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The effect of virtual reality exposure therapy on focus of attention, self-criticism, and interpretation bias in university students with social anxiety

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Abstract:

BACKGROUND: The present research aims to investigate the effectiveness of virtual reality exposure therapy on the focus of attention, self-criticism, and interpretation bias among university students with social anxiety.

MATERIALS AND METHODS: The present research was conducted using quasi-experimental research with pre-test and post-test control group design. The participants were university students aged between 10 and 30 years old who had visited Isfahan counseling centers in 1399 HS. Among 53 patients referred to the counseling centers, 30 were randomly selected by convenience sampling and then assigned to an experimental group (15 individuals) and a control group (15 individuals). The experimental group received eight sessions of 30-minute and face-to-face virtual reality-based interventions. In contrast, the control group remained on the waiting list. A structured clinical interview and Social Phobia Inventory (SPIN) were used to select and screen students, and the Focus of Attention Questionnaire (FAQ), Levels of Self-Criticism Scale (LOSC), and revised interpretation bias inventory were applied for the pre-test and the post-test. Then, all the data were analyzed by a statistical analysis of covariance.

RESULTS: The results showed that virtual reality exposure therapy significantly reduces the symptoms of the focus of attention, self-criticism, and interpretation bias in the experimental group compared to the control group. ($P < 0/01$).

CONCLUSION: The research showed that virtual reality exposure therapy reduced the symptoms of social anxiety. Therefore, this method can be applied to reduce some symptoms of social anxiety in university students.

Keywords:

Exposure therapy, focus of attention, interpretation bias, self-criticism, social anxiety, virtual reality

Introduction

The development of students' cognition, emotion, and behavior is critical during university. Interpersonal communication with others is essential for students' education, life, and career. However, interpersonal communication problems have become a common psychological issue that students are dealing with nowadays. Social anxiety is one of the most important psychological issues that affect student's life and education.[1] Several studies have shown that university students' moderate and severe social anxiety reaches 22.4%.[2]

Moreover, university students' different levels of social anxiety affect their social performance.[3] The fear and avoidance

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of social occasions and crowds often lead to severe psychological impairment and other psychological disorders, such as depression and compulsion, which seriously affect the healthy development of personality.[4] Interpretation bias is a critical variable among patients with social anxiety—the tendency toward the negative interpretation of ambiguous social situations.[5] Interpretation bias is considered a metacognitive phenomenon resulting from aberrant information processing.[6] People with social anxiety tend to make biased interpretations in social situations. For instance, they would probably interpret facial expressions as negative rather than neutral or positive.[7] As mentioned, when confronting new social occasions, they tend to interpret them threateningly due to their prejudice. Also, they have experienced various negative consequences, including increased anxiety and physical symptoms on social occasions. Moreover, they selectively recall the negative aspects of social occasions.

According to these findings, some researchers believe that interpretation bias is critical in maintaining and perpetuating social anxiety disorder.[8] Self-criticism is robustly associated with anxiety, and it is considered one of its factors. Excessive self-criticism is shown to be associated with a broad spectrum of psychological disorders, which can cause anger, anxiety, social avoidance, delinquency, personality disorders, interpersonal issues, and, ultimately, social maladjustment.[9] Self-criticism is considered a form of self-harm behavior that leads to stress and weakness. It is defined as having high expectations for themselves when trying to achieve goals. Self-critical individuals experience vulnerability when facing obstacles and setbacks on their way to success and their goals. They are prone to depression, extreme humiliation, guilt, unworthiness, and failure when they fail to reach high standards.[10]

Studies show self-criticism is robustly associated with social anxiety disorder, and individuals with social anxiety show high levels of self-criticism.[11] One of the cognitive components closely related to social anxiety is the focus of attention.[12] Self-focused attention is a type of cognitive processing that maintains negative emotions.[13] Self-focused attention is defined as an awareness of self-referent, internally generated information that stands in contrast to an awareness of externally generated information derived through sensory receptors. When individuals with social anxiety disorder enter a social occasion, they focus on detailed monitoring and observations of themselves.[14] It is not helpful since being aware of internal information, such as emotions, increases anxiety and mental images, which individuals may take as confirmation of their negative beliefs.[15] Many years of empirical work indicate exposure therapy's effectiveness in various anxiety disorders. Cognitive behavior therapy is considered the gold standard in the psychotherapeutic treatment of anxiety disorders. In particular, exposure to social occasions has been reported to effectively reduce social anxiety and overcome social avoidance.[16] Virtual reality exposure therapy is an alternative behavioral therapy and has shown initial clinical effectiveness in reducing anxiety symptoms. Moreover, it can significantly affect the assessment and treatment of mental disorders.[17]

Virtual reality exposure therapy simulates real-life occasions for the patients, such as anxiety and fear. Virtual reality exposure scenarios are very much like real-life situations, and it is possible to adjust situational factors such as the patient's exposure levels and control the reaction of others involved in the scenario.[18] Virtual reality exposure therapy can challenge the boundaries of everyday surrounding by providing a unique ability to stimulate environments.[19] Virtual reality treatment involves repeated exposure and allows therapists to practice with patients repeatedly, making training more straightforward and accessible.[20]

Besides, there is also the ability to control stimuli. Because therapists can observe what really happens in the real world and overcome the limitations of imaginal exposure, such as patients' inability to create mental images, this allows therapists to guide patients while observing and supporting them. Therefore, virtual reality exposure therapy is a valuable tool for mental health treatments by providing an exciting physiological and emotional experience for patients.[21] Thus, in a safe environment, patients can be exposed to others' negative reactions to help them learn that such situations are not dangerous. Therapists can also guide patients through challenging moments, even dealing with the public ridicule they fear the most.[22] For the effectiveness of virtual reality exposure therapy, it is essential that the patients feel that they are actually in the real world, and they have to be immersed in the environment. The more virtual reality imitates reality in terms of graphic clarity, different types of scenarios, and their dynamic adaptation to the patient's behavior, the more effective it will be.[23]

The results of the previous meta-analysis on the effectiveness of virtual reality exposure therapy for anxiety disorders showed that virtual reality exposure therapy significantly reduces anxiety symptoms.[24] Zainal *et al*.[25] (2021) showed that virtual reality exposure therapy significantly reduced social anxiety disorder symptom severity. Therefore, the current research completes the previous studies, which is in line with them, and it seeks to investigate the effectiveness of virtual reality exposure therapy on social anxiety

variables, including the focus of attention, self-criticism, and interpretation bias. According to our review, no research has been conducted on the mentioned variables, so further clinical research in this field would greatly help. The current research is the first regarding the effectiveness of virtual reality exposure therapy on the focus of attention, self-criticism, and interpretation bias in individuals with social anxiety disorder. Therefore, the current research attempts to show whether virtual reality exposure therapy significantly affects the focus of attention, self-criticism, and interpretation bias in university students with social anxiety.

Materials and Methods

Study design and setting

The current research was conducted using quasi-experimental research with pre-test and post-test control group design. The statistical population consisted of 53 university students. They were aged between 18 and 30 with social anxiety symptoms. They also visited Isfahan counseling centers in 1399 HS.

Study participants and sampling

Due to the pandemic COVID_19, 30 eligible university students were selected by convenience sampling, then randomly assigned to two groups (15 individuals each), 15 people in the experimental group and 15 people in the control group. Both groups were pre-tested, and the experimental group received virtual reality exposure therapy. However, the control group did not receive any treatments; then post-test was conducted.

Eligibility and inclusion criteria

Participants must be university students aged between 19 and 30 with no multiple acute psychiatric. They must be diagnosed with social anxiety disorder, confirmed by a clinical psychologist.

Exclusion criteria

Participants must have one psychotic disorder or the full criteria of other mental disorders.

Statistical analysis was performed by using the SPSS-25 software and the Covariance method.

Data Gathering Tools and Techniques

Revised interpretation bias inventory

The revised interpretation bias inventory was applied in the present research. The questionnaire has two versions, the self-relevant version (22 items) and the other relevant version (22 items). Each version comes with subscales of ambiguous social situations or scenarios (15 items) and ambiguous non-social situations or scenarios (7 items). Each item includes three interpretive options with positive, negative, and neutral connotations. The interviewee must rate them on a scale of 1 to 3. After the occurrence of the scenario, whatever comes to the interviewee's mind immediately must be given a scale of 1 and 0 for whatever comes to last their mind, and the remaining option is given a scale of 2. Both versions of the questionnaire have high internal consistency; the alpha coefficient of the self-relevant equals 0.85, and the other relevant version equals 0.88, both with good ecological validity.[26] In a study, the internal consistency of both the self-and-relevant versions was reported as 0.83 and 0.79, respectively, using Cronbach's alpha method.[27] In the present study, the calculated Cronbach's alpha coefficient for the entire questionnaire was equal to 0.81.

Display, headset, and social phobia treatment application based on virtual reality technology

In this research, a three-dimentional application based on virtual reality technology was used for exposure therapy; It is called Speech Trainer and made by the Stream companies. The therapy consisted of eight sessions lasting from 10 to 20 minutes. In a simulated environment, the participant started observing and presenting a text in the presence of the audience. In order to make it happen, they were given a virtual reality (VR) headset, a microphone to hear the reflection of their voice, and two remote controls; one as a laser pointer and the other as a microphone [Table 1].

Levels of self-criticism scale

This questionnaire was designed by Thompson and Zuroff (2004) to measure Comparative Self-Criticism and Internalized Self-Criticism. It is a 22-item self-report questionnaire on a scale of 7, ranging from 0 (strongly disagree) to 6 (strongly agree)[28] Another research reported an appropriate internal consistency (Cronbach's Alpha = 0.90) for this scale.[29] In Iran, the validity and reliability of self-criticism were calculated using Cronbach's alpha. The calculated value for the comparative and internalized self-criticism was reported as 0.87 and 0.55, respectively.[30] The reliability of the present questionnaire was calculated using Cronbach's alpha, which equals 0.84.

Social phobia inventory

This questionnaire was first developed in 2000 by Connor *et al*.[31] to measure social anxiety. It is a 17-item self-report questionnaire composed of three subscales: Fear (six items), avoidance (seven items), and physiological symptoms (four items), and each item is measured on a 5-point Likert scale. The subscale scores are obtained by summing the scores of its items. The test-retest validity of this scale in individuals diagnosed with social phobia is 0.78 to 0.89, and its internal consistency is reported in normal individuals as 0.94. In another research on an Iranian sample, the reliability of this scale was obtained

Table 1: A Summary of Virtual Reality Therapy Sessions Protocols

Session	Content of Sessions
1	acquaintance interview; conducting the pre-tests, making the participant familiar with the concept of social anxiety, therapy procedures, tools, and equipment; simulating a public place for the participant using VR (as the audience in a conference hall is observing them)
2	Leaving the participant in a virtual conference hall under constant observation by the audience, then discussing anxiety triggers during the presentation.
3	Rehearsal of the second session: Leaving the participant in a virtual conference hall under constant observation by the audience, then discussing anxiety triggers during the presentation
4	Leaving the participant in a conference hall under constant observation by the audience; then they are asked to read a text for the audience loud and clear.
5	Rehearsal of the fourth session: Leaving the participant in a conference hall as they are under constant observation by the audience; then they are asked to read a text for the audience loud and clear
6	Leaving the participant in a seminar hall as they are under constant observation by the audience, then they are asked to make a speech from a provided text while making eye contact with the audience
7	Rehearsal of the sixth session: Leaving the participant in a seminar hall as they are under constant observation by the audience, then they are asked to make a speech from a provided text while making eye contact with the audience
8	We continue the practice of being in a virtual conference hall, under constant observation by the audience, and presenting a new provided text in a more extended period than the previous ones while making more prolonged eye contact with the audience. The post-tests will be taken from the participant using the same tools as the pre-test immediately after this session.

(Adapted from North, North, and Koble's Virtual Reality Therapy Protocol)

by Cronbach's alpha and reported as 0.94 and the test-retest coefficient of 0.96.[32] In the mentioned research, Cronbach's alpha coefficient for the whole questionnaire was found to be 0.86.

Focus of attention questionnaire

This questionnaire was developed by Woody, Chambless, and Glass to assess the focus of attention of individuals with social anxiety in social situations. The FQA is a self-report measure and consists of five-item subscales to assess self-focused attention (FAQ_{inter}) and other-focused attention (FAQ_{extern}). Each item is indicated on a 5-point Likert scale (1 = not at all to 5 = the whole time). Participants respond to each item based on their perception of the previous social attractions. The score of each subscale is obtained by summing the scores of all five items. The Cronbach's alpha coefficient for the subscales of self-focused attention and other-focused attention was reported to be 0.76 and 0.72, respectively. The construct validity of this scale using principal component analysis was investigated by Woody *et al*.[33]; they also confirmed the two-factor structure. In Iran, the internal consistency coefficient for the subscales of self-focused attention and other-focused attention was reported as 0.75 and 0.86, respectively.[34] The reliability of the present questionnaire was calculated using Cronbach's alpha, which was 0.82.

Ethical considerations

According to the ethical principles in the research, the participants were assured that their information would be confidential, and an informed consent form was given to all the participants. This research has achieved the code of ethics from the Islamic Azad University of Isfahan (Khorasgan) under the number IR.IAU.KHUISF.1399.215.

Findings

Table 2 shows the demographic characteristics of the research sample.

According to the Chi-square test results, there is no significant difference in the distribution of variables of education, age, and level in the two groups ($P < 0.05$). Descriptive indices related to the research variables are presented in Table 3 by type of test and group. First, the assumptions of this test were examined.

Multivariate analysis of covariance (MANCOVA) was used to investigate the effectiveness of virtual reality of exposure therapy with the scales of focus of attention, self-criticism, and interpretation bias in patients with social anxiety disorder.

Table 4 shows the normality of data distribution for all variables in both groups, including the pre-test and post-test stages. Besides, in Levene's test, the variable F is not significant for all variables. Therefore, this assumption that the variances are equal is tenable. The assumption of homogeneity of the variance-covariance matrices for the variables is fulfilled. The results of the multivariate analysis of covariance (MANCOVA) on the post-test stage after controlling the effects of the pre-test have been presented in Table 5.

The multivariate analysis of covariance results showed a significant difference between the mean of focus of attention, self-criticism, and interpretation bias in the experimental and control groups. The results indicate the effectiveness of virtual reality exposure therapy compared to the control group.

Discussion

The present study was designed to determine the effect of virtual reality exposure therapy on the attention of focus, self-criticism, and interpretation bias. The results of this investigation indicated that virtual reality exposure therapy significantly affects the focus of attention,

Table 2: Frequency distribution table and percentage frequency of the research groups

Variable	Virtual Reality Exposure Therapy			Control Group	
	Frequency	Frequency %		Frequency	Frequency %
Education					
BA student	8	53/3		10	66/7
MA student	7	46/7		5	33/3
Total	15	100		15	100
Chi-Square			0/56		
Significance			*P*=0/98		
Age					
Up to 20	3	20		2	13/3
21 to 25	8	53/3		9	60
26 to 30	4	26/7		4	26/7
Total	15	100		15	100
Chi-Square			6/87		
Significance			*P*=0/81		
Social Anxiety Levels					
Moderate	6	40		7	46/7
Severe	6	40		5	33/3
Very severe	3	20		3	20
Total	15	100		15	100
Chi-Square			0/17		
Significance			*P*=0/92		

Table 3: Mean and standard deviations for the two groups of the research variables

Variable	Stage	Control Group		Virtual Reality Exposure Therapy	
		M	SD	M	SD
Focus of attention	Pre-test	33/27	3/22	33/80	2/57
	Post-test	33/33	1/57	29/80	3/84
Self-criticism	Pre-test	77	13/92	81/67	16/05
	Post-test	76/93	13/87	73/07	13/51
Interpretation bias	Pre-test	87/67	9/79	93/54	8/28
	Post-test	91/73	3/90	87/53	8/54

self-criticism, and interpretation bias in university students with social anxiety disorder. Although extensive research has been carried out, no studies have specifically covered the mentioned criteria. However, the present findings are consistent with those of Fodor *et al*.[24] and Zainal *et al*.,[25] indicating that virtual reality exposure therapy has a promising effect on the treating social anxiety disorder.

The results imply that virtual reality exposure therapy helps them build courage and bravery to confront their weaknesses and failures. It also improves self-acceptance and a healthy sense of self-worth. Social anxiety leads to negative self-evaluations and, consequently, rumination and self-criticism. As a result, it makes individuals with social anxiety more vulnerable. They constantly feel anxious about being scrutinized and losing self-control; then, they feel guilty for having such emotions and continue with the rumination.[35] Deliberate and long-term exposure in a safe environment provides a virtual world and a safe environment for the patients so that they can evaluate their limitations and performance. Hence, they will undoubtedly experience less self-criticism and anxiety during the extinction process in the following sessions. Excessive and constant interpretation bias as a cognitive deficit can result in cognitive disorders. Individuals with social anxiety tend to interpret new social occasions as negative and threatening. Virtual reality exposure therapy creates a simulated social setting that reduces attention bias toward threats, negative self-evaluations, and interpretation bias. As a result, virtual reality exposure therapy reduces interpretation bias and ineffective judgments of individuals towards themselves. Moreover, virtual reality exposure therapy has increased other-focused attention in university students with social anxiety when confronting new situations and interacting socially. In virtual reality exposure therapy, individuals with social anxiety are more involved with external and other-focused attention than internal and self-focused. In other words, virtual reality exposure therapy is more focused on individuals and interactions in a social setting rather than the symptoms of the individuals.

Limitations and recommendation

The current investigation was limited to 18–30 university students with social anxiety disorder, and the findings cannot be transferred to the whole society. The most important limitation lies in the fact that it was not feasible to tailor a virtual reality exposure therapy (VRET) movie specifically for individuals. Future studies should therefore concentrate on individuals with social anxiety with no age limit. In addition, it is recommended to

Table 4: The results of the Shapiro-Wilk and Levene's test on research variables at the general level

Number	Variable	Shapiro-Wilk Test		Leven's Test		MBox Test	
		Statistics	Significance	Statistics	Significance	Statistics	Significance
1	Focus of attention (Pre-test)	0/96	0/39	-	-	46/55	0/06
2	Focus of attention (Post-test)	0/92	0/021	2/94	0/1		
3	Self-criticism (Pre-test)	0/94	0/08	-	-		
4	Self-criticism (Post-test)	0/96	0/39	1/35	0/25		
5	Interpretation bias (Pre-test)	0/96	0/35	-	-		
6	Interpretation bias (Post-test)	0/95	0/29	6/46	0/02		

Table 5: Results of the Multivariate Analysis of Covariance (MANCOVA) on the Post-Test Stage after Controlling the Effects of the Pre-Test

Variable	Resource of Changes	Sum of Squares	Degree of Freedom	Mean Square	Coefficient F	Significance Level	Eta Squared	Power of a Test
Focus of attention	Pre-test effect	163/87	1	163/87	57/86	0/001	0/71	1
	Group Membership	91/15	1	91/85	32/18	0/001	0/57	1
	Error	67/98	24	2/83	-	-	-	-
	Total	335/37	29	-	-	-	-	-
Self-Criticism	Pre-test effect	4014/45	1	401/454	486/54	0/001	0/95	1
	Group Membership	306/72	1	306/72	37/17	0/001	0/61	1
	Error	198/03	24	8/25	-	-	-	-
	Total	5360	29	-	-	-	-	-
Interpretation Bias	Pre-test effect	923/69	1	923/69	104/12	0/001	0/81	1
	Group Membership	76/07	1	76/07	8/57	0/007	0/26	0/80
	Error	212/91	24	8/87	-	-	-	-
	Total	1366/976	29	-	-	-	-	-

produce movies about other phobias covering different scenarios.

Conclusion

The results showed that virtual reality exposure therapy is effective in the focus of attention, self-criticism, and interpretation bias in university students with social anxiety disorder. This treatment could be used as a new method to treat social anxiety disorder and other similar ones.

The effect of Virtual Reality Exposure Therapy on Focus of Attention, Self-criticism, and Interpretation Bias.

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Conflicts of interest

There are no conflicts of interest.

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