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Reducing public speaking anxiety through the use of virtual reality assisted distraction: a systematic pilot study

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ABSTRACT

BACKGROUND: Fear of Public Speaking (FOPS), also known as glossophobia, is classified as a nongeneric social anxiety disorder associated with performance situations that involve perceived scrutiny by others. Distraction can be used passively or actively, and one of the active types of distraction is virtual reality (VR) distraction. **OBJECTIVE:** The purpose of this study is to investigate whether VR distraction is effective in reducing anxiety caused by fear of public speaking. **METHODS:** Fifty-six individuals participated in the study (VR Distraction- VR-D:19, Non VR Distraction- Non VR-D:19, Control: 18), who were university students in a split-plot experimental design. The mean age of the participants was 20.9 ± 1.8 and 55 % (n:31) was female. Participants completed the Personal Information Form, the Public Speaking Anxiety Scale (PSAC), and the COVID-19 Fear Scale (CAS) and were randomly assigned to groups based on these scores. Pre- and post-test measurements were taken using the State-Trait Anxiety Inventory (STAI-I). **RESULTS:** Pre and post-test comparisons revealed statistically significant reductions in STAI-I in all groups. Our main results were pre-test (F: 0.23, p: 0.792, η^2 : 0.00) and post-test (F: 10.50, $p < 0.001$, η^2 : 0.28). VR-D reduced anxiety more than the other groups.

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Public speaking;
glossophobia; virtual reality;
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1. Introduction

Fear of public speaking (FOPS), also known as glossophobia, is classified as a non-generic social anxiety disorder associated with performance situations that involve perceived evaluation by others (American Psychiatric Association 2013). FOPS is associated with debilitating anxiety that impacts social, academic, and occupational opportunities (Kessler, Stein, and Berglund 1998). The onset age for social anxiety is typically between 8 and 15 years, and FOPS is the most common lifelong social anxiety (21.2%) according to US data (Ruscio et al. 2008). People with FOPS underestimate their abilities when they need to speak in public and exaggerate the potential for negative evaluation by others (Freeman et al. 2004). Therefore, situations in which they have to speak in front of an audience can be very distressing and personally threatening.

Many treatment modalities are being tried to improve FOPS. Reconsolidation-based treatment with propranolol for fear of public speaking has also been tried in a recent article and shown to be promising (Eley et al. 2020). In addition to medical treatments, many psychotherapies are also used in the treatment of FOPS. Cognitive behavioural therapy (CBT) is the

most widely researched treatment modality with proven effectiveness in FOPS treatment (Price and Anderson 2012). According to the cognitive model, the basis of anxiety is the perception of a physical or mental threat or danger. Anxiety occurs when a situation or feeling, real or not, is interpreted by the person as dangerous (Leahy 2007). This is a complex structure involving physical, cognitive, and behavioural changes. The individual's indecision between losing the ability to control the danger and fighting it is related to the cognitive processes of the situation (Beck and Emery 1985). Exposure to anxiety-provoking stimuli reinforces negative emotions (Leahy 2007).

The exposure component of CBT can be realised in a natural setting ('in vivo') or through imagination ('in vitro'). In vivo exposure is better than imagination, but it is costly and time-consuming, and control of situational elements is difficult. Another issue that arises with in vivo exposure is the possibility that the client will be confronted with familiar people, so the person is in therapy. In vivo exposure can be difficult for people who cannot vividly imagine the situation, or who cannot avoid imagining, or who tend to choke on the images. This reduces the effectiveness of the therapy (Safir, Walach, and Bar-Zvi 2012). 30 randomised controlled trials

of FOPS therapy have been summarised in a meta-analysis in recent years (Ebrahimi et al. 2019). In this meta-analysis, it was concluded that technology-assisted applications are at least as effective as conventional applications and that they offer greater benefits in terms of time and cost. The most common technology-enabled applications used today are computer-assisted, virtual reality (VR) assisted, augmented reality assisted, or artificial intelligence assisted. VR is defined as an immersive tool in which individuals wear goggles to participate in. In our literature review, we found that the use of VR-assisted applications in FOPS therapy, along with other technology-assisted applications, is limited (Kahlon, Lindner, and Nordgreen 2019).

Some studies in the literature indicate the potential benefits of distraction in VR-assisted applications (Eijlers et al. 2019). Rapee, Sanderson, and Barlow (1988) state that self-directed attention to the emotional qualities of distress plays an important role in the maintenance of anxiety. Distraction is thought to divert attention from feelings and reactions to a distressing stimulus (Parslow et al. 2008). Distraction includes any type of communication that diverts a person's thoughts to a topic unrelated to the stress. Distraction can also include speech that prevents the anticipation of a stressful event in order to direct thoughts to another issue that requires action. From the perspective of appraisal theory, distraction works by momentarily interrupting the appraisal of threats in the situation. If individuals are distracted from appraising the threatening aspects of a situation, they will not experience the corresponding stress. Thus, any communication that interrupts the appraisal process by drawing attention to an issue that is irrelevant to the stressor reduces stress (Priem and Solomon 2009). Distraction methods can be divided into active and passive distraction. Active distraction includes methods such as video games (VG), VR goggles, controlled breathing and relaxation. These methods involve the child, adolescents and adults in certain activities during the process (Botella et al. 1998). Passive distraction includes methods such as listening to music and watching television (Nilsson et al. 2013). Some studies have shown that active distraction is more effective than passive distraction (Hussein 2015; Parslow et al. 2008).

Hinrichsen and Clark (2003) informed participants that they would deliver a videotaped speech in 20 min to create anticipatory anxiety in participants. Prior to the speech, half of the participants were instructed to think about the upcoming performance and the other half were given an insect video to watch as a distraction. Participants in the distraction group reported lower anxiety scores immediately before the speech, while

those instructed to think about the speech showed a steady increase in anticipatory anxiety. From this point of view, it can be thought that distraction can reduce individuals' public speaking anxiety. However, in the literature review, it was noticed that the data were limited and it was not evaluated whether VR-assisted distraction was superior to other methods. To our best knowledge, this is the first study to test the difference between the use of VR-assisted distraction, control, and distraction-only use in the treatment of FOPS. Our hypothesis is that VR-assisted distraction is at least as effective as VR-assisted distraction and that it is significantly more effective than control in reducing FOPS.

2. Methods

2.1. Participants

The participants of the research were determined among volunteer university students with easily accessible sampling. In easily accessible sampling, the researcher determines a sufficient number of items from the existing items as a sample (Singleton and Straits 2005). All volunteer participants were included in the study, and the applicants were worked with within the 60-day working period. In other words, the sample size was determined by the number of voluntary participants. A total of 56 participants were included in the study (VR-D:19 Non VR-D: 19 Control: 18). The participants are undergraduate students in Gaziantep province in Turkey. The participant group comprised 31 females (55%) and 25 males (45%) with ages ranging from 19 to 24 years ($M = 20.87$, $SD = 1.83$ years). The distribution of participants across academic years was as follows: 13% were in their first year of study, 39% in their second year, 27% in their third year, and 21% in their fourth year. Regarding the distribution across faculties, 24% of the participants were studying in the Faculty of Education, 17% in the Faculty of Health Sciences, 22% in the Faculty of Law, 22% in the Faculty of Fine Arts, and 15% in the Faculty of Business and Administration.

Inclusion criteria: Be an undergraduate or graduate student, be a volunteer, be between the ages of 18–25.

Exclusion criteria for the study: Psychiatric treatment or taking medication, COVID -19 positive or contact with COVID-19 positive, epilepsy, physical, visual or hearing impairment, predefined cardiac arrhythmia. Block randomisation was done in a 1-1-1 ratio considering gender and age meeting the inclusion criteria. The number of participants in each block is presented in Table 1.

Table 1. Participants in Block Randomisation.

BLOCK		I (VR-D)	II (Non VR-D)	III (Control)
Gender	Female	10	11	10
	Male	9	8	8
Age	<20	10	11	10
	>21	9	8	8

2.2. Study design

Approval for the study was obtained from the Ethics Committee of University (2021/E-804.01-BABBFCF3). Written and verbal informed consent was obtained from the participants.

This study, which aims to reduce participants' public speaking anxiety using a VR application, was conducted in an experimental design with pre-test, post-test measurement in VR-D, Non VR-D and control groups. VR-D group was asked to play a game using the VR goggles, and Non VR-D group was asked to play a game using a mobile phone. The games were those that lasted an average of 120 s and could be downloaded for free from mobile app stores. The control group was not affected in any way. The study also included supplementary qualitative data.

2.3. Measurement tools

Personal Information Form: Participants were asked to answer age, gender, major field of study, whether they were COVID-19 positive or had contact with a COVID-19 positive, whether they were receiving psychiatric treatment or had taken medication in the past, whether it was ongoing, or whether they had any physical, visual, or hearing impairments. They were asked to answer to list the scales.

State Anxiety Inventory (STAI-I): The State Anxiety (STAI-I) was developed by Spielberger, Gorsuch, and Lushene (1968), its Turkish form was adopted by Öner and LeCompte (1985) and the validity reliability study was conducted. The internal consistency and reliability of the Turkish form was found to be between 0.94 and 0.96 on the Kuder Richardson Alpha Reliability State Anxiety Scale. The scale includes 20 items. The responses vary between 1 and 4. The total score obtained on the scale ranges between 20 and 80. A high score indicates a high level of anxiety. In this study, the STAI-I Cronbach alfa was found to be 0.88. In this study, the Cronbach alpha is 0.73.

Public Speaking Anxiety Scale (PSAC): The scale developed by Bartholomay and Houlihan (2016) was adopted into Turkish by Çabuker, Çelik, and Aldemir (2020). The scale includes 16 items on a 5-point Likert

scale and consists of 3 subscales (cognitive dimension, behavioural dimension, and psychological dimension). A high score indicates a high level of anxiety. Cronbach alfa was calculated as .93 for the total score, .88, .69, and .86 for the subscales. In this study, the Cronbach alpha is .95.

Coronavirus Anxiety Scale (CAS): This scale was developed by Lee to define potential dysfunctional anxiety that may be observed due to psychological reactions in individuals to the coronavirus pandemic that has become a social crisis, and to quickly and reliably measure the severity of anxiety symptoms (Lee 2020). The 5-item Likert scale was developed with data collected from 775 adults using an online questionnaire. As a result of the analysis, a measurement sensitivity of 90% and a diagnostic specificity of 85% were calculated. The Cronbach's alfa value of 0.93 points indicates that the scale can be used as a highly reliable as well as thematically and psychometrically coherent measurement tool. A high score indicates a high level of anxiety. The Turkish validity and reliability of the scale was conducted by Akkuzu et al. (2020). In this study, the Cronbach's alpha is .67.

Semi-structured interview form: The form asked participants what they thought about the application process, how they would describe their experience, and how much they felt like they were giving a speech during the application process. They were asked to give a score from 1 to 5.

2.4. Procedure

The list of participants was identified through announcements on the University's social media accounts, portals and billboards. Verbal and written consent was obtained from those who applied and met the inclusion criteria. After consent was obtained, participants completed the Personal Information Form, PSAC, and CAS. Results were analysed and randomly assigned to groups according to PSAC and CAS results, and no participant was excluded from the study based on these results. The date and time for participant enrolment were set and participants were assigned a code that could only be identified by the researchers to determine the group to which participants were assigned. Participants were randomly assigned to VR-D, Non VR-D and control groups, stratified by age and gender. Information about the time and place of the appointment to participate in the study was sent to the email addresses of the participants.

The prepared scenario was read to the participants on the day and time of the appointment,

There are 15-20 administrators in office #205 next to us in the online meeting room; these individuals have gathered here to be informed about an event we will be conducting, I would like you to share this information, I will give you the information slip in writing as you enter the room.

Participants in the control group completed the post-tests after 10 min without any application, the VR-D group wore VR goggles, and the Non VR-D group played a game on their mobile phones that lasted an average of 120 s. Participants in the VR-D and Non-VR-D groups gave their 5-min virtual classroom presentations on the computer installed on the table in office 205. Before the participants began to speak, a researcher whom the participants had not seen before stated the participant's name, last name, age, and department and said, 'He will tell us his experience about the university and university life.' Then a video was launched with a scenario of a meeting on the Google Meet platform, consisting of adults in different cities. The subject had a stopwatch with him to check the 5-minute time. The STAI-I scale was completed again in the test groups (VR-D, Non VR-D) after the online speech was finished, and in the control group after waiting for the same period of time. Participants were asked what they thought about the delivery process and how much they felt 'like they were giving a speech' while watching the video. The study concluded. In the study, both VR-D and Non-VR-D groups are classified as active distraction.

VR-D Game and Non VR Game: The selection of games for the study involved the establishment of specific criteria. Both VR-D (Virtual Reality-Distracted) and Non-VR games were chosen by the researchers, considering factors such as ease of use, image quality, suitability for 120 s of use, and included tasks. The identified games were further evaluated by a psychiatrist and three experts with PhDs in psychology based on the established criteria. Only the games mentioned by all three experts were ultimately used in the study. The VR-D game chosen was an arrow shooting game, freely available on Google Play. The researchers evaluated 27 games in the free category by searching the Google Play Store with the keywords '3D game, VR game' to determine the VR-D game. The selected game stood out due to its ability to fulfil the specified criteria and received positive feedback from the experts. In this game, participants were required to locate targets, fix markers on them, shoot arrows, and earn points. On the other hand, the Non-VR game involved birds moving up and down on electric wires, available on the YouTube platform. During the selection process, the researchers conducted a search on Google using the

keywords 'Short Animation' and assessed the results in terms of distraction and multitasking. They carefully selected five videos that featured the same characters on the screen, exhibited slow movement speed, and allowed tasks to be given to the user. Once the VR-D and Non-VR games were determined based on their scores and the researchers' opinions, they underwent a further review by the experts. The review focused on aspects such as colours, picture similarity, number of tasks, and frequency. The games were found to align with the experts' evaluations, confirming their appropriateness for the study. Each expert rated the games in these five categories on a scale of 1-3 points. These videos were presented to the experts and the video with the highest score was selected based on other criteria, especially the difficulty with the VR-D game. Participants try to keep track of the number of these birds. In both games, there are tasks that repeat 10 times. In this application, a mobile phone with a screen width of 7 in. is used. While determining the screen size, it is taken into account that it is similar to the size of the VR glasses. For VR-D and NonVR-D applications, no headset was used, but the application was made with VR glasses and the voice of the mobile phone. Before the participants started playing the game, a trial application was created. For VR and Non VR-D games, before the application started, the participants were told how to play, the devices were introduced, and they were asked to put on the glasses for VR-D and play the game once (approximately 30 s). For the non VR-D game, the video was opened and the task was explained and asked to make a trial (30 s).

Statistical Method: IBM SPSS Statistics 23 programme was used for data analysis. As descriptive statistics, the mean \pm standard deviation values were given for continuous data, and frequency and percentages for qualitative data. The normality of continuous data was evaluated with the Kolmogorov-Smirnov test ($p = .02$). After conducting the analysis, we examined the Kurtosis and Skewness values of the variables. The results showed that STAI-I (Skewness 0.52, Kurtosis -0.02), PSAC (Skewness -0.14 , Kurtosis -1.2), and CAS (Skewness 0.7, Kurtosis -0.56) variables all fell within the acceptable range of -1.5 to $+1.5$, indicating that the data were normally distributed (Tabachnick and Fidell 2013). For group comparisons, ANOVA test was used for continuous data. Post hoc analysis of the parameters found significant in the ANOVA test was conducted with the Tukey HSD test. For in-group pre-post comparisons, T-test was used. $p < 0.05$ was considered statistically significant. Complementary qualitative data, on the other hand, was obtained by conducting content analysis on the data obtained with a semi-structured interview form.

Table 2. The participants' sociodemographic and pre-study PSAC and CAS comparisons.

	VR-D (n:19) x̄ (ss)	Non VR-D (n:19) x̄ (ss)	Control (n:18) x̄ (ss)	p.
Age	20.7 (±1.8)	20.9 (±1.9)	21.2 (±1.9)	0,420
Gender				
Female	11 (57.9%)	10 (52.6%)	10 (55.6%)	0.948
Male	8 (42.1%)	9 (47.4%)	8 (44.4%)	
PSAC	43.6 (±12.8)	45.8 (±14.3)	45.6 (±14.3)	0.869
CAS	6.5 (±1.4)	6.0 (±1.3)	6.3 (±1.4)	0.563

VR-D: The group played VR before the speech; Non VR-D: The group played the game on mobile phone before the speech; PSAC: Public Speaking Anxiety Scale; CAS: Coronavirus Anxiety Scale

Table 3. Comparison of pre-test and post-test STAI-I.

	VR-D (n:19) x̄ (ss)	Non VR-D (n:19) x̄ (ss)	Control (n:18) x̄ (ss)	F (2,53)	p	η ²
Pre-test	37.8 (±10.7)	37.2 (±6.6)	39.0 (±5.9)	.23	0.792	.00
Post-test	29.1 (±5.3)	33.7 (±6.8)	38.4 (±6.2)	10.50*	<0.001	.28

VR-D: The group played VR before the speech; Non VR-D: The group played the game on mobile phone before the speech; STAI-I: State-Trait Anxiety Inventory, $p < 0.05$.

3. Results

A total of 56 participants were included in the research. Mean age of the participants was (20.9 ± 1.8) and their gender distribution (Female:55.4%, Male: 54.6%). PSAC showed no statistically significant difference by age ($F_{(5,50)} = .680$, $p = .641$) and gender ($t_{(54)} = 1,024$, $p = .30$). Moreover, no statistically significant difference was identified between pre-test PSAC ($p > 0.05$), and CAS ($p > 0.05$) values in group analysis of the participants who are randomly distributed (Table 2). After the distributions were examined, each 3 groups were found not different with respect to all characteristics.

The measurements made before and after the application are detailed in Table 3. According to these results, although there is no difference in STAI-I measure before application ($p > 0.05$), there is a significant difference in the values after application. Tukey HSD test was used for post hoc analysis of the parameters with differences identified in the ANOVA test. We found that the

difference between post-application STAI-I scores was due to the difference between the VR-D group and the control group ($p < 0.05$). No significant difference was identified in other comparisons. No significant difference was observed in post hoc tests between VR-D and Non VR-D.

Table 4 shows the statistical difference levels between pre- and post-application measurement values of VR-D, Non VR-D and Control groups. The results we obtained showed a statistically significant drop in pre- and post-application STAI-I levels of all groups. According to Cohen's criteria, the effect size for the VR-D group was high ($d = 1.03$); moderate ($d = 0.52$) for the non-VR-D group; a negligible ($d = 0.10$) effect size was found for the control group (Rice and Harris 2005). Means for the pre-test and post-test of the groups are given in Figure A1 (Appendix 3).

Qualitative data: The quantitative data of the study were obtained from complementary qualitative state study data and post-application interviews with the participants. The participants were asked about their opinions on the VR and video applications they experienced within the scope of the research. In the VR-D group, three themes arose: game, experience and task. The game theme includes the entertainment code. The experience team shows being interesting and new experience codes. The following statement of P 13's can be given as an example to the code of being interesting: 'It was a very interesting experience for me; perhaps it is the reason why I forgot for some time that I was to give a speech'. The task theme appears both in VR-D and Non VR-D (video) groups, while the codes of moving to a different world for VR-D group, and directing attention to the task for Non VR-D group were observed. The statement of P 27 can be given as an example to the code of directing attention to the task: 'I believe that directing my attention to fulfilling the task in the game decreased by anxiety,' and the statement of P5 as an example to the code of moving to a different world: 'I moved to a completely different world while shooting an arrow in VR'. In the control group which does not receive any application, the

Table 4. STAI-I Scores Statistical difference levels between pre- and post-test measurement values of VR-D, Non VR-D and Control groups.

		n	M (SD)	df	t	p	Cohen's d
VR-D	Pre-test	19	37.84 (10.77)	18	15.31	<0.05	1.03
	Post-test		29.05 (5.34)	18	23.67		
Non VR-D	Pre-test	19	37.26 (6.65)	18	24.39	<0.05	0.52
	Post-test		33.73 (6.86)	18	21.42		
Control	Pre-test	18	39.05 (5.95)	17	27.82	<0.05	0.10
	Post-test		38.38 (6.27)	17	25.93		

VR-D: The group played VR before the speech; Non VR-D: The group played the game on mobile phone before the speech; STAI-I: State-Trait Anxiety Inventory.

experience them which includes the codes of ambiguity and thinking of the speech to be given, and the theme of emotion which includes the code of high anxiety emerged. In the answers given by the participants to the question 'how much did you feel like you were giving a speech', 2 participants in each of the VR-D and Non-VR-D groups gave 4 points, and all the other participants gave 5 points.

As a result, in this study, it was found that there was a difference in STAI-I post-test scores between the VR-D group and the control group, but not between the other groups. No significant difference was detected in other comparisons. However, when the effect size values were examined, the difference between the pre-test and post-test scores of the VR-D group showed that the difference in this group was high. According to the qualitative data, it was seen that the experiences of the participants in the VR-D group increased the distraction level.

4. Discussion

The aim of this study is to evaluate the effectiveness of VR assisted distraction application in reducing public speaking anxiety. The main finding of our study is that public speaking anxiety (STAI-I) decreased in all parameters of the VR-D, Non VR-D, and control groups. However, anxiety decreased the most in the VR-D group and then in the non VR-D group. The decrease in the control group was negligible. Speakers' anxiety decreases from the beginning to the end of the speech (Sawyer and Behnke 1999). Although this is confirmed in our study, this decrease is too small to be ignored. In the non VR-D, anxiety decreased statistically significantly and more than in the control group. In a study examining the effect of distraction on post-event processing and anticipatory anxiety with a sample of 77 socially anxious participants, participants who received distraction reported lower post-event processing than the rumination and control groups, as expected. Furthermore, distraction has been reported to be associated with anticipatory anxiety about the next speech, and distraction was an important tool for reducing incongruent processes in this study (Blackie and Kocovski 2016). It is known that any communication that interrupts the appraisal process by directing attention to a topic irrelevant to the stressor reduces stress (Priem and Solomon 2009). Anxiousness decreased more in the VR-D group than in the other groups. Our results are consistent with data from the literature. VR-D, which has not been previously tested, may also prove effective in reducing

FOPS (Harris, Kemmerling, and North 2002; Owens and Beidel 2015; Priem and Solomon 2009). A recent meta-analysis found that VR may be an effective method for reducing anxiety in children during the perioperative period (Simonetti et al. 2022).

The results showed that public speaking anxiety and CAS did not differ by age and gender. It has been suggested that women are more anxious than men in tasks such as speaking in a meeting (Turk et al. 1998). The difference in our study may be related to the fact that anxiety is also related to factors such as individual differences (Eisenberg et al. 2004). In addition, women tend to socialise more by talking about themselves (Shaffer et al. 1991). The relationship between public speaking and age has not yet been established. However, different results can be found in the literature regarding the relationship between other anxiety disorders and age. One study reported that generalised anxiety disorder is more common in older adults than in young adults (Brenes et al. 2008), and fear of illness is more common in older people (Fergus et al. 2017). In another study, somatic symptoms reported in relation to anxiety were found to show no change with age (Cohen 2014). From these points of view, it can be said that the relationship between age and anxiety is not clear. In addition, one reason why we did not find a difference in our study could be because we included individuals at a similar developmental stage (young adult) in terms of age. This is because the studies mentioned above are often conducted in a wide age range such as 18–87.

In our study, a significant increase was observed between VR-D and Non VR-D after use, and both methods showed a positive effect in reducing FOPS compared to the control group. As we know, distraction strategies and non-pharmacological medical treatments form the basis of easy-to-implement interventions that can reduce children's anxiety and disruptive behaviour. Patients undergoing routine blood draws may experience less severe pain and anxiety while reporting higher levels of pleasure when using VR gadgets (Gold and Mahrer 2018). A recent systematic review and meta-analysis found that children's preoperative anxiety during induction of anaesthesia is reduced by game-based therapies (Suleiman-Martos et al. 2022). In conclusion, our systematic pilot study shows that VR-D can effectively reduce subjective anxiety and physiological signs FOPS.

4.1. Limitations

Our study does not include a comprehensive treatment of FOPS nor does it test momentary relaxation. It can therefore provide only limited information but is

considered important because it is the first study to test VR-D. An important limitation of the study is that there was no real experience with public speaking. Due to the limitations of the COVID-19 epidemic trial, face-to-face use could not be conducted. It is recommended that the same conditions be repeated with a face-to-face application. In the study, the face-to-face speaking exercise in which the experimental groups participated was conducted with a video that appeared to be simultaneous. To overcome this limitation, participants were asked to what extent they were in a speaking environment. Because fear of speaking in public could not be measured specifically for the situation, the study also measured state anxiety, which was thought to be caused by fear of speaking in public.

These measurements were limited to use, and no long-term follow-up was performed. Another limitation of our study is the small sample size, as this is a pilot study. Our results should be supported by studies that include a larger sample.

Considering the importance of FOPS and the results of this study, the study can be repeated on adults after the study. Based on the results of our study, intervention programmes can be developed using VR to reduce public speaking anxiety.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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Appendices

Appendix 1. Semi-structured interview form

Dear participant,

Please answer the following questions by considering the application process. The rating is from 1 to 5, with 1 being disagree, 5 totally agreeing.

- I felt comfortable during the application.
1 () 2 () 3 () 4 () 5 ()
- I really felt like I was going to give a speech.
1 () 2 () 3 () 4 () 5 ()
- Visuals, sound, etc. of the game I play. was qualified.
1 () 2 () 3 () 4 () 5 ()
- The device used for the game was easy to use.
1 () 2 () 3 () 4 () 5 ()
- Other points you want to specify:

Appendix 2. Sample photos of VR application



Appendix 3

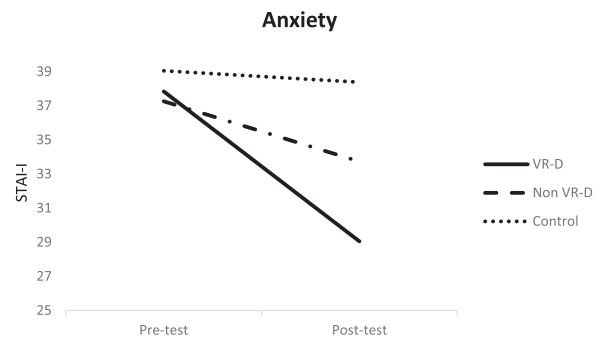


Figure A1. Comparison of pre-test and post-test STAI-I.