and clinicians. Unfortunately, none of the VRET interventions included in the studies reviewed have been conducted in the South African context, which not only leaves a large gap within the field in South Africa but also creates immense potential for further research. An international study (Cárdenas et al., 2016) advocates for more research to

be done in culturally diverse contexts and economically disadvantaged countries, as the prevalence of psychological problems may be higher.

Some potential barriers South Africa may face for wanting to implement or increase the presence of VRET in its clinical context may include, firstly, addressing the attitude of clinicians and researchers towards technology in the field of clinical psychology. Other barriers may be related to high costs of hardware and software, and inadequate training programs for clinicians or the lack of such programs. An important factor for the future of VRET, emphasized by Botella et al. (2017), is that clinicians should accept these new technologies and their place in the field, which could lead to more investment in the training of clinicians and continued developmental support (e.g. becoming more economical and user-friendly). Despite being a socio-economically challenged country, there is still hope where the prospect of costs is concerned, as the cost of VRET hardware has become less of a barrier when it comes to adopting or implementing VRET in the clinical context (Rizzo & Koenig, 2017). Considering these technological additions to an existing field, Botella et al. (2017) allude to the necessary discussion that needs to occur with regard to who will benefit from the implementation thereof and in what context it will or can be used. These points seem to be part of a larger discussion happening, since a greater need has emerged for the next generation of VRET technologies to be developed and as other technologies, such as the internet and mobile devices, can be utilized to treat more people. With the findings of this research study, it is hoped that awareness is created among South African clinicians and other researchers as to why or why not more research should be invested into VRET and the field of cybertherapy in the future.

Limitations of the Research Study

A limitation of this research study was that some of the literature reviewed had limitations of their own, for example the protocol of VRET intervention (e.g. only one

session or limited numbers) and limited participants on which conclusions could be drawn. Not all studies available on the topic of VRET were necessarily included in this research study due to the strict inclusion and exclusion criteria of this critical review. Hence, the findings of the research study were limited to the collective information gathered on the studies that were included, meaning the findings of other studies were not taken into consideration or included. Therefore, psychological disorders other than anxiety disorders were largely neglected in the research study.

Conclusion

This review was conducted in an attempt to understand whether or not VRET was effective. Thus, based on the findings of this research study, the conclusion can be drawn that VRET certainly has some benefits and unique characteristics, allowing clinicians to approach exposure treatments in new and innovative ways. However, in order for its full potential to be utilized, it would be beneficial for the next generation of VRET to address the shortcomings thereof identified in the findings of this research study and improve on what distinguishes VRET from other treatment methods. Therefore, in answering the research question, this research study concludes that VR is effective enough, but not without shortcomings when used in a clinical psychology context. This research study supports the presence and future of VRET in the field of cybertherapy, as it will only grow stronger in the years to come.

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SECTION 3: CRITICAL REFLECTION

In Section 3 of this mini-dissertation, the researcher (Francois Liebenberg) has included a personal reflection where he describes his experiences regarding the research study.

Critical Reflection

The critical reflection provides me, the primary researcher, the opportunity to describe my experiences regarding the processes and procedures adhered to as part of conducting this critical review of the literature. The processes that will be discussed include the data collection, the data analysis and the discussion of the findings of the research study. As described by Grant and Booth (2009), the distinguishing feature of a critical review is presenting what the body of knowledge has to offer and then critically evaluate the quality thereof, allowing the possibility of new understandings to emerge from the literature. This critical literature review used the six steps described by Carnwell and Daly (2001) to guide me from the beginning to the end of this critical review study. These steps include defining the purpose of the review, defining the scope for the review, identifying the sources of relevant information for the review, reviewing the literature, writing the review and applying the literature to the research study.

The critical literature review evaluated what the literature was able to provide on virtual reality (VR) in the clinical psychology context and whether these studies were able to indicate whether VR was effective or not. By assembling, analysing and synthesising what has already been found in other studies, the reader has been provided with an updated pool of knowledge of the effectiveness of VR in the clinical psychology context, thus informing researchers and clinicians thereof and creating the possibility of more widespread acceptance and implementation. It furthermore highlights the areas of improvement for VR in the field of

cybertherapy as well as which aspects specifically require more research and investment. Ethical considerations were minimal in this research study, as no participants were involved and all the appropriate rigour and ethical guidelines were applied throughout this research study.

The purpose of this critical review was identifying, selecting, analysing, synthesising and interpreting the literature, while taking into consideration the ethical responsibility associated therewith. The process of rigour was followed in order to accurately report the results or findings and drawing conclusions (Gnyawali & Song, 2016). I ensured that the credibility, confirmability and transferability of the data were preserved and in order to achieve transparency, I personally conducted the critical review. I am registered as a master's student within the North-West University's MA Clinical Psychology Programme (2019-2020). Prior to the commencement of this critical review, I underwent the necessary ethical and academic training required by the North-West University. I was assisted by the second reviewer, Professor Werner de Klerk (my study leader), with the general procedures one should take into consideration when conducting a critical review, the appraisal process and input on the final themes, as Professor De Klerk had experience in the critical review process and thematic analysis (see article De Klerk & Pretorius, 2019).

It should be noted that the final report (article in Section 2) will be reserved for only one publisher, not multiple ones, and other works used in this research study were appropriately referenced, using the guidelines of the American Psychological Association, 6th edition. I stated clearly that this research study was not a study of comparison to put any treatment or intervention in either an inferior or superior position, nor had I received any form of compensation from involved parties for writing this review. I ensured that the meaning of the data was maintained relevant to the context in which they were found, while

also still being able to critically evaluate the data and make appropriate interpretations thereof.

Data Collection

Collecting the data for this critical literature review seemed like a daunting challenge at first, but due to the strict inclusion and exclusion criteria, the process started looking more manageable. The analytical framework resembling that of SALSA (**s**earch, **a**ppraisa**l**, **s**ynthesis and **a**nalysis) was an effective way of processing the data, as it assisted me to examine whether VR was effective in the clinical psychology context. When it came to identifying and selecting appropriate sources of data, specific keywords and other search filters were used. Identifying the keywords was largely driven by the three main components of the research study. However, due to the vast pool of literature concerned with VR and effectiveness and the clinical context, with the help of Nestus Venter (librarian at the North-West University Ferdinand Postma Library), synonyms and similar alternatives (e.g. "effectiveness" or "success" or "efficacy" or "benefit" or "advantage" or "value" or "usefulness" or "constructiveness" or "efficiency") had to be included as keywords to prevent losing potential studies from being identified. Furthermore, Mister Venter also informed me of more reliable ways to conduct a search by using Boolean search items (AND, NOT and OR). With this inclusive yet specified search strategy, more relevant and appropriate sources were identified, and the volume seemed much more manageable with an attractive 136 results to work through, making me much more hopeful about the study and excited for the appraisal process to begin. Even though I (the primary reviewer) was responsible for identifying the relevant sources in the literature search, the second reviewer (Professor De Klerk) monitored and facilitated in the process of appraisal and provided input on the data extracted.

Data Analysis and Interpretation

This process was tedious and took up the majority of time conducting this critical review. The first phase, working through all of the 136 potential sources to identify which ones were appropriate to include in the study was easily done by narrowing them down to 30 articles, as the titles and abstracts of most of the sources excluded them immediately. However, moving to the 30 sources identified and starting the second phase of the appraisal process, which included reading through all 30 articles meticulously, proved more challenging than I had initially foreseen. Due to the strict inclusion and exclusion criteria, many factors had to be taken into consideration and every study had to be thoroughly examined. In some cases, even the shortest of sentences would exclude that particular study when taken into consideration the aims of this critical review study. An important guide used when reading through the literature retrieved that helped me was keeping the research question of the research study in mind. Studies that proved more challenging than others on whether or not they should be included, were mostly other literature reviews.

While one of the parameters of this research study only included literature within the timeframe of 2008 to 2019, the literature review studies themselves did meet this criterion; however, the studies reviewed within those literature reviews did, at times, not meet this criterion. With the help of the second reviewer, the appropriate decision was made, as it was something I (the primary researcher) had not foreseen. After the appraisal process, I was left with nine studies in total that fully met the inclusion and exclusion criteria, and the synthesis and analysis processes could commence. These processes were initiated by extracting the information relevant to answering the research question from the full text of each article and transferring it to a data extraction table. The information extracted included the title of the work, the author(s) and publication date, the research design and methodology, software used in the VRET interventions, findings or results, concluding comments, limitations and

recommendations. It was of the utmost importance to ensure that the essence and context of each study were not lost in this process, which is why the key features of these studies were identified and included in the data extraction table. This process helped me get a summative sense of each study, providing me with valuable insight into what the literature on the subject had to offer, how it was determined and why it needed to be (cf. Carnwell & Daly, 2001).

For the analysis phase, I had to search and identify specific patterns and broader themes within the data while making sense of their greater meaning within each study. As suggested by step one of the thematic analysis (Clarke & Braun, 2013), I started by reading through the following sections of all nine articles included in the research study: the results or findings, discussion, conclusion, limitations and recommendations. As I read through each article as part of the official analysis process, it assisted in more ways than I had foreseen, as I was able to consider the data from different perspectives and became familiar with the data (cf. Carnwell & Daly, 2001; Clarke & Braun, 2013). The rest of the steps provided by Clarke and Braun (2013) included identifying possible codes and grouping them into broader categories called “themes”, reviewing these themes and, once finalised, defining and describing them. This was the most challenging part of the review due to the complex way some results or findings were presented and then keeping in mind that when translated, the meaning of the codes and themes should be respected, and therefore not lost. Thus, I had to read the text again and again, and evaluate and re-evaluate my codes and themes constantly, which was time consuming and overwhelming. It was also frustrating to identify a theme and then discover that it needed to be reworked, included or discarded, forcing me to go back to the literature. When this process repeated itself, it made me doubt ever completing this mini-dissertation on time.

Findings

After having completed the synthesis and analysis, the review needed to be written where the literature would be applied to the research study. It was important to convey these findings with respect to each article in a clear, logical, coherent and interesting manner (Puks, 2016). Firstly, the before-mentioned data table also included key information of each study reviewed, thus providing the reader with access to important aspects related to each study. A discussion was included, where interpretations of the findings and the significance thereof were discussed in general as well as with respect to the South African context. After the limitations of this research study had been mentioned, a final concluding paragraph summarised the findings of the research study. Based on the conclusions that could be drawn, I became excited about the future of VR, not only in the field in general but also within the South African clinical psychology context. The most prominent finding in this study refers to the fact that VR would be a useful addition and alternative to the exposure therapy repertoire rather than a competitor in the field.

Most studies reviewed found VR, or as the findings indicated, virtual reality exposure therapy (VRET), to be almost or just as effective at reducing symptoms and showing improvement as traditional forms of exposure treatment, based on the lack of statistically significant differences found. Even though VRET was found to be effective in numerous cases, in others, it was outperformed by traditional exposure methods and even, at times, equal to those of the waiting list. Areas in which VRET was found to less effective were when evaluating the longevity of its effects and by simply not producing statistically significant results in addressing specific aspects related to severe forms of anxiety disorders. To determine exactly why those seemingly contradictory findings presented themselves at times, it would be beneficial to evaluate the VR protocol used in each study (e.g. amount of exposure sessions, and variability and quality of exposure scenarios). In terms of the quality

and variability of the exposure scenarios, the responsibility thereof would largely rest on the software that had been developed. In terms of the software playing a vital role in the quality and variability of the exposure scenarios, a more detailed description and emphasis thereof could also assist in identifying shortcomings of the VRET intervention (e.g. a lack of facial expressions in a simulated social situation).

Based on these findings, it would appear that the concept of VRET and the basic principles of exposure therapy under which it operates are contributing to its effectiveness. However, in some studies, VRET is seen as a good supportive form of exposure therapy, and it would be beneficial to explore where and how either VRET could be used to facilitate other treatments or other treatments could be used in conjunction with VRET to maximise effectiveness. I have learnt a lot about how VRET works and what is currently possible while writing up these findings, and it has made me excited about the future of VRET.

Conclusion

I hope the findings of my research study can assist researchers and clinicians in the field to make an informed decision on whether to consider using or researching VR or VRET in the clinical psychology field, be it in South Africa or elsewhere. Now that these findings are suggestive of VRET being an effective means of treatment for anxiety disorders, it is my hope that other researchers and clinicians will be open to the new possibilities this technology has to offer and possibly implement and enhance this technology in the South African clinical psychology context. This would provide the opportunity for future studies to research VRET, taking into account some of the pitfalls identified by this research study when conducting research or trials on the matter.

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ADDENDUM A

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Health Sciences Ethics Office for Research, Training and Support

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Dr W de Klerk
Psychology
COMPRES

11 July 2019

Dear Dr de Klerk

APPROVAL OF YOUR APPLICATION BY THE NORTH-WEST UNIVERSITY HEALTH RESEARCH ETHICS COMMITTEE (NWU-HREC) OF THE FACULTY OF HEALTH SCIENCES

Ethics number: NWU-00469-19-S1

Kindly use the ethics reference number provided above in all future correspondence or documents submitted to the administrative assistant of the North-West University Health Research Ethics Committee (NWU-HREC) secretariat.

Study title: The effectiveness of virtual reality in the clinical psychology context: A critical review

Study leader: Dr W de Klerk

Student: F Liebenberg-26906074

Application type: Systematic review

Risk level: Minimal (monitoring report required annually)

Expiry date: 31 July 2020 (monitoring report is due at the end of July annually until completion)

You are kindly informed that after review by the NWU-HREC, Faculty of Health Sciences, North-West University, your ethics approval application has been successful and was determined to fulfil all requirements for approval. Your study is approved for a year and may commence from 11/07/2019. Continuation of the study is dependent on receipt of the annual (or as otherwise stipulated) monitoring report and the concomitant issuing of a letter of continuation. A monitoring report should be submitted two months prior to the reporting dates as indicated i.e. annually for minimal risk studies, six-monthly for medium risk studies and three-monthly for high risk studies, to ensure timely renewal of the study. A final report must be provided at completion of the study or the NWU-HREC, Faculty of Health Sciences must be notified if the study is temporarily suspended or terminated. The monitoring report template is obtainable from the Faculty of Health Sciences Ethics Office for Research, Training and Support at Ethics-HRECMonitoring@nwu.ac.za. Annually, a number of studies may be randomly selected for an internal audit.

The NWU-HREC, Faculty of Health Sciences requires immediate reporting of any aspects that warrants a change of ethical approval. Any amendments, extensions or other modifications to the proposal or other associated documentation must be submitted to the NWU-HREC, Faculty of Health Sciences prior to implementing these changes. These requests should be submitted to Ethics-HRECApply@nwu.ac.za with a cover letter with a specific subject title indicating, "Amendment request: NWU-XXXXX-XX-XX". The letter should include the title of the approved study, the names of the researchers involved, the nature of the amendment/s being made (indicating what changes have been made as well as where they have been made), which documents have been attached and any further explanation to clarify the amendment request being submitted. The amendments made should be indicated in yellow highlight in the amended documents. The *e-mail*, to which you attach the documents that you send, should have a *specific subject line* indicating that it is an amendment request e.g. "Amendment request: NWU-XXXXX-XX-XX". This e-mail should indicate the nature of the amendment. This submission will be handled via the expedited process.

Any adverse/unexpected/unforeseen events or incidents must be reported on either an adverse event report form or incident report form to Ethics-HRECIncident-SAE@nwu.ac.za. The *e-mail*, to which you attach the documents that you send, should have a specific subject line indicating that it is a notification of a serious adverse event or incident in a specific project e.g. "SAE/Incident notification: NWU-XXXXX-XX-XX". Please note that the NWU-HREC, Faculty of Health Sciences has the prerogative and authority to ask further questions, seek additional information, require further modification or monitor the conduct of your research or the informed consent process.

The NWU-HREC, Faculty of Health Sciences complies with the South African National Health Act 61 (2003), the Regulations on Research with Human Participants (2014), the Ethics in Health Research: Principles, Structures and Processes (2015), the Belmont Report and the Declaration of Helsinki (2013).

We wish you the best as you conduct your research. If you have any questions or need further assistance, please contact the Faculty of Health Sciences Ethics Office for Research, Training and Support at Ethics-HRECApply@nwu.ac.za.

Yours sincerely



Digitally signed by Wayne Towers
Date: 2019.07.11 22:10:59 +02'00'

Prof Wayne Towers
Chairperson: NWU-HREC



Digitally signed by Prof Minrie Greeff
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Prof Minrie Greeff
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Current details: (23239522) G:\My Drive\9. Research and Postgraduate Education\9.1.5.3 Letters Templates\9.1.5.4.1_Approval_letter_HREC.docm
30 April 2018

File reference: 9.1.5.4.1

ADDENDUM B

CERTIFICATE OF LANGUAGE EDITING

Dr. L. Hoffman, APEd (SATI), APRed (SAVI)

Kroonstad

BA, BA(Hons), MA, DLitt et Phil, Certificate (English Grammar for Editors)

Accredited Professional Text Editor – English and Afrikaans (South African Translators' Institute)

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DECLARATION

To whom it may concern

I hereby confirm that I have proofread and edited the following mini-dissertation, excluding the reference lists.

Edited by Dr L Hoffman

Title of mini-dissertation

The effectiveness of virtual reality in the clinical psychology context: A critical review

Student

Francois Liebenberg

Lariza Hoffman

Kroonstad

5 October 2020