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A preliminary study on the potential of Virtual Reality Therapy in reducing public speaking anxiety

Estudio preliminar sobre el potencial de la Terapia de Realidad Virtual para reducir la ansiedad al hablar en público

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Abstract: This study probes on the potentials of Virtual Reality Therapy (VRT) to overcome glossophobia in the context of online classes. To achieve the objective, this study employs experimental design in which students who are enrolled in an online public speaking course were grouped into two: Experimental and control group. The experimental group experienced three sessions of VRT throughout the semester whereas the control group did not. After the end of the course, the descriptive analysis findings suggest that the rate of change for the experimental group was -17% in comparison with the control group -4%. This indicates that the experimental group had decreased their public speaking anxiety four times more than the control group; hence suggesting that VRT has helped to reduce the anxiety in public speaking. All in all, this study foreshadows the great potentials of VRT in the education and communication field.

Keywords: Public Speaking Anxiety (PSA); Virtual Reality Therapy (VRT); online classes; technology in education.

Resumen: Este estudio investiga los potenciales de la Terapia de Realidad Virtual (VRT) para superar la glosofobia en el contexto de las clases en línea. Para lograr el objetivo, este estudio emplea un diseño experimental en el que los estudiantes que están inscritos en un curso de oratoria en línea se agruparon en dos: Grupo experimental y grupo de control. El grupo experimental experimentó tres sesiones de VRT a lo largo del semestre, mientras que el grupo de control no. Después del final del curso, los hallazgos del análisis descriptivo sugieren que la tasa de cambio para el grupo experimental fue de -17% en comparación con el grupo de control -4%. Esto indica que el grupo experimental había disminuido su ansiedad por hablar en público cuatro veces más que el grupo de control; lo que sugiere que VRT ha ayudado a reducir la ansiedad al hablar en público. Con todo, este estudio presagia el gran potencial de VRT en el campo de la educación y la comunicación.

Palabras clave: Ansiedad de hablar en público (PSA); Terapia de realidad virtual (VRT); clases en línea; tecnología en educación.

1. Introduction

As an effort to revamp students' employability to prepare them for the fierce competition of job seeking, public speaking has become one of the essential skills in 21st century education. This ex-

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plains why many tertiary institutions are introducing Public Speaking courses as part of their curriculum (Shamsuddin et al., 2021). This is also concurred by an online newspaper article published by New Straits Times (New Straits Times, 2020) which talks about the main priority of Malaysian Ministry of Education that is to align the curriculum with the requirements of the job market. A study by Rahmat et al. (2017) also found that employers are now looking for job seekers who do not only have good academic qualifications, but also new skills that will help them to adapt with the job such as critical thinking and effective communication skills. Sung et al. (2013) also listed public speaking as one of the essential skills that should be acquired by most graduates today. Therefore, it is undeniable that public speaking is becoming an important area in the field of applied linguistics. In many past literatures on language anxiety, students have always demonstrated higher anxiety in speaking tasks as compared to reading, writing and listening (Kim, 1998; Khamkhien, 2010; Yaikhong & Usaha, 2012; Raja, 2017). This is especially evident amongst non-native speakers (Yaikhong & Usaha, 2012; Raja, 2017). The following paragraphs will discuss on public speaking anxiety and some of the past literature to reduce public speaking anxiety.

1.1. Public Speaking Anxiety (PSA)

Pioneering studies on language apprehension have attempted to define this condition. One of the well-known definitions is from McCroskey (1982) who defines it as the state of uneasiness whereas another scholar, Brown (1994) defined public speaking anxiety as a state of discomfort related to a speech activity. Public speaking anxiety can be exhibited in many ways, such as trembling hands, stuttering, freezing up, avoiding eye contact with the audience and forgetting the prepared materials during presentation (Brundage & Hancock, 2015; Ortega, 2014). Much research has focused on students' apprehension in speaking tasks, but there is lack of literature that focuses on public speaking anxiety. Perhaps, one of the recent and most contemporary research on public speaking anxiety is the Public Speaking Class Anxiety (PSCAS). PSCAS is a research instrument developed by a group of researchers from Thailand called Yaikhong & Usaha (2012) that attempted to evaluate the anxiety of students who enrolled in a public speaking course. This instrument is used and adapted in this research as it fits the objective of this research which is to find out the level of speaking anxiety amongst students who are enrolled in a public speaking course. Even though public speaking anxiety is not an uncommon condition, but not many researchers and scholars managed to prescribe effective ways to reduce this condition. In one study by Westwick (2014), it is found that there are several practical ways to apply in classroom settings to overcome public speaking anxiety which include exposure therapy, cognitive modification, skills training and assessments. Exposure Therapy, disseminated through the use of virtual reality technology, has received considerable attention in treating anxiety disorders particularly in public speaking (Kampmann et al., 2016; Morina et al., 2015; Opriş et al., 2012). Therefore, present study employed a treatment called Virtual Reality Therapy (VRT) which was associated with exposure therapy as an effort to reduce public speaking anxiety. In the next subsection, a discussion on past studies on VRT will be explained.

1.2. Virtual Reality Therapy (VRT)

Virtual reality (VR) can be defined as "an advanced form of human-computer interface that allows the user to interact with and become immersed in a computer-generated environment in a naturalistic fashion" (Schultheis & Rizzo, 2001, p. 82). Virtual reality technology offers an illusion that induces the sense of "presence" or "being there" inside the virtual experience. The induced presence offered by VR makes it possible to present realistic and credible experiences that may be assumed to be true and real to the users. This enables VR users to engage in adaptive behaviour, as their minds and bodies behave as if it's a real experience (Riva, 1998; , Riva & Waterworth, 2003; Gorini et al., 2011). Furthermore, VR allows the development of multiple environments, in which the stimulus presentation can be controlled and regulated. Therefore, the controlled stimulus pro-

vides opportunities for minimal consequences of mistakes; thus, this versatile technology is often more acceptable by the users (Freeman, et al., 2017).

VR technology has been commonly used in several medical treatments and social interaction training. Therapists have alternatives to use virtual humans and scenarios in the VR exposure treatment, which allows manageable, reproducible and controlled social exposure. With these advantages offered by VRT, it allows complete confidentiality of the patients as they do not have to leave the treatment room or office and they are able to maximise the generalisation of inhibitory learning (North et al., 1997). Recent studies confirm that VR exposure to multiple stimuli contexts can significantly reduce the recurrence of anxiety to a greater extent (Dunsmoor et al., 2014; Shiban et al., 2015). Riva & Mantovani (2012) explained that VRT provides opportunities for practice situations that are similar to the desensitization approach. This therapy teaches patients to control their anxiety as they are intentionally confronted with three-dimensional computer-generated stimuli that they fear the most (Morina et al., 2015). This allows patients to interact via different senses such as sight, sound and touch to induce desensitization for particular stimulus; hence reducing the generated anxiety (Anderson et al., 2013; Vanni et al., 2013).

To date, a considerable amount of research has been conducted on the VR applications to investigate the effectiveness of VRT for anxiety disorders. According to Rothbaum et al., (2000) exposure therapy can be considered as the most effective treatment for aviophobia, or fear of flying. In this research, patients were given manual intervention based on the exposure technique consisting of a total of eight sessions which were conducted twice a week. During each session, the patients' perceived anxiety was frequently measured and immediately after the treatment, the patients were asked to sit through a real flight. The research concluded that VRT has reduced clinical symptomatology associated with the fear of flying and flight anxiety continued to decrease at 6-month follow-up (Rothbaum et al., 2002).

VRT was also found to be effective in anxiety and avoidance treatment in acrophobia, or fear of heights. Since 1995, this VR technology has been utilized in psychological treatment, as measured using the Acrophobia Questionnaire (AQ) and the Attitude towards Heights Questionnaire (AHQ). Even though the present study uses relatively cheap hardware and software of VRET, the study shows positive results in reducing acrophobia (Emmelkamp et al., 2001). VR technology also has been used extensively with specific phobias such as arachnophobia (fear of spiders), social phobia and panic disorder with agoraphobia (fear of not being able to escape). (Opriş et al., 2012; Emmelkamp, 2013).These studies also show considerable positive effect in minimizing the anxiety disorder.

Besides phobia treatments, VRT applications have now extended to more complex disorders. In a research by Bouchard et al. (2017) in the treatment of social anxiety disorder, or the fear of negative judgment during social interactions, patients were exposed to eight different scenarios using virtual environments from Klinger et al (2005). The scenarios include having a job interview, meeting unfriendly neighbours, having a talk with relatives in an apartment and facing strangers on a coffee shop patio. When the patients are immersed in the virtual reality, they are expected to interact and speak aloud to the virtual characters. The characters replied using pre-formatted answers decided by the therapists, if relevant to the patient. Using the Liebowitz Social Anxiety Scale, the results of this present study showed improvements in reducing social anxiety disorder. On top of that, VRT was significantly more effective than other exposures as the effectiveness was maintained at the 6-month follow-up. However, Shannan et al (2013) argued that it can be challenging to treat social anxiety disorder using a virtual environment as the negative evaluation is challenging to evoke.

VRT also has been used to treat autism. The controlled stimuli used in virtual reality creates safe environments for autistic children where they can repeat tasks and learn specific rules. On top of

that, the opportunities to replicate social situations where patients are able to interact with avatars enables patients to adapt with the situations and find flexible solutions (Aresti-Bartolome & Garcia-Zapirain, 2014; Den Brok W & Sterkenburg, 2014). There are many other treatments where VRET have been used, such as depression, addictions, eating disorders (Gutiérrez-Maldonado et al., 2015) and schizophrenia.

Past studies on clinical VRT applications for public speaking fear though are available but can be limited. In few studies, users are exposed to fear-triggering stimuli, such as presenting a speech in front of a group of people. Pertaub et al. (2002) and Slater et al. (2006) argued that realistic virtual audiences can significantly reduce public speaking anxiety. Repeated exposure to a virtual audience may lead to reduced public speaking symptoms such as forgetting the prepared materials, trembling hands and stuttering (Wallach et al., 2009)

With the advent of virtual reality in education, this opens new avenues for more studies to investigate the use of VRT in combating public speaking anxiety. Hence, present study used VRT by replicating a virtual environment for the participants to practice their speech. The objectives of this study are to find out the level of anxiety amongst the students who were enrolled in a public speaking course and whether the anxiety is reduced after a series of VRT. In order to achieve the objectives, the following research questions were formulated for this study:

1) What is the level of public speaking anxiety among students who are enrolled in a public speaking course?

To what extent is the difference in public speaking anxiety of the students after the Virtual Reality Treatments were done?

2. Methodology

1.1. Participants

The participants are 15 diploma students enrolled in a public speaking course at a private university. The students are majoring in business studies and have English as their second language. Because of the pandemic, all classes are conducted in online mode. Therefore, throughout the data collection stage, the students were completing a public speaking course online. However, not all students who were enrolled in the course participated in this study. This is part of the ethical consideration for the research in which the participation is completely voluntary. This also explains the unequal number of participants between control and experimental groups. Due to the small number of participants, this study can be considered as a preliminary study and more improvements will be done in future studies.

The 15 participants will be divided into control and experimental groups on their own choices as illustrated in Table 1.0 below. The experimental group were given a VR headset to assist their training while control group proceeded the training without any aid from VR headset.

Table 1.

The number of participants in each control and experiment group

Group	Control	Experimental
N=15	9	6

Procedures

To understand the procedures done for this study, the following table simplifies the information on the data collection process.

Table 2.

Summary of data collection process

Pre-test	Both control and experimental groups underwent the same public speaking course by the same instructor. All materials and contents were the same for both groups. In Week 1, both groups answered the PSCAS questionnaire as pre-test to determine their level of public speaking anxiety.
During Treatment	The treatment started from Week 4. Each student in the experimental group was given a personal VR headset together with a manual detailing on the VRT. The experimental group was required to complete three sessions of VRT encompassing 10 minutes in the first treatment, 15 minutes for the second treatment and 20 minutes for the final treatment.
Post-test	This was done on the final day of the course which was the end of Week 7 after all three VRT sessions were done. Both control and experimental groups completed the PSCAS questionnaire again. The results were collected and analysed to record any difference between the pre-test and post test results.

1.2. Instruments

PSCAS Questionnaire

This instrument was constructed by a group of researchers from Thailand who wanted to investigate the apprehension of students who are in a public speaking class. Even though this instrument was a contemporary study, but it adopted many pioneering language anxiety scales by McCroskey (1970), Clevenger and Halvorson (1992) and Foreign Language Classroom Anxiety Scale (FLCAS) by Horwitz et al. (1986). This instrument was chosen in present study because the items are specifically designed to fit in public speaking course. For this study, 17 questions were utilised from PSCAS and changed slightly according to Malaysian context which was adapted from another study by one of the authors (Shamsuddin et al., 2021). The Cronbach Alpha reading for the instrument was 0.847 which suggests that the instrument is a reliable questionnaire. According to Fraenkel and Wallen (2009), to be considered as a reliable instrument, the Cronbach Alpha reading should be above 0.700.

Virtual Reality Treatment (VRT)

For the VRT, students who were in the experimental group were given a VR headset together with a manual on the VRT. Students were given extensive information on how to perform the treatments. The students were monitored very closely by the researchers through constant communication to ensure all three treatments were completed. After each treatment, the students were asked to complete a simple survey to monitor any side effects from the treatments. To perform the treatment, students were required to use the VR headset and their personal phone with a VR environment that was provided by the researchers (Refer to Appendix A). The VR environment consisted of a virtual classroom setting with an audience. The audience consists of 13 people seated in a classroom setting. Each person has different facial expressions and body language. An illustration of the VR environment can be seen in Figure 2.0.

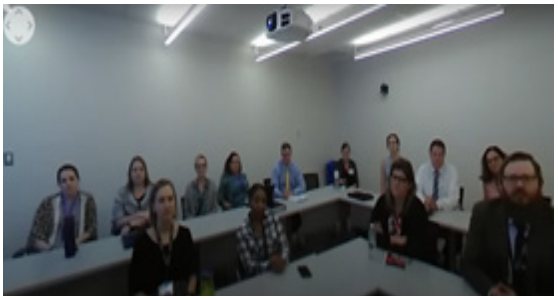

Figure 1. Illustration of the VR environment used during the VRT

3. Results

To answer the research questions, data from the pre-test and post-test will be recorded and analysed. Data can be categorised into three main classifications: 1) comparison between pre-test and post-test for control group, 2) comparison between pre-test and post-test for experimental group and 3) rate of change between pre-test and post-test for both control and experimental group.

Table 3.

Comparison between pre-test and post-test for control group.

No.	Item	PSA Mean (N=6)		Rate of Change [%]
		Pre-test	Post-test	
1	I never feel quite sure of myself when I'm speaking English.	2.22	2.33	5
2	I often tremble when knowing that I am going to be called on to speak English.	2.44	2.67	9
3	I start to panic when I have to speak English without a preparation in advance.	2.67	2.44	-8
4	In Public Speaking class, I can get so nervous that I forget things I know.	2.78	2.56	-8
5	I don't feel confident when speaking in English.	3.11	2.89	-7
6	I feel very self-conscious (embarrassed/uncomfortable) while speaking English in front if other students.	2.67	2.56	-4
7	I get nervous and confused when I am speaking in English.	2.56	2.44	-4
8	I am afraid that other students will laugh at me when I am speaking in English.	2.78	2.56	-8
9	I have fear of speaking English.	2.56	2.56	0
10	It embarrasses me to volunteer to go out first to speak English.	2.89	3.11	8
11	I do not enjoy the experience of speaking English.	2.33	2.22	-5
12	The more presentation (from Public Speaking class) I have, the more confused I get.	2.78	2.67	-4
13	I want to speak less because I feel shy while speaking English.	2.89	3.11	8
14	I dislike using my voice and body expressively while speaking English.	3	2.33	-22
15	I have trouble coordinating (synchronising) my movements when speaking in English.	2.67	2.44	-8
16	Even if I am well-prepared, I still feel anxious about speaking English.	3	2.44	-19
17	I keep thinking that other students are better at speaking English than I am.	3.11	2.89	-7
	Overall Mean of Control Group	**2.73**	**2.6**	**-4**

Table 3.0 compares the results obtained from pre-test and post-test using PSCAS questionnaire in accordance to all 17 questionnaire items. It is evident from the table that the overall mean of control group in post-test (mean= 2.6) is lower than the overall mean of pre-test (mean =2.73). It can also be seen from the table that 12 items are rated lower anxiety in post-test as compared to pre-test (Item 3,4,5,6,7,8,11, 12,14,15,16,17). Interestingly, the range of the decrement rate is between 0%-22%. On the other hand, four items are rated with higher anxiety in post-test as compared to pre-test (Item 1,2,10, 13). Here, the range of the increment rate is between 0%-9%, which is relatively small changes recorded compared to decrement rate. This suggests that participants in control group experienced lower anxiety after the completion of the course.

Table 4.

Comparison between pre-test and post-test for experimental group

No.	Item	PSA Mean (N=6)		Rate of Change [%]
		Pre-test	Post-test	
1	I never feel quite sure of myself when I'm speaking English.	3.33	2.17	-35
2	I often tremble when knowing that I am going to be called on to speak English.	3.5	2.5	-29
3	I start to panic when I have to speak English without a preparation in advance.	3	2.33	-22
4	In Public Speaking class, I can get so nervous that I forget things I know.	3.17	3	-5
5	I don't feel confident when speaking in English.	3	1.83	-39
6	I feel very self-conscious (embarrassed/uncomfortable) while speaking English in front if other students.	3.17	2.33	-26
7	I get nervous and confused when I am speaking in English.	2.67	2.17	-19
8	I am afraid that other students will laugh at me when I am speaking in English.	2.67	2.5	-6
9	I have fear of speaking English.	2.5	1.67	-33
10	It embarrasses me to volunteer to go out first to speak English.	2.67	2.5	-6
11	I do not enjoy the experience of speaking English.	2.5	1.83	-27
12	The more presentation (from Public Speaking class) I have, the more confused I get.	2.67	3.17	19
13	I want to speak less because I feel shy while speaking English.	2	2.17	8
14	I dislike using my voice and body expressively while speaking English.	2	2	0
15	I have trouble coordinating (synchronising) my movements when speaking in English.	2.83	2.5	-12
16	Even if I am well-prepared, I still feel anxious about speaking English.	3.33	2.83	-15
17	I keep thinking that other students are better at speaking English than I am.	4.17	3.33	-20
	Overall Mean of Experimental Group	**2.89**	**2.4**	**-17**

The results from Table 4.0 suggests the difference of students' anxiety for experimental group from pre-test to post-test. It can be learned that the students have lower anxiety in public speaking in post-test (mean= 2.4) as compared to pre-test (mean = 2.89). Out of all 17 items, 14 items are rated lower anxiety in post-test (Item 1,2,3,4,5,6,7,8,9,10,11,15,16,17) and two items have higher anxiety in post-test (Item 12,13). It is noteworthy to note that the range of the decrement rate is between 0%-39%. On the other hand, the recorded increment rate was only between 0%-19%. This means that participants in experimental group also experienced lower anxiety after the completion of the course.

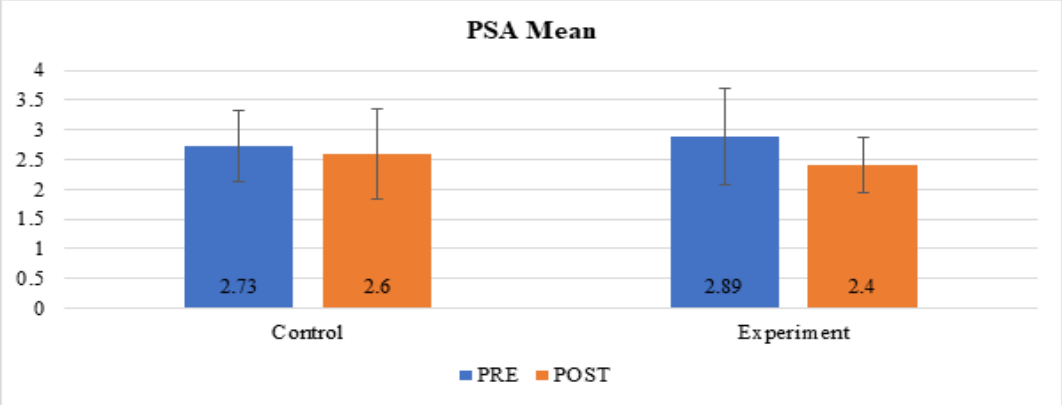

Figure 2. The PSA mean of both control and experiment groups for pre-test and post-test.

Figure 2.0 shows the bar chart of PSA mean calculated for both control and experiment groups during pre-test and post-test respectively. The graph shows that both control and experimental groups experienced decreasing trend in the PSA mean from pre-test to post-test. Here, it is found that participants in experimental group have higher PSA mean (mean =2.89) as compared to participants in control group (mean = 2.73) in the beginning of the study. In addition, the PSA mean of participants in experimental group is lower (mean =2.40) than those in control group after the completion of the course (mean = 2.60). Then, when further analysed on the data of the PSA mean from pre-test to post-test to determine the rate of differences, it is found that experimental group has higher rate of decrement at 17% as compared to control group at 4%. This suggests that as compared to control group, the experimental group experiences four times lower anxiety after the completion of VRT.

4. Discussion

In this section, a discussion on the implications of the findings from the three main classifications: 1) comparison between pre-test and post-test for control group, 2) comparison between pre-test and post-test for experimental group and 3) rate of change between pre-test and post-test for both control and experimental group will be explained. Findings will be compared with previous literature to suggest the potential of VRT in education field.

Based on the three main classifications, the findings show the obvious results where, the experimental group had more reduction in public speaking anxiety as compared to control group. This is evident from the range of decrement rate of experimental group which is 0%-39% and control group is 0%-22% only for the PSA items individually. In addition, overall PSA decrement rate shows higher for experimental group (17%) four times more than those for control group (4%). This suggests that upon completing the three sessions of VRT, participants from experimental group had greater decrement in public speaking anxiety. This study concurred with a past study by Song & Lee (2002) who found positive outcome when using VR in teaching a geometry lesson. Another study by Li et al. (2002) also found similar result when using VR to teach Earth Science concepts that might be difficult for the students to visualise.

5. Conclusions

In conclusion, present study attempted to investigate the potential of VRT in reducing public speaking anxiety. It is found that there is a positive result with the experimental group who completed three sessions of VRT by four times more as compared to control group that did not. Nevertheless, due to the limited number of participants and the nature of online classes, this study was not able to tease out on the significance difference between both experimental and control groups. To overcome this limitation, future studies should consider adding number of participants so that the

findings can be overgeneralised. Despite the promising result from present study, it is premature to overgeneralise the findings. Therefore, future studies can also include more specific domains in public speaking anxiety. In short, present study managed to suggest the potential of VRT in public speaking classroom at a preliminary level. This study may be explored more in future.

Author contributions

Conceptualization, W.N.F.W.S Methodology, M.N.A.M.A; W.N.F.W.S Analysis, M.N.A.M.A.; Literature Review, I.S.M.R.; W.N.F.W.S Writing, W.N.F.W.S; M.N.A.M.A; I.S.M.R. Funding acquisition, W.N.F.W.S

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Competing interests

The authors declare no conflict of interest.

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