THE EFFICIENCY OF VIRTUAL REALITY THERAPY FOR FEAR OF PUBLIC SPEAKING

By

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Abstract

In this paper, I will be focusing on fear of public speaking, more specifically the effectiveness of Virtual Reality Therapy for mitigating fear of public speaking. The capstone will focus on VR's effectiveness as a therapy for this specific phobia by testing the effectiveness of VR by conducting a meta-analysis. Meta-Analysis gives effect sizes which in turn will show the relationship between variables. The majority of the research listed for fear of public speaking or social anxiety usually treats Cognitive Behavioral therapy with some sort of exposure component. The exposure component that is being researched is Virtual Reality. Within my capstone, I will be discussing how past research has been able to advance by adapting how phobias are being treated as a whole. Some potential drawback with this type of exposure therapy is that individuals are trying to get over their fear of public speaking without actually having to speak in front of a live audience. I will also be researching the benefits of exposure therapy within virtual reality and actual reality. Both the benefits and detriments will be observed and I will offer some tips on how to improve this type of therapy to allow for better treatment for individuals with fear of public speaking.

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Table of Contents

Introduction

Virtual reality (VR) is an advanced electronic universe that gives you the ability to interact in whichever way you want (Zheng et al., 1998). VR is a tool that emerged in the early to mid-90s and has since continued to evolve as time passes. When someone thinks of VR, they immediately think of video games or creating a cyber world. However, this electronic universe has been a help to psychologists and researchers in addition to its gaming qualities. This tool has since been introduced into the practice of therapy, which is VRT. VRT (Virtual Reality Therapy) is most used to treat phobias by desensitizing the patient with the stimuli(North et al., 1997). This type of treatment would be beneficial for phobias that are targeted toward social anxiety or public speaking. Public speaking is specifically important because of its everyday uses in work, academics, and social interactions. The Fear of public speaking is a common phobia to have and when the level of fear begins to debilitate and interfere with your life, therapy is usually the common route. Cognitive-behavioral therapy is usually the typical route, however, VRT is also another option. The question we are investigating today is which is more effective in decreasing fear of public speaking. I will be reviewing empirical studies and give a broad overview of the history of VR and its connection as a treatment plan for fear of public speaking. The advantages and disadvantages will be examined, as well as the criterion of the studies being used. Performing a meta-analysis on the effectiveness of VRT will then give us a total effect size that will indicate its significance.

Literature Review

Glossophobia is the fear of public speaking, yet it also refers to public speaking anxiety. The fear of public speaking is often associated with social anxiety. In an article written by Levin et al. (1993) the connection between public speaking and social anxiety can be perceived as those who suffer from an abnormal fear of social interaction and have a tendency to perform badly in front of multiple individuals and/or in social settings.These types of phobias that incorporate social anxiety can be difficult in a numerical sense for studies (Slater et al., 2006).This can be due to a number of factors: such as the difficulty of measuring social anxiety. Any phobia that indicates an abnormal fear of social interaction and public speaking is both common and difficult to measure. In research done by North et al. (1998) states that social phobia, or abnormal fear of communication, can potentially be ranked as one of the top five common phobias. A study done by North shows that the participants found that the fear of public speaking disrupted their daily life and it began to extend to different parts of their life in a negative manner (North et al., 1998). The general signs of being caught in a social interaction in which someone is being watched by one or more individuals is discomfort and some signs are physiological. Some research done by Harris et al. (2002) states that some common symptoms are disorientation, stomach problems, increased muscle tension, or an elevated heart rate. These symptoms are common in most people when engaging in large social interactions. These specific phobias that have an impact on how individuals socialize when unattended can detrimentally affect the individuals. These effects come in terms of lost opportunities in different aspects of their lives such as communication. Public speaking is an important tool that should be taught due to the communication and the fundamental skills that it lends itself to. These foundational types of skills such as

communicating effectively, and being able to vocalize a message to a crowd of people should be important to everyone. These skills benefit your future by expanding how you are able to communicate something in a manner that sways a crowd. Some aspects of public speaking – such as eye contact and being able to direct the human gaze towards not just a crowd, but an individual – is a significant part of a socially centered world. Studies done by Senju & Johnson (2009) find that maintaining eye contact plays a large role in balancing another individual's attention and keeping it. It is appropriate to assume that eye contact would be necessary in treating fear of public speaking.

The main therapy for fear of public speaking is cognitive-behavioral therapy (CBT). The key component of this therapy is being subjected towards the thing you fear (Wallach et al., 2009). CBT is meant to give the patient exposure to what they fear and this in itself can be seen as the primary step in exposure therapy. In research that was done by Finn et al. (2009) the types of therapies that use exposure therapy as a way of allowing the patient to become less afraid of their phobia are based on the time that each exposure takes and it can also depend on if the exposure is in vitro or not. In vitro means imagined and in-vivo signifies in real life, in-vivo can be done through virtual reality. The second type of treatment for cognitive behavioral therapy is virtual exposure therapy and Lee et al. (2002) said that because of technological advancements in computers, (VR) Virtual Reality would be utilized in the treatment of many phobias, including public speaking. In many ways, Virtual Reality is looked at as a form of compromise when used in therapy. In research done by Anderson et al., (2003), it is asserted that VR is a middle ground for individuals that are being treated by the use of exposure therapy. This same study was using it for the treatment of social anxiety; however, its

idea is the same for public speaking. In the study, their initial results show VR as being an efficient replacement for exposure therapy in the treatment against social anxiety (Anderson et al., 2003). VR is seen as a replacement for the exposure component in cognitive behavioral therapy, and in later studies is shown to support Anderson's claim. In a survey done by Garcia-Palacios et al. (2007) the focus was on whether individuals with specific phobias, including social phobia, preferred VR exposure over in-person. The findings of the data given indicate that VR was preferred in this study and sample (Garcia-Palacios et al., 2007). These studies could indicate that VR is a more effective form of exposure therapy compared to in-vitro, however, it could also indicate that these individuals prefer the exposure therapy that has less social interaction.

Disadvantages/Drawbacks

However effective VR is, the treatment is still growing and it has drawbacks and disadvantages like any other treatment. In their study, Anderson et al. (2005) found that VR is a cost impediment and is not equipped to complement an individual's distinctive fears. The few disadvantages in using VR versus in-vivo have to do with the difficulty of VR being able to emulate human emotion to the extent that the patient is able to respond organically. In another study, Slater et al., (2006) stated that the most difficult phobias to calculate mathematically are those that deal with a social component. It is difficult for a computer to emulate In-vivo experiences and for individuals to actually experience the VR stressors as actual stressors. The idea that VR can imitate reality is correct. However, in research done by Slater et al. (1999) shows people in VR do not display and report the same emotions and signs of distress compared to in-vivo, then VR cannot be an effective substitute for in-vivo. VR has come a long way since

1999 and is still advancing to a different level of being able to interact with others. Using VR as a form of treatment is similar to in-vivo treatment, the goal stays the same, which helps decrease the anxiety and/or fear of the stimulus being treated for. This type of treatment has its own disadvantages and advantages like any other treatment. Research done by Senju & Johnson et al. (2009) suggests that keeping eye contact adapts perception and awareness. The effect of making eye contact in VR is simple, however maintaining that it is real can be difficult for VR.

Advantages

When looking at Virtual Reality Cognitive Behavioral therapy (VRCBT) can be a better option for those that are over-stimulated and extremely fearful of the stimuli and need a proxy of some sort. In research that was done by Safir et al. (2012), VRCBT holds precedence over in vitro for patients that are unable to visualize situations that are connected to their phobia and that also get overstimulated and will unintentionally flood themselves that causes them to get high levels of anxiety. A study done by Kilinger et al. (2005) showed that using virtual conditions helped patients with social phobia interact with these constructed avatars and helped reduce the social phobia scale of effects. The effectiveness of VR coincides with the technology, as shown in research done by Stupar-Rutenfrans et al., (2017), and its ability to catch a 360 environment and make it as real as possible. A complication with VR is that it runs the risk of not being realistic and this can skew the results of any study due to the lack of validity. A study done by Garcia-Palacios et al. (2007) shows that some participants feel as if not being able to experience the real thing will not aid in overcoming the fear. That is why getting the virtual environment to seem realistic and organic is important for VR to be effective. More studies are showing productive results such as a Takac et al. (2019) study that showed that the more VR exposure

sessions participants partake in, the higher the chances of them being more acclimated. Bouchard et al., (2017) study claim that the VR component with CBT can be a better alternative path than In-vivo alone and this can suggest these two components are the best option together, rather than apart. To further research the effectiveness of VR, Hinojo-Lucena et al. (2020) conducted an SLR, which is a systematic literature review, and found that in 13 experiments VR was observed as less invasive compared to in-vivo and was more effective. These studies highlight the effectiveness of VR and although there are some limitations that can be improved, VR seems the most effective compared to other control groups. In order to view the effectiveness of VR, the focal point of the research was on studies that offered VR as a treatment plan for fear of public speaking. The measure of effectiveness will be based on effect size which will then indicate the relationship between the groups. I will be using a statistical analysis called a meta-analysis to compute the effect size of various studies. Comparing the odds between the advantages and disadvantages of using VR as a treatment for fear of public speaking, I hypothesize that we will have a large effect size.

Methods

This section of the paper will cover the criterion that the article had to meet to be included in the meta-analysis. The criterion of the studies includes exclusion and inclusion points that were made prior to simplify the search for data. The section for literature will explain where the articles were found in regards to databases and keywords. A summary of the articles will be provided and the results of the meta-analysis will be provided as well as the forest graft.

Criterion

While going through various articles that were going to be included in the meta-analysis, I had a set of inclusion and exclusion criteria.

Fear of public speaking was a requirement when searching for studies to include in the analysis. Many studies used fear of social interaction and fear of public speaking as interchangeable terms, however fear of public speaking had to be stated in the study to be accepted.

The first inclusion criteria was that the study had to have virtual reality as a group that was being tested. Articles that had no group that implemented virtual reality as a study group were immediately rejected. The quality of virtual reality had no effect on whether it was rejected or accepted into the analysis, due to some of these studies being done in the late 90s. This means that virtual reality in the 90s cannot be compared to virtual reality in the present.

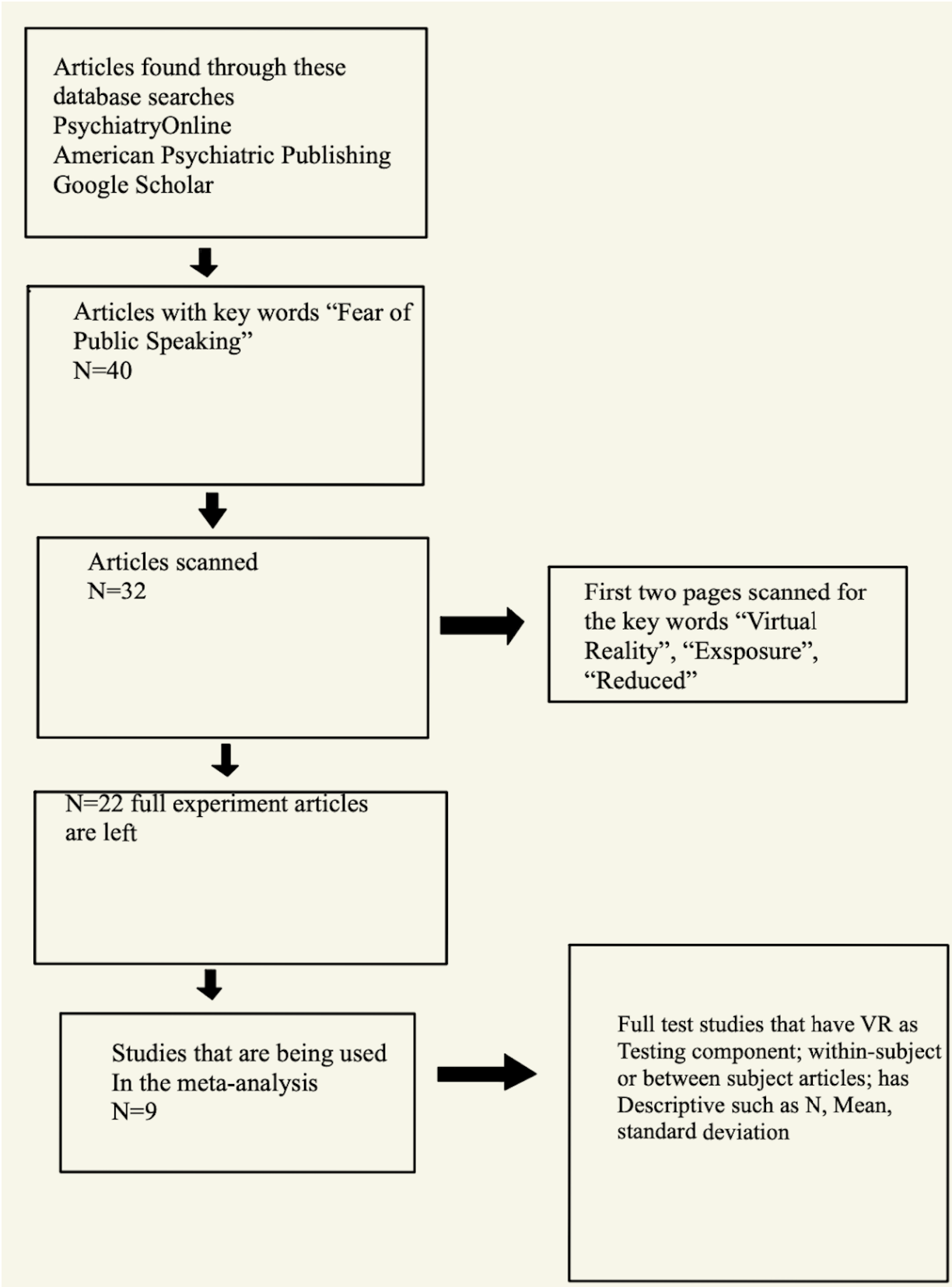
The second criterion was that it would be an actual study or pilot study, and not a literature review or another meta-analysis. These types of studies and systematic reviews were used for the literature review but not the analysis. These studies were instrumental in understanding how many studies were being conducted on fear of public speaking as a whole, and not many of them utilized VR as a form of therapy.

The third set of criteria was that the study found in the article had to have a between-subject or in-between-subject design type of data set. A between-subject design is when a study has multiple groups simultaneously being tested for something different. A within-subject design is one group being tested for the same condition.

The ages or gender of participants had no significance in whether the study was excluded or included. Studies were required to have at least one group in the study that would participate in a VR [virtual reality] group and be tested before and after.

Literature

A large sum of the articles listed was found in the UCR database PsychiatryOnline via American Psychiatric Publishing. When looking for studies, the words that were used in the search engine consisted of VR therapy, Cognitive Behavioral Therapy, and fear of public speaking. Google scholar was used to locate studies with keywords being fear of public speaking, VR, and Cognitive-behavioral therapy. The keyword public speaking was used synonymously with social anxiety, however, these studies were included in the literature review, but excluded from the data analysis. The studies that were included in the meta-analysis included


Articles found through these database searches
PsychiatryOnline
American Psychiatric Publishing
Google Scholar
Articles with key words "Fear of Public Speaking"
N=40
Articles scanned
N=32
First two pages scanned for the key words "Virtual Reality", "Exsposure", "Reduced"
N=22 full experiment articles are left
Studies that are being used In the meta-analysis
N=9
Full test studies that have VR as Testing component; within-subject or between subject articles; has Descriptive such as N, Mean, standard deviation

a variety of studies came from different times when technology was vastly different. The times of these studies range from 1998 to 2017. The literature on this topic yielded many articles, but few studies fit the criteria that were set for the meta-analysis.

	Study name	n1	Mean1	SD1	n2	Mean2	SD2	Moderator Variable	g	SEg	g_lower	g_upper	weight(%)-fixed model	weight(%)-random model
1	North et al., 1998	6	1.33	0.99	8	5.44	2.01	0	2.313882	0.668459	1.003703	3.624061	2.774735	6.879284
2	Wallach et al., 2009	28	9.60	13.29	28	8.78	9.80	0	-0.069249	0.263613	-0.585931	0.447433	17.841702	13.098562
3	Harris et al., 2002	8	37.75	23.29	6	57.67	28.24	0	0.732185	0.524182	-0.295213	1.759582	4.512382	8.780333
4	Klinger et al., 2005	18	47.60	20.40	18	43.50	24.60	0	-0.177402	0.326596	-0.817530	0.462726	11.623838	12.027398
5	Stupar-Rutenfrans et al., 2017	10	20.92	3.67	25	25.10	3.51	0	1.149092	0.390544	0.383626	1.914557	8.128902	10.925190
6	Anderson et al., 2005	10	27.20	5.49	10	36.30	9.97	0	1.082937	0.461275	0.178839	1.987036	5.827082	9.751161
7	Safir et al., 2012	28	19.39	8.31	30	25.30	13.73	0	0.509573	0.263516	-0.006919	1.026065	17.854837	13.100167
8	Kahlon et al., 2019	36	49.28	10.23	38	62.81	9.88	0	1.331976	0.254865	0.832441	1.831511	19.087555	13.242468
9	Bouchard et al., 2017	17	51.80	23.30	22	56.00	26.90	0	0.161942	0.316862	-0.459107	0.782991	12.348966	12.195437

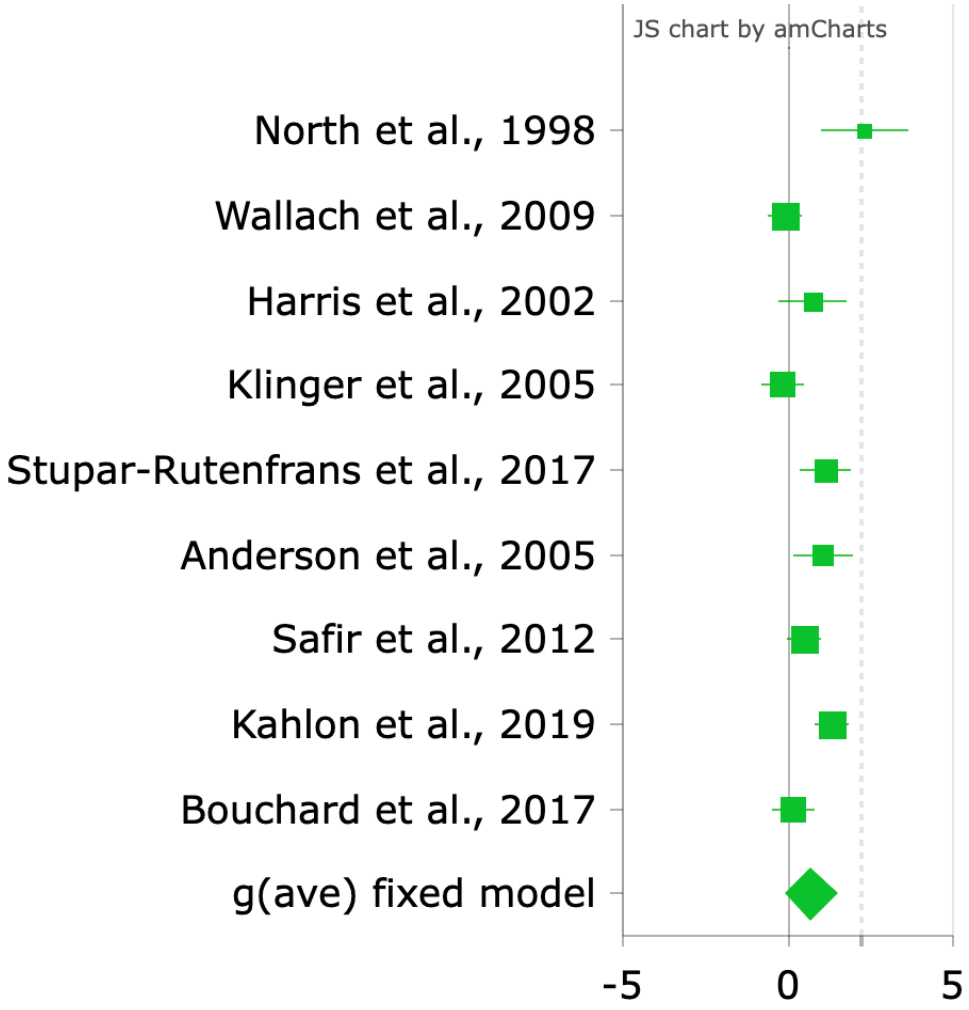
Data Extraction

A meta-analysis typically has 20 to 40 articles worth of studies in its data analysis. The meta-analysis flow chart is shown above. During the search for data, an estimate of 40 articles was used to make up the research on fear of public speaking. By skimming the articles they were narrowed down to 32 by including only the articles that had the keywords “Virtual Reality”, “exposure”, and “reduced” in the first two pages of the study or article. The articles are also scanned for mention of VR being used as exposure therapy and cognitive behavioral therapy as other options as well. Of the 32 articles that were left, the further exclusions that were made for the data analysis included having a viable number to extract in order for an effect size to be calculated. 22 articles were left and a total of 9 articles were included in the Meta-analysis, while the rest were included in the literature review and for insight into virtual reality. A summary of the studies is shown above.

A website called Social Science Statistic was used at the beginning to calculate the effect size of each article, the data needed to be imputed on the site consisted of the mean, standard deviation, and sample size. Later in the process, I opted for a website called Meta-mar that detailed the summary of statistics. This website also displays the random and fixed effect model

Results

Heterogeneity was measured through I^2 and was 75.1%, which boarded between high and moderate heterogeneity. The effect size total was 9 and the sample size was 161. The forest plot can be seen in the figure down below which displays all of the studies used in the



Meta-analysis. Using a random-effects approach, which assesses the likely effect size in the total population of potential studies on the topic, resulting in a Hedge's g = .69 [95% CI: .23, 1.15], p = .0033. We chose to go with the random effects approach versus the fixed-effect approach because the random effect approach deals with studies that vary in many different aspects: such as the level of intensity of an intervention or different sample pools (Borenstein et al., 2010). The Hedge's g is a measure of effect size and is calculated by the difference in means divided by the pool and weighted standard deviation. This overall effect size indicates a moderate to large effect of VR interventions to reduce fear of public speaking, compared to control conditions. The Tau^2=0.348, which equals 75.1 %. The fail- N safe calculation came out to $Z_c(\alpha = 0.05) = 1.645$. This means that in order for the effect size to be 0 there would need to be 65.18 articles in the meta-analysis.

Article	Measure
North et al., 1998	Anxiety/avoidance
Wallach et al., 2009	Liebowitz Social Anxiety scale
Harris et al., 2002	LSAS
Klinger et al., 2005	LSAS
Stupar-Rutenfrans et al., 2017	PRCA-24
Anderson et al., 2005	Personal Report of
Safir et al., 2012	(LSAS avoidance
Kahlon et al., 2019	Public Speaking axiety Scale
Bouchard et al., 2017	Liebowitz Social Anxiety Scale-Self Reported

Discussion

The goal of this statistical analysis was to investigate the efficiency of VR as a form of treatment for fear of public speaking. We looked at the total effect sizes through a meta-analysis

to view whether the use of VR substantially lowers the fear of public speaking. The measure that was recorded was the Liebowitz Social Anxiety Scale (LSAS) which was created by Fresco et al., (2001). If LSAS was not used then a different but similar measure was used in its place and a list of them can be seen in the figure above. Among LSAS we used likert scales that measured anxiety and a personal report of confidence. These measures were only used if LSAS was not a scale used in the study. The data supported our hypothesis which stated that the effect size was moderate and supported that VR when compared to other controls, does reduce fear of public speaking. Although the total effect size was moderate which showed a relationship between these two variables, the calculator used for the meta-analysis was for between-subject experiments. The effect sizes came from the within-person comparison which gave very similar results; however, the precision was not entirely precise. Due to this difference, the results could have potentially been different, however not by much.

The number of studies found on this type of research, specifically VR, was small considering the number of studies that show VR to be effective. However, the research was mostly on just fear of public speaking or social anxiety. VR is used in therapy but is slowly starting to be used for other uses such as educational and professional (Hinojo-Lucena et al., 2020). This analysis does support that VR is an effective tool for decreasing fear of public speaking and can further help other phobias. It does not answer the question: “Is it better than Cognitive Behavioral Therapy?” Studies like Klinger et al., (2005), ask this same question. When testing the measure LSAS, they did find that both CBT and VRT showed no significant differences, but they also stated that it would be in favor of VRT if the sample size was larger. It was also in that same study that CBT tested more effectively in the measure Social Context Inducing Anxiety (SCIA)

scale (Klinger et. al., 2005). It could be inferred that at least in this study by Klinger, the treatment option is more effective with different scales.

Implications

The implications of this meta-analysis, although it has a small testing pool, can be applied to larger implications – such as the benefits of this type of exposure therapy. In a systematic review, the many advantages that VRT could bring if integrated more commonly into treatment for phobias would be control, and the level of the stimulus would be easy to manipulate (Frietas et al., 2021). These benefits would be able to further help therapists have better control over treatment. Although in Frietas et al., (2021) some phobias do not have the same level of immersion compared to in-vivo exposure and this can lead to VR being a stepping stone in therapy. This can implicate how future therapy on phobias goes forward in regards to how therapy will be executed. On a smaller scale, the few studies that were in the analysis established that VRT is effective against the fear of public speaking; the next question would be whether it changes the way cognitive–behavioral therapy is practiced.

Further Research

Going forward in this direction, some potential changes and/or future research that could be made towards VRT is the size of the study samples. In the meta-analysis that was done above, we can see that due to the small sample size which could have potentially affected the accuracy of the results. A large sample pool would benefit the experiment and help with accuracy. Some different variables that could be added to VRT research would be moderators such as age, and whether VRT could be perceived differently at different ages where imagination is more malleable. Age could be a moderator and future research because what you see is affected for each age.

Challenges

Conducting this meta-analysis has had its challenges and still leaves room for more inquiries. One of the main challenges was the literature and the lack of studies on VR and public speaking. Overall, 3-4 websites were used to extract articles that fit the criterion and some of them were dated. Of the 9 studies used, about 3 of them were conducted in the late 90s to the early 2000s – which posed a bit of a challenge because the technology was vastly different compared to today. Other challenges consisted of the measure LSAS not being found in all of the studies and having to substitute similar measures. This caused 3 articles to be taken out of the study because we could not find any other measure to substitute. The literature on this topic of fear of public speaking and VR are not as popular as I had thought and was underwhelming considering that many studies supported the treatment as it did reduce anxiety and fear towards public speaking. The lack of studies did not allow for moderator questions because of how small the pool of articles there was. The time constraints of this capstone did not allow for a deeper analysis of the subject of VR and fear of public speaking. Overall, the experiments themselves used mostly questionnaires to measure what the participants were feeling at the time and this can make the data biased. There were not many studies that used physiological measures such as heartbeat or even eye responses which could have less bias.

Conclusion

We hypothesized in this statistical analysis that VRT was effective by comparing it to other controls such as CBT and what we found was a moderate to large effect size. Our hypothesis was confirmed by looking at the p-value. Overall the p-value was .0033 which showed that it was statistically significant and indicates that the VRT was effective in decreasing the anxiety that comes with public speaking in the phobia. The studies we found used similar measures, but the

common factor Liebowitz Social Anxiety Scale (LSAS) was used to find whether it decreased the measure. It is also confirmed in other studies that VRT is a commonly used treatment for exposure therapy, but it still needs to have more immersion so it can be at the same level as CBT. Future researchers that see VRT as the main component against phobias in therapy should further look into a variation of combined treatment options. VRT has its many benefits, however, CBT is still a necessary component for combating phobias and the therapy process. A future study could look into having VRT be the initial exposure to the phobia and then the subsequent step would be CBT. This could yield better and longer results.

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