




The effect of virtual reality therapy and counseling on students' public speaking anxiety

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Abstract

Background and Aims: One of the barriers to effective communication between speaker and listeners is public speaking anxiety (PSA). Over recent years, PSA has become common among students as the most widespread social anxiety (SA). Virtual reality (VR) and counseling therapy help reduce PSA. Therefore, the present study aimed to investigate the effect of VR therapy and counseling on students' PSA and SA.

Methods: This quasi-experimental study was conducted on 30 students at three levels of undergraduate, postgraduate, and PhD at Kerman University of Medical Sciences and Shiraz University of Medical Sciences (15 students in the intervention group and 15 in the control group). The intervention group observed four virtual classroom scenarios in a 30-min session, and the control group attended a 90-min group counseling session. Data were collected using by Personal Report of Public Speaking Anxiety, Liebowitz Social Anxiety Scale, and Igroup Presence Questionnaire. The data analysis was done using SPSS version 21. Descriptive analysis (frequency and percentage, mean, standard deviation, and quartiles) and analytical tests (paired *t*-test and independent *t*-test) were used to analyze the data.

Results: The results showed that VR and counseling did not affect SA scores and statistical differences before and after the intervention were not statistically significant. However, VR and counseling reduced PSA. The mean of IPQ/IGP (physical presence) was 63.73. The participants' SA means (93.76) were higher than the mean PSA (73.4).

Conclusions: VR and counseling did not affect students' SA, but they reduced PSA. If the intervention duration in future studies are longer, the effect of VR and counseling on reducing SA is likely to become more apparent.

KEYWORDS

counseling, public speaking anxiety, social phobia, students, virtual reality

Fatemeh Sarpourian and Taha Samad-Soltani contributed equally as first authors.

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1 | INTRODUCTION

Public speaking anxiety (PSA) disorder is the most common social anxiety (SA), prevalent among about 21% of the people,¹ which is described as debilitating anxiety and discomfort when communicating with the audience² and is more common in students.³ This disorder is associated with fear of social functioning, especially when the speech is in the presence of unfamiliar audiences. As a result, it disrupts communication and daily functioning, affecting social, academic, and job opportunities.⁴

Today, many student activities (e.g., class presentation, thesis defense, and job interview) require social interactions.⁴ Therefore, people who seek to gain a place in the current competitive environment should improve their public speaking and social communication skills. Due to the limited resources for developing social communication skills, students may be unable to control their speech anxiety. Therefore, this situation negatively affects their performance when presenting. An effective way to overcome the PSA is to practice in the field topics. If people have enough time to present in a real or similar environment, their level of anxiety decreases during the presentation. However, the limitations of everyday life, such as long distances and busy schedules, may not give people the opportunity to practice speaking. In particular, finding a crowd presentation environment, which is the most important factor in increasing people's anxiety level during the presentation, is almost impossible.⁵

A new approach for treating anxiety disorders is using virtual reality (VR) technology.¹ This technology is an innovative way to manage a wide range of health conditions⁶ and includes immersion in three-dimensional and simulated computer environments, allowing the user to interact with the real world by providing a visual and audio experience.⁷ The virtual environment provides consistent and predictable scenarios,¹ helps reuse and customize the environment and privacy, and is an attractive treatment for patients⁸ in a safe, practical, and realistic way.⁹ When using this method, people feel themselves in simulated conditions. This "feeling of being" in a virtual environment is called "presence."¹⁰ So, people can increase their speaking success by improving their skills and experiences in the simulated environment.⁵

Various studies have shown that VR can overcome speaking anxiety. Lindner et al.¹¹ used mobile-based VR therapy sessions, significantly reducing the speaking anxiety in both groups studied. Another study¹² showed that stimuli in simulated scenarios were equal to or even stronger than the real environment. Stupar-Rutenfrans et al.² confirmed the effectiveness of a quasi-experimental cross-sectional study of 360-degree VR-based video exposure therapy in reducing students' speaking anxiety. Studies on software engineering students have also proven the effectiveness of three-dimensional virtual environments in reducing the PSA.^{4,5}

Another way to help manage and control PSA is counseling.¹³ Counseling can be used as a useful means to assist students in reaching development, as well as being one the help to overcome SA troubles.¹⁴ Various studies have demonstrated that students who

experience counseling improve their stress and anxiety levels. Based on Rimonda's¹⁴ study, counseling in cognitive behavior therapy (CBT) groups directly impacts the endurance of academic stress. Moreover, to alter the beliefs, modifying attitudes, feelings, imaginations, behavior, exercising social skills, self-confidence, and assisting students in accepting themselves with their abilities and capabilities, this formulation also assists group members in perceiving how their beliefs affect what they feel and what they do. Madoni et al.¹⁵ examined the effectiveness of group counseling in reducing students' "public speaking anxiety" and concluded that counseling could reduce students' speech anxiety. Another study¹³ examined the effect of counseling on the PSA of six students. The findings of this study also showed that after receiving counseling students, their PSA levels decreased significantly.

Various studies have examined the effect of VR therapy or counseling on students' PSA.^{5,16–22} But none of these studies have examined and compared VR therapy and counseling in students' PSA.^{13,15–21,23–26} Therefore, this study investigates the effect of both VR therapy and counseling methods on anxiety on students' speech anxiety. In this study, we try to introduce the potential of these treatment methods to behavioral scientists, develop experimental knowledge of VR therapy and counseling, and reduce speaking anxiety in students. Accordingly, the first section of the research answers whether VR therapy and counseling influence students' speaking anxiety and if there is a difference between the two methods. Moreover, the relationship between SA and PSA is examined. We also evaluated the virtual scenario designed by the participants to understand how similar the virtual scenario was to the public speaking environment in the real world.

2 | MATERIAL AND METHODS

2.1 | Study design and settings

This study was a quasi-experimental study conducted in 2020 using a sampling method on 30 students who claimed speaking anxiety. Students were randomly divided into intervention and control groups. The intervention group observed four virtual classroom scenarios in a 30-min session, and the control group attended a 90-min group counseling session. Then, data were collected using the Liebowitz Social Anxiety Scale (LSAS), Personal Report of Public Speaking Anxiety (PRPSA), and Igroup Presence Questionnaire (IPQ/IGP). The ethics committee approved the protocol of this study at the Kerman University of Medical Sciences (KUMS) (IR.KMU.R-EC.1398.543). Furthermore, before intervention and data collection, informed consent was obtained.

2.2 | Study population and sample

The study population consisted of students of KUMS and Shiraz University of Medical Sciences (SUMS) (Iran) at three levels

undergraduate, postgraduate, and PhD. A convenience sampling method was applied to select the study participants, and 100 students of KUMS and SUMS who claimed to have experienced speaking anxiety in the initial interview were invited to the study on June 7, 2020. We sent an invitation to 100 students through WhatsApp and Telegram. The invitation explained the purpose of the study, emphasized the voluntary and anonymous participants, and outlined the extent of confidentiality. Forty-five students accepted our invitation. Finally, 30 students were selected to participate in the study according to the inclusion and exclusion criteria. Inclusion criteria included: students' claims about speaking anxiety, no experience of participation in VR studies, not receiving psychology training before joining the study, and tendency to view all four scenarios in one session.

Exclusion criteria included major vision and hearing impairment, speech or hearing disorders, mental and cognitive disorders, history of heart disease, and hypertension. It should be noted that, as in the study of Guitard et al.¹⁰ because the designed scenarios of VR and the use of headset may exacerbate heart disease and hypertension patients, this group was excluded from the study.

Students were randomly divided into case and control groups (15 in the intervention group and 15 in the control group).

2.3 | Measurement tools

The paper questionnaires included LSAS, PRPSA, and IPQ/IGP. The purpose of the three questionnaires LSAS,^{4,5,8,11,27,28} PRPSA,¹¹ IPQ/IGP^{1,12,29,30} is to assess the level of SA, PSA, and sense of presence in a virtual environment, respectively. Various studies have shown that the effectiveness of VR on speaking anxiety can be assessed using these three questionnaires.

The LSAS³¹ is a 4-point Likert questionnaire that evaluates SA, fear, and avoidance across several social states. LSAS contains 24 items, each of which is listed separately for the fear or anxiety subscale (from 0: none to 3: severe) and the avoidance behavior subscale, that range from zero to three and are based on the percentage of time avoiding the special situation (0 = never; 1 = occasionally [10%]; 2 = often (33%–67%); and 3 = usually [67%–100%]). Moreover, to the fear and avoidance subscales, the LSAS is further divided into two subscales for scoring, including performance situations (13 items) and social interaction (11 items). Thus, a general score is derived along with six extra scores based on fear and avoidance: “total fear, fear of social interaction, fear of performance situations, total avoidance, avoidance of social interaction, and avoidance of performance situations.” The scoring scale for this questionnaire is as follows:

- 0–54: Mild SA;
- 55–65: Moderate SA;
- 66–80: Marked SA;
- 81–95: Severe SA;
- Greater than 95: Very severe social phobia (anxiety).

In this study, we used the Persian version of LSAS. The reliability, validity, and confirmatory factor structure of the Persian version of

the LSAS Scale were studied by Hasani et al.³¹ on 453 students. The internal correlation of the questionnaire is between 0.81 and 0.92.^{4,5,8,11,28,32,33} Its Cronbach's α range (from 0.82 to 0.95) indicated an internally consistent Persian version of this questionnaire. Moreover, the correlation coefficients between subscales were high (0.70–0.96).

PRPSA is a useful measure for investigation which centers on PSA. PRPSA English questionnaire contains 34 items, and its scores fall into five groups (numbers in parentheses are percents of a normalized group fitting each group): scores of 34–84 represent low anxiety (5%); 85–92 moderately low anxiety (5%); 93–110 moderate anxiety (20%); 111–119 moderately high anxiety (30%); and 120–170 high anxiety (40%). Also, the participant's score should be between 34 and 170. If their score is below 34 or above 170, there is a mistake in computing the score.

We translated it into Persian and confirmed cross-cultural validity. The questionnaire is scored by the first summation of the 22 positive items, then summing the scores of the conversed items, and eventually subtracting the sum from 132.³⁴ The Persian version of the short PRPSA validity was examined by two medical informatics experts (with a history of scientific-research activities related to VR), five psychiatrists and psychologists and two health information management. Its reliability was examined after completing the questionnaire by 25 students of KUMS. Good scale reliability (Cronbach's $\alpha = 0.74$) was observed. Each item is rated on a 5-point Likert scale (from 0: strongly disagree to 5: strongly agree).

Another questionnaire used in the present study was IPQ/IGP, which measures the sense of presence in a virtual environment. The original version of this questionnaire is in English with 13-item. This 13-item questionnaire includes the following three subscales:

- Spatial presence;
- Participation (determining the ability to attract people's attention);
- Realistic evaluation (showing whether the user knows the environment as a real one).

Each item is on a 7-point Likert scale with variable values ranging from 0 to 6. Therefore, the scores of the people were within the range of 13 to 91.³⁵

In this study, we used the Persian version of this questionnaire. Its validity and reliability have been confirmed by Panahi-Shahri et al.³⁰ on 118 male volunteers. IPQ/IGP factor analysis led to the extraction of three factors, that is, realism, presence, and participation that explained the common variance of 0.64. The internal consistency, summative, and remeasured validity coefficients of this questionnaire were 0.87, 0.85, and 0.74. The correlation of the three scales with each other and the total score of the sense of presence was significant.³⁰

We also used IPQ/IGP for Quality assessment of the designed virtual scenarios. For this purpose, we calculated quartiles (first quarter = unsuitable, second-quarter = medium, third-quarter = good, and fourth quarter = excellent).

It should be noted that the demographic items in all three questionnaires included age, gender, and level of education.

2.4 | Intervention and data collection

Before starting the study, we first simulated the study process through different scenarios. These scenarios included a virtual classroom. The video was played in four parts for 30 min. The first part was 5 min and included the arrival of students and professors. The second part was 10 min, in which the student had to speak in two 3-min intervals about using social media in the health field (4 min were spent for the occurrence of speech stimuli). The third part was 10 min, during which the student had to give a speech in two 3-min intervals (4 min were spent talking to the judges as anxiety-inducing stimuli). Finally, the fourth part was 5 min. In this section, the reviewers asked questions, and the student answered them. To make the environment more realistic, stressful stimuli, such as the ringing of a mobile phone and the entrance and exit of people, were considered. The researcher wrote the draft script according to the objectives of the research. After experts in the field assessed its validity, the scenarios were developed by researchers.

To evaluate the effectiveness of a new treatment (e.g., VR therapy) with traditional treatment (e.g., counseling) to reduce students' speech anxiety, we randomly divided the students into the case and control groups, and then informed consent was obtained from the participants. Fifteen students in the control group were invited to the Rahe Sabz psychology clinic (Shiraz city, Iran). It should be noted the Rahe Sabz psychology clinic has been established in the field of psychological counseling and deals with the problems of psychology and psychiatry of children, adolescents, and adults individually, in groups and in families. One psychiatrist and four PhDs in psychology provide services to people at this clinic. In addition to the possibility of face-to-face counseling and referral for people, this clinic also has facilities such as audio and video training, online visits, and online prescribing. Before receiving psychological counseling, the purpose and protocol of the study and how to complete the questionnaires were explained to them. Then, participants completed the LSAS and PRPSA questionnaires. After completing the questionnaires, the psychologist asked each participant to introduce themselves in the present session and talk about themselves for 5 min. Then, the clinical psychologist advised them on how to reduce the stress and anxiety of public speaking, successful speech techniques, and ways to manage and control anger

during public speaking for 90 min. Five minutes after receiving the counseling, the students again completed the LSAS and PRPSA questionnaires, and we collected them immediately.

Fifteen students in the intervention group were invited to KUMS. For this group, a simple three-dimensional virtual environment similar to a real classroom was developed to examine its effect on reducing the participants' anxiety levels. The draft scenario was written by the researcher. During an agile process, the intended environment was filmed using the Samsung 360-degree 2017 Gear Camera and video editing software programs, such as After Effects and Premiere. The development team consisted of designers and researchers. The virtual classroom was prototyped until a stable and acceptable version was reached (Figure 1). A smartphone of model Samsung Galaxy A5 2016 with a gyroscope sensor and Quilo VR box headset was used to run the program. For intervention, the students first completed the LSAS and PRPSA questionnaires. Then, to use the headset, the VR player software was first installed on the phone by the researcher. The necessary explanations were given about the headset use and users' role in the virtual interactive environment. The immersion in the environment was produced by watching four separate scenarios for about 30 min. Due to the Covid-19 pandemic, the intervention meetings were held individually. After observing the first scenario, the participants interacted with the virtual audience, talked about the use of social media in the health field, and answered their predesigned questions. During the intervention, students experienced the audience's behaviors in the virtual environment, including cell phone use, yawning, predetermined questions, leaving the class, and talking to each other. Therefore, people had the opportunity to reduce their worries and anxieties before being in the real world. Immediately after the intervention, the IPQ/IGP and the LSAS and PRPSA questionnaires were completed by the students and then collected. Finally, the effectiveness of each treatment method in each group and between the two groups was compared.

2.5 | Data analysis

Before analysis, data were tested for normality and appropriate parametric or nonparametric tests were used. The Shapiro–Wilks



FIGURE 1 The virtual classroom scenario in the Quilo VR box headset. VR, virtual reality.

test was used to check the normality of data distribution. The results of this test showed that the data in both the intervention and control groups have a normal distribution ($p \geq 0.05$). Demographic characteristics of individuals were analyzed by descriptive analysis (frequency and percentage, mean, and standard deviation [SD]). In the intervention and control groups, the paired *t*-test was used to compare the mean of LSAS and PRPSA before and after the intervention. The independent *t*-test was used to compare the difference between the two groups before and after the intervention. Moreover, to calculate the IPQ/IGP scores of the virtual scenario by students, the mean, SD, and quartiles were calculated. The data analysis was performed using SPSS version 21.

2.6 | Ethical considerations

For this study, the code of ethics with the number IR.KMU.R-EC.1398.543 was obtained from the ethical committee of KUMS. Personal identifiers were not included in the questionnaire to maintain confidentiality.

3 | RESULTS

The CONSORT flowchart is presented in Figure 2. This Figure describes the participant flow through the course of the study. Of the 100 participants who were recruited, 70 people were excluded from the study, and the remaining participants were randomized to either the intervention ($n = 15$) or the control ($n = 15$).

A total of 30 students (15 in the intervention group and 15 in the control group) were recruited for this study, and all 30 students completed the questionnaires. Table 1 shows Participants' characteristics. The frequency of female participants was higher than men (76.7%). Most age groups were 20–30. Also, most of the participants were Undergraduate.

Table 2 compares LSAS results before and after the intervention separately for each group. The results of the intervention group indicated the mean LSAS (SA of people) being equal to 95.80 (SD = 12.72) and 77.20 (SD = 16.07), before and after using the VR headset, respectively. This implies that although the score of LSAS declined, the difference was not statistically significant ($p = 0.123$). In the control group, the mean LSAS before and after psychological counseling was found at 94.56 (SD = 16.85) and 75.73 (SD = 19.37),

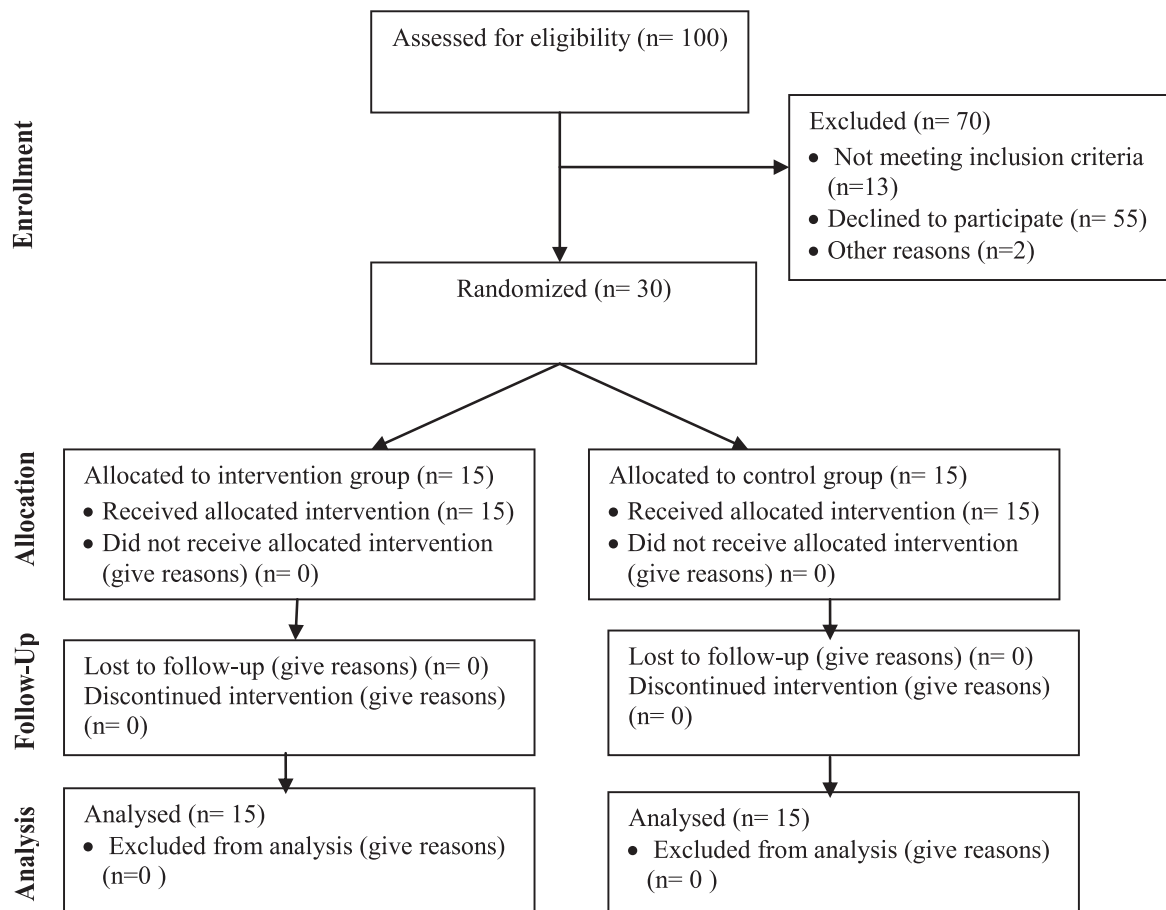


FIGURE 2 Consort table showing participants

TABLE 1 Participants' characteristics

Variable	Frequency (%)
Gender	
Male	7 (23.3)
Female	23 (76.7)
Age	
20–30	19 (63.33)
31–40	6 (20)
41–50	5 (16.66)
Education level	
Undergraduate	15 (50)
Postgraduate	8 (26.7)
PhD	3 (10)

TABLE 2 Comparison of LSAS results before and after the intervention separately for each group

Group	Mean	SD	p Value
Intervention (n = 15)	(before) 95.80	(before) 12.72	0.123
	(after) 77.20	(after) 16.07	
Control (n = 15)	(before) 94.56	(before) 16.85	0.052
	(after) 75.73	(after) 19.73	

Abbreviation: LSAS, Liebowitz Social Anxiety Scale.

TABLE 3 Comparison of LSAS results between the two groups before and after the intervention

Before/after	Control (n = 15) mean (SD)	Intervention (n = 15) mean (SD)	p Value
Before	94.56 (16.85)	95.80 (12.72)	1.79
After	100.20 (10.11)	99.4 (11.77)	0.31

Abbreviation: LSAS, Liebowitz Social Anxiety Scale.

respectively. This shows that, although the score of LSAS decreased, the difference was not statistically significant ($p = 0.052$) (Table 2).

Table 3 shows a comparison of LSAS results in intervention and control groups in before and after the intervention. Before the intervention, there was no significant difference between the intervention and control groups for LSAS. ($p = 0.48$). Also, the independent t -test in the two groups after the intervention did not show a significant difference ($p = 0.92$). However, because the mean LSAS in both groups increased slightly after the intervention, it can be said that the counseling and VR were ineffective in reducing LSAS.

A comparison of PRPSA results before and after the intervention separately for each group is shown in Table 4. In the intervention group the mean PRPSA before and after using the VR headset was obtained at 68.30 (SD = 29.33) and 60.28 (SD = 19.39), respectively. This shows that the score of PRPSA decreased, and the difference was statistically significant ($p = 0.001$). So, VR affected PRPSA scores.

TABLE 4 Comparison of PRPSA results before and after the intervention separately for each group

Group	Mean	SD	p Value
Intervention (n = 15)	(before) 68.30	(before) 29.33	0.001
	(after) 60.28	(after) 18.98	
Control (n = 15)	(before) 71.13	(before) 28.13	0.001
	(after) 58.49	(after) 29.31	

Abbreviation: PRPSA, Personal Report of Public Speaking Anxiety.

TABLE 5 Comparison of PRPSA results between the two groups before and after the intervention

Before/after	Control (n = 15) mean (SD)	Intervention (n = 15) mean (SD)	p Value
Before	71.13 (28.13)	68.30 (29.33)	0.89
After	70.56 (31.76)	63.83 (33.15)	0.90

Abbreviation: PRPSA, Personal Report of Public Speaking Anxiety.

TABLE 6 Descriptive table of IPQ/IGP

Maximum	Minimum	SD	Mode	Median	Mean	Variable
80	53	6.94	59	63	63.73	Intervention group

Abbreviation: IPQ/IGP, Igroup Presence Questionnaire.

In the control group, the mean PRPSA before and after the psychological counseling was obtained at 71.13 (SD = 28.13) and 58.49 (SD = 29.31), respectively. These results show that the mean PRPSA was reduced after counseling, and the difference was statistically significant ($p = 0.001$). This implies that counseling significantly affected PRPSA scores. So, it can be concluded that counseling was more effective than VR.

A comparison of PRPSA results between the intervention and control groups is shown in Table 5. Before the intervention, there was no significant difference between the intervention and control groups for PRPSA. ($p = 0.89$). Also, the independent t -test did not show a significant difference between the two groups after the intervention ($p = 0.90$). However, because the mean PRPSA decreased in both groups after the intervention, it can be concluded that counseling and VR affected reducing PRPSA.

The mean of IPQ/IGP (physical presence) in the intervention group was found at 63.73 and SD 6.94, respectively (Table 6).

Table 7 shows the quality assessment of the designed virtual scenarios with IPQ/IGP. According to this table, the answers of 14 (93.3%) of the students were in the third quarter, while 1 (6.7%) of the people were in the fourth quarter. This means that most participants rated the quality assessment of the designed virtual scenarios with IPQ/IGP as "good."

The means of SA and PSA were 93.76 (SD = 40.01) and 73.4 (SD = 19.67), respectively.

TABLE 7 Quality assessment of the designed virtual scenarios with IPQ/IGP

Percent	Frequency	Quartile
93.3	14	3
6.7	1	4
100	15	Total

Abbreviation: IPQ/IGP, Igroup Presence Questionnaire.

4 | DISCUSSION

This study investigates the effect of both VR therapy and counseling methods on anxiety on students' speech anxiety. Findings showed that both VR and counseling methods effectively reduced SA scores, but this difference was not statistically significant. Also, other findings showed that counseling and VR affected reducing PSA. Most participants rated the quality of the designed virtual scenarios as "good."

Various studies have shown that VR can reduce SA.^{36,37} In contrast, many studies have shown heightened self-reported SA and physiological outcomes when exposed to social environments in VR. In one meta-analysis,³⁸ the authors observed significantly worse treatment outcomes of VR for SA disorder when compared with control groups that received balanced amounts of in-vivo exposure. It has been proposed that it is more difficult to create VR environments for SA than other phobic disorders because human interaction is complicated and hence hard to realistically recreate, which may describe these outcomes.³⁹ Accordingly, the same meta-analysis established no significant difference in treatment efficacy for CBT with VR versus CBT with in-vivo exposure for agoraphobia and specific phobia.³⁸

On the other hand, although various studies have shown that counseling can reduce SA,^{14,40,41} the results of our study showed the opposite of the findings of these studies. Similar to our restricted understanding of key counseling components, we also have minimum information concerning the necessary parameters of consultation (e.g., active factors, essential dose, and frequency).⁴² There is some evidence that consultant expertise in evidence-based treatment may be associated with more accomplished treatment implementation and improved individual outcomes.⁴³ Another study proposes that consultants' comments concerning specific methods to use in upcoming sessions, rather than feedback on performance in former sessions, improve consequent therapist adherence.⁴⁴ Future studies should examine the content of consultation meetings more nearly for the differential impact that specific consultation methods have on counselors' competence and students' clinical outcomes.

The lack of effect of VR and counseling in reducing SA scores in the present study can be due to various reasons. According to similar studies,^{8,45,46} it can be said that the reason for the reduction in the SA scores was the high similarity of the virtual environment with the real world, attractive and practical scenarios, maintaining the confidentiality of students, and participation in previous interventions. On the other

hand, according to the results of opposing studies,^{10,47} one of the reasons for the lack of meaning or increase in SA scores may be too much immersion of students in scenarios, the weight of the headset, inappropriate location, the inexperience of the researcher, and the expressive power of the consultant. Social presence is the other concept theorized to have an important influence on treatment results and experiencing anxiety virtually. Social presence is conceptually different from the physical presence and defines the sensation of being in the presence of another, which needs a level of cognitive and emotional engagement.⁴⁴ No survey has examined the relationship between social presence and VR outcomes. Still, SA patients have demonstrated heightened copresence and reciprocal attention in response to virtual environments, suggesting it might be influential.⁴⁸ These links require further research to inform the treatment characteristics and modalities required for treating SA. Also, previous studies showed that social scenes,⁴⁹ avatars' body position,⁵⁰ and avatar's facial expression⁵¹ could evoke SA. Therefore, when designing VR environments and providing counseling to individuals, it is necessary to consider all aspects related to effectively reducing stress and anxiety, including the physiological and cognitive status of individuals and environmental influences.

The results of the PRPSA questionnaire showed that in both groups, the mean scores of speaking anxiety decreased, and this reduction was statistically significant in both groups. Premkumar et al.,¹⁶ by examining the effectiveness of VR therapy on public-speaking anxiety in students, concluded that VR could reduce the reduction in heart rate and self-reported anxiety and arousal in students. They believed increased self-exposure to virtual social threats from self-guided virtual-reality exposure therapy alleviates anxiety and shows immediate decreases in subjective and physiological arousal during the application. It also yields sustained recovery in PSA.¹⁶ In another study, Harris and colleagues^{18,24} examine the effectiveness of VR in reducing the PSA of students. The finding of their study indicated that VR therapy sessions effectively reduced PSA in university students. Studies have shown that reduced speech anxiety in VR environments may be due to reasons and that VR environment designers and consultants should always consider these reasons. According to similar studies,^{2,4,5,11} the reasons for the reduced speaking anxiety in similar studies were immersion and sense of presence, the presence of the therapist during the intervention, the researcher's experience, allocating appropriate time and place, and the sufficient number of sessions to study, providing exercises at home, showing three-dimensional videos to familiarize students with virtual scenarios before the main intervention, and considering different scenarios according to their level of anxiety. On the other hand, according to the results of the inconsistent study,¹ some factors might not be meaningful or increase the scores of speaking anxiety, such as observing scenarios in one session, unequal distribution of genders, differences in beliefs, differences in degrees and fields of study, community conditions, and lack of guides and a sufficient menu in the scenario.

As mentioned above, the findings of the study also showed that therapeutic counseling could effectively reduce students'

public-speaking anxiety. Giffin et al.²⁴ also examined the effect of group counseling on students' speech anxiety. Their study proved that counseling is highly credible for students who have less self-confidence in communicating with others and is effective in improving speech anxiety. In another study, Giffin et al.²³ also studied the effect of group counseling on students' self-perceived speech anxiety. In their study, it was established that counseling could further amend self-confidence in cases of speech anxiety. In another study,⁵² the impact of biofeedback and counseling in treating stress and anxiety in the college student population was examined. The results of this study showed that in the control group (therapeutic counseling) and the intervention group (therapeutic counseling and biofeedback training), the level of anxiety and stress decreased significantly. Still, this decrease was greater in the intervention group. Also, this study showed that acceptance of biofeedback training as an adjunct to traditional counseling can increase the effect of counseling therapy in reducing stress and anxiety among college students.⁵² Although conventional counseling approaches are often effective in assisting students when used alone, the investigation has shown that counseling may be even more effective when combined with alternative treatment methods such as biofeedback.⁵³ Therefore, along with counseling therapy, treatment methods such as biofeedback can be used to further reduce speech anxiety. Participating in behavioral basics courses to prepare people before the counseling process begins,⁵⁴ and the duration of the intervention (neither too long nor too short) can also increase the effects of counseling in reducing students' public-speaking anxiety.⁵²

5 | STUDY LIMITATIONS

When interpreting the results of this study, it is necessary to consider its limitations, which include the following:

1. Lack of evaluation of clinical or physiological characteristics of individuals during speaking, such as heart rate and skin temperature;
2. Financial difficulties in purchasing equipment and consulting costs;
3. The lack of psychological clinics' cooperation due to the lack of space and unaffordable individual counseling;
4. Receive the intervention in both groups and absence the third group as a control group.

Therefore, future studies may include physiological assessments, such as heart rate and skin temperature during speaking. According to the results of this study and given that no similar studies have been conducted, it is suggested to repeat it in appropriate conditions by allocating sufficient time, the number of sessions, more appropriate equipment; personal scenarios; providing home exercises; and considering different environments. Therefore, the health system is

suggested to create the necessary culture regarding using this method instead of traditional methods and encourage patients and therapists to use it. Due to time and budget constraints, developing a software program was impossible. Therefore, it is suggested to implement more comprehensive software programs in future studies. Furthermore, the effectiveness of this technology in other areas rather than psychiatry can be investigated. Finally, it is suggested that in future studies, the third group as a control group be added to the study, and the outcomes in all three groups be examined and analyzed.

6 | CONCLUSION

This study showed that VR and counseling did not affect reducing SA. Also, our study showed that counseling and VR effectively reduced students' PSA. In addition to counseling, VR as an emerging method could effectively treat students' PSA. VR has the potential to raise engagement with services and increase treatment effects before, during and after treatment. VR enables individuals with high PSA to voluntarily expose themselves to virtual social threats, decrease short-term anxiety and physiological arousal, and amend perceived PSA after the intervention.

The results of this study can help select patterns for applying PSA therapies, as they show various aspects of VR and counseling such as treatment duration, number of sessions and minutes, and content of VR exposures. It is proposed that empirical investigation on VR and counseling for treating SA and PSA in students be continued to provide more examples and end the literature inconsistency in this area. So, If VR technology and consulting are used in suitable conditions, with a larger sample size and for a longer period, their effectiveness in controlling and managing SA and PSA will probably become more apparent.

AUTHOR CONTRIBUTIONS

Fatemeh Sarpourian: Software; validation; visualization; writing – original draft; writing – review & editing. **Taha Samad-Soltani:** Resources; software; supervision; validation; visualization. **Khadijeh Moulaei:** Investigation; methodology; writing – original draft; writing – review & editing. **Kambiz Bahaadinbeigy:** Formal analysis; funding acquisition; project administration; resources; software; supervision; validation; visualization; writing – original draft; writing – review & editing.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

ETHICS STATEMENT

All methods of the present study were performed following the relevant guidelines and regulations of the ethical committee of Kerman University of Medical Sciences. Participation was voluntary, the consent was verbal, but all participants responded via email or text message to approve their participation. Participants had the right to withdraw from the study at any time without prejudice.

TRANSPARENCY STATEMENT

The lead author Kambiz Bahaadinbeigy affirms that this manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

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