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Impact of Virtual Reality Relaxation Training on Somatic Anxiety and Coping Strategies

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A B S T R A C T

This study aimed to evaluate the effectiveness of an eight-session Virtual Reality Relaxation Training (VRRT) program on reducing somatic anxiety and improving coping strategies in young adults. A randomized controlled trial was conducted with 30 participants from Armenia, randomly assigned to either an experimental group ($n = 15$) receiving VRRT or a control group ($n = 15$) placed on a waitlist. The intervention consisted of weekly 60-minute sessions over eight weeks, involving immersive virtual environments integrated with guided breathing, progressive muscle relaxation, mindfulness, and visualization. Somatic anxiety was measured using the Beck Anxiety Inventory (BAI), and coping strategies were assessed with the Coping Inventory for Stressful Situations (CISS). Assessments were conducted at three time points: pretest, posttest, and five-month follow-up. Data were analyzed using repeated measures ANOVA and Bonferroni post-hoc tests via SPSS-27. Repeated measures ANOVA revealed significant group × time interaction effects for both somatic anxiety ($F = 23.19$, $p < .001$, $\eta^2 = .462$) and coping strategies ($F = 19.66$, $p < .001$, $\eta^2 = .412$). Bonferroni post-hoc tests indicated that the experimental group showed a significant reduction in somatic anxiety from pretest to posttest ($p < .001$), which was sustained at follow-up. Likewise, significant improvements in coping strategies were observed in the experimental group ($p < .001$), with no significant change in the control group across time. The findings support the effectiveness of Virtual Reality Relaxation Training in reducing somatic anxiety and enhancing coping strategies, with sustained benefits observed up to five months post-intervention. VRRT offers a promising, immersive approach for anxiety management and resilience training among young adults.

Keywords: *Virtual reality, somatic anxiety, coping strategies, relaxation training*

1. Introduction

In recent years, the intersection of psychological intervention and immersive technologies has opened new avenues for addressing emotional dysregulation, particularly anxiety-related disorders. Among these technologies, Virtual Reality (VR) has gained substantial attention as a tool for psychological and behavioral health interventions. VR offers a dynamic, immersive environment capable of simulating real-life scenarios while ensuring a safe space for emotional engagement and skill acquisition. This makes VR particularly suitable for interventions targeting somatic anxiety—a form of anxiety characterized by physical symptoms such as muscle tension, rapid heartbeat, and gastrointestinal distress—as well as for improving individuals' coping strategies in stress-inducing situations (Amiri et al., 2023; Chen et al., 2024; Gungor et al., 2022).

Anxiety remains one of the most pervasive mental health challenges worldwide, and the somatic dimension of anxiety significantly affects both clinical and non-clinical populations. Traditional treatment approaches, such as pharmacotherapy and cognitive-behavioral therapy (CBT), though effective, may not appeal to all individuals due to issues of accessibility, stigma, or side effects. This has spurred interest in non-pharmacological, technology-assisted interventions like VR-based relaxation and exposure therapy (Hosseini et al., 2024; Tesfaye et al., 2024). Notably, VR interventions have demonstrated efficacy in reducing physiological arousal and enhancing adaptive emotional processing through structured relaxation scenarios, mindfulness, and controlled exposure (MacDonald, 2024; Mao et al., 2024).

VR's therapeutic potential is rooted in its capacity to activate presence—the psychological sensation of "being there" in a virtual environment—which facilitates focused attention and deeper emotional processing (Woods et al., 2022). A growing body of evidence supports the use of VR in treating preoperative anxiety (Amiri et al., 2023; Jamal et al., 2024), dental-related stress (Leopardi et al., 2023; Tesfaye et al., 2024), social anxiety (Huy, 2023; Kumar, 2023), and phobias (Arnfred et al., 2023; Caltabiano, 2025). These studies often reveal a dual benefit of VR exposure: a decrease in physiological stress responses and an increase in users' perceived control and emotional regulation.

Relaxation-based VR programs—particularly those incorporating guided breathing, progressive muscle relaxation (PMR), and mindfulness-based cognitive prompts—have been found to significantly reduce anxiety symptoms in clinical and subclinical populations (Lepilkina et al., 2023; Rougereau et al., 2023). VR-induced relaxation stimulates parasympathetic nervous system activity, which counteracts the hyperarousal typical of somatic anxiety. The inclusion of serene immersive environments, such as natural landscapes, has further been associated with reductions in muscle tension and cortisol levels (Smith et al., 2022; Zaki et al., 2024).

Research into VR's impact on coping mechanisms—the cognitive and behavioral efforts to manage internal and external stressors—has also been expanding. Effective coping is essential for mitigating the development of anxiety disorders and improving quality of life. VR-based training can facilitate the rehearsal of adaptive coping strategies by providing simulated scenarios that require decision-making under stress, allowing individuals to learn through experience without real-world consequences (Gungor et al., 2022; Meneses-Claudio & Auccacusi-Kañahuire, 2023). This is particularly relevant in populations that struggle with emotion-focused or avoidant coping styles, as immersive environments promote emotional engagement and problem-solving behavior (Natali et al., 2024).

The mechanisms underlying VR's effectiveness appear multifaceted. On a cognitive level, the novelty and immersion of VR enhance attentional focus, which disrupts negative thought cycles common in anxious individuals. Physiologically, VR scenes—especially those designed for relaxation—have been shown to modulate autonomic responses, such as reducing heart rate and blood pressure (Rişvan & Sü, 2024; Вакуленко et al., 2024). This physiological grounding supports users' ability to engage in the moment and adopt healthier coping responses. Furthermore, studies in various clinical settings—from oncology to perioperative care—support the long-term impact of VR on mental well-being when implemented over multiple sessions (Chen et al., 2024; Mao et al., 2024; Massov et al., 2024).

A particularly compelling aspect of VR training is its flexibility and adaptability across populations and conditions. For example, in cancer patients, VR mindfulness modules significantly reduced both somatic and emotional distress (Mao et al., 2024). In hemodialysis patients, even a brief VR exposure reduced procedural anxiety (Hosseini et al., 2024). In laboring women, VR-assisted relaxation during delivery fostered a sense of control and comfort (Massov et al., 2024). Such versatility suggests that VR has transdiagnostic utility and can be applied across clinical and non-clinical anxiety spectra, including educational settings and stress management workshops (Gungor et al., 2022; Wang et al., 2022).

Despite the promising findings, several gaps remain in the literature. Many previous studies have relied on single-session interventions, limited sample sizes, or lacked long-term follow-up to assess the durability of effects (Rougereau et al., 2023; Smith et al., 2022). Additionally, much of the research has focused on general anxiety or pain rather than isolating the somatic dimension of anxiety, which has distinct physiological correlates and treatment needs (Chen et al., 2024; Lepilkina et al., 2023). Furthermore, while coping strategies are often mentioned in VR literature, few studies have directly measured changes in coping behaviors as primary outcomes (Huy, 2023; Meneses-Claudio & Auccacusi-Kañahuire, 2023).

To address these gaps, the current study examines the effectiveness of a structured 8-session Virtual Reality Relaxation Training (VRRT) program in reducing somatic anxiety and enhancing coping strategies in a sample of young adults in Armenia.

2. Methods and Materials

2.1. Study Design and Participants

This study utilized a randomized controlled trial (RCT) design to evaluate the effectiveness of a Virtual Reality Relaxation Training (VRRT) program on somatic anxiety and coping strategies. A total of 30 participants were recruited through public advertisements and university health centers in Yerevan, Armenia. Eligibility criteria included: age between 18–35 years, elevated somatic anxiety scores based on the Beck Anxiety Inventory (BAI), no prior experience with virtual reality therapy, and no diagnosis of severe psychiatric or neurological disorders. After baseline assessment, participants were randomly assigned to either the experimental group (n = 15), which received the VRRT intervention, or a control group (n = 15), which was placed on a waitlist and received no intervention during the study period. All participants provided written informed consent. The study was conducted over a period of five months, including an 8-week intervention and a five-month post-intervention follow-up to assess the stability of treatment effects.

2.2. Measures

2.2.1. Anxiety

The Beck Anxiety Inventory (BAI), developed by Beck, Epstein, Brown, and Steer in 1988, is a widely used self-report inventory designed to assess the severity of anxiety symptoms, with a particular emphasis on somatic manifestations of anxiety. The BAI consists of 21 items, each describing a common symptom of anxiety (e.g., "numbness or tingling," "heart pounding," "hands trembling"). Respondents rate how much they have been bothered by each symptom during the past week on a 4-point Likert scale ranging from 0 (not at all) to 3 (severely – it bothered me a lot), yielding a total score range from 0 to 63. The BAI is especially sensitive to somatic symptoms of anxiety, making it appropriate for use in interventions targeting physical manifestations of stress. The tool has demonstrated high internal consistency (Cronbach's α = .92) and test-retest reliability (r = .75 over one week) across clinical and non-clinical populations. Its validity has been supported through correlations with other established measures of anxiety and its ability to discriminate between anxious and non-anxious groups in numerous studies.

2.2.2. Coping Strategies

The Coping Inventory for Stressful Situations (CISS), developed by Endler and Parker in 1990, is a standardized measure that assesses individual differences in coping styles when facing stress. The CISS includes 48 items, divided into three major coping strategy subscales: Task-Oriented Coping, Emotion-Oriented Coping, and Avoidance-Oriented Coping (which can further be broken into Distraction and Social Diversion components). Respondents rate each item on a 5-point Likert scale ranging from 1 (not at all) to 5 (very much), indicating the frequency of each coping behavior in stressful situations. The CISS is suitable for both clinical and non-clinical populations and has been extensively used in psychological intervention studies. It exhibits strong psychometric properties, including good internal consistency (Cronbach's α ranges from .76 to .92 across subscales) and construct validity supported by confirmatory factor analyses and correlations with related constructs such as personality traits and stress levels. This tool is well-suited to evaluating changes in coping styles following relaxation-based interventions such as virtual reality training.

JPPR Journal of Personality and Psychosomatic Research
E-ISSN: 3041-8542

2.3. Intervention

The Virtual Reality Relaxation Training (VRRT) program was conducted over eight consecutive weekly sessions, each lasting 60 minutes, and delivered individually in a controlled environment. The intervention was designed to immerse participants in soothing and interactive virtual environments while integrating evidence-based relaxation techniques such as guided breathing, progressive muscle relaxation, and cognitive coping prompts. The goal was to alleviate somatic symptoms of anxiety and enhance adaptive coping strategies by fostering mindfulness, physical relaxation, and emotional regulation. Each session combined psychoeducation, virtual immersion, and reflection exercises to promote progressive learning and transfer of skills to real-life settings.

Session 1: Orientation and Baseline Immersion

The first session introduced participants to the purpose and structure of the VRRT program. After informed consent and rapport-building, participants received a brief psychoeducation module on the nature of anxiety, somatic symptoms, and the physiological stress response. This was followed by a 15-minute introduction to virtual reality equipment and safety instructions. Participants then engaged in their first virtual experience—an immersive 10-minute guided forest walk focused on observing nature and synchronizing breath with ambient sounds. The session concluded with a short debrief and reflection journal entry on physical sensations and emotional responses.

Session 2: Breathing Regulation in Virtual Calm

This session focused on diaphragmatic breathing and respiratory control techniques to reduce somatic arousal. Participants were immersed in a tranquil virtual beach environment, where visual cues (e.g., expanding and contracting orbs) guided rhythmic breathing for 20 minutes. The first 10 minutes included in-headset audio instruction, while the next 10 minutes encouraged autonomous practice. Pre- and post-session ratings of somatic tension were collected. A discussion followed on how breath regulation can serve as an adaptive coping strategy in daily stress situations.

Session 3: Progressive Muscle Relaxation (PMR)

Building on the previous session, this session integrated progressive muscle relaxation (PMR) with a serene virtual mountain lake scene. Participants followed a structured 20-minute PMR script delivered through the VR headset, alternating muscle contraction and release while seated in a relaxed posture. The guided script synchronized with calm environmental sounds and dynamic visuals (e.g., water ripples with each relaxation phase). The final part of the session involved processing physical awareness and identifying body tension cues, reinforcing self-monitoring skills.

Session 4: Mindful Observation and Grounding

This session emphasized mindfulness and present-focused attention within a rich virtual environment (e.g., Japanese zen garden). Participants were guided to focus attention on sensory details such as textures, colors, and sounds without judgment. The VR program included a 15-minute audio guide followed by 10 minutes of silent mindful immersion. After the experience, participants engaged in reflective discussion on how mindfulness helps regulate emotional reactivity and prevent maladaptive coping such as avoidance or rumination.

Session 5: Visualization and Safe Place Creation

This session introduced guided visualization techniques to develop an internal "safe place." Participants were guided to co-create a comforting virtual space based on preferred elements (e.g., fireplace, waterfall, forest cabin). Within the headset, they engaged in a 15-minute semi-personalized scene paired with calming narration. The goal was to foster a reliable internal coping image for use outside the VR context. Participants were encouraged to draw or write about their safe place and practice recalling it during daily stress encounters.

Session 6: Emotional Regulation and Reframing

This session focused on emotional awareness and cognitive reframing strategies, with exposure to mildly stress-inducing but manageable VR scenes (e.g., walking through light crowds or speaking in a meeting setting). Participants practiced identifying emotional responses and were coached through adaptive thoughts and breathing regulation while remaining in the environment. The emphasis was on recognizing automatic thoughts, slowing physiological arousal, and choosing constructive interpretations—a critical transition toward more active coping strategies.

Session 7: Coping Strategy Integration and Rehearsal

Participants engaged in a scenario-based virtual simulation where real-life stressors were portrayed (e.g., exam room, job interview). With prior skills consolidated, they were prompted to select and implement coping strategies (e.g., breath control, grounding, reframing) in the moment. The VR system offered minimal guidance, allowing autonomy. Afterward, a structured reflection discussion was held to evaluate which strategies were used, how effective they felt, and how they could be transferred to actual challenges.

Session 8: Consolidation, Generalization, and Closure

The final session served as a review and consolidation of all relaxation and coping strategies learned. Participants revisited their favorite VR scenes for a 10-minute immersion and engaged in a reflective discussion on progress, challenges, and personal growth. They completed a post-intervention self-assessment and created a personal coping plan incorporating VR and non-VR techniques. Participants were encouraged to continue using brief virtual modules (if available) or imagery-based alternatives. The session concluded with a motivational summary and program feedback.

2.4. Data Analysis

Data were analyzed using SPSS version 27. To assess changes in somatic anxiety and coping strategies across time and between groups, a repeated measures analysis of variance (ANOVA) was conducted with three time points: pretest, posttest, and five-month follow-up. The model included one between-subject factor (Group: Experimental vs. Control) and one within-subject factor (Time). A Bonferroni post-hoc test was applied to identify specific pairwise differences between time points within each group. The level of statistical significance was set at $p < .05$, and partial eta squared (η^2) was reported to determine effect sizes.

3. Findings and Results

The final sample consisted of 30 participants, with 18 females (60.3%) and 12 males (39.7%). The mean age of participants was 24.6 years (SD = 3.9), ranging from 19 to 33 years. Regarding educational background, 14 participants (46.7%) had completed undergraduate education, 10 participants (33.4%) were currently enrolled in graduate programs, and 6 participants (19.9%) held postgraduate degrees. Employment status indicated that 17 participants (56.8%) were students, 9 (30.1%) were employed part-time, and 4 (13.1%) were unemployed at the time of the study. No significant differences in demographic variables were found between the experimental and control groups at baseline ($p > .05$).

Table 1

Means and Standard Deviations for Somatic Anxiety and Coping Strategies by Group and Time

Variable	Time Point	Experimental Group (n = 15)	Control Group (n = 15)
Somatic Anxiety	Pretest	M = 27.46, SD = 4.72	M = 27.13, SD = 5.08
	Posttest	M = 17.39, SD = 3.95	M = 25.88, SD = 4.97
	Follow-up	M = 18.21, SD = 4.01	M = 26.31, SD = 5.12
Coping Strategies	Pretest	M = 105.27, SD = 9.64	M = 106.12, SD = 9.47
	Posttest	M = 121.86, SD = 8.75	M = 107.44, SD = 9.29
	Follow-up	M = 120.39, SD = 8.96	M = 107.73, SD = 9.35

At pretest, both groups exhibited comparable levels of somatic anxiety and coping scores. After the intervention, the experimental group showed a substantial reduction in somatic anxiety (M = 17.39), whereas the control group remained relatively stable (M = 25.88). These gains were largely maintained at follow-up (M = 18.21). Regarding coping strategies, the experimental group improved from a baseline of M = 105.27 to M = 121.86 at posttest and sustained these improvements at follow-up (M = 120.39). The control group showed no meaningful change over time (Table 1).

Before conducting the repeated measures ANOVA, the assumptions of normality, homogeneity of variances, and sphericity were examined and met. Shapiro-Wilk tests for normality indicated that all variables were normally distributed across time points (e.g., pretest somatic anxiety: $W = 0.968$, $p = .451$; follow-up coping strategies: $W = 0.981$, $p = .673$). Levene's test confirmed homogeneity of variance between groups ($F = 1.34$, $p = .257$ for somatic anxiety; $F = 1.01$, $p = .311$ for coping strategies). Mauchly's test of sphericity was non-significant for both dependent variables (somatic anxiety: $\chi^2(2) = 3.12$, $p = .210$; coping strategies: $\chi^2(2) = 2.67$, $p = .244$), indicating the assumption of sphericity was upheld. Therefore, repeated measures ANOVA was deemed appropriate for the analysis.

JPPR
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Table 2

Results of Repeated Measures ANOVA for Somatic Anxiety and Coping Strategies

Variable	Source	SS	df	MS	F	p	η²
Somatic Anxiety	Time	934.61	2	467.31	26.92	<.001	.491
	Group	1102.17	1	1102.17	30.47	<.001	.526
	Time × Group	801.44	2	400.72	23.19	<.001	.462
	Error	967.22	56	17.27			
Coping Strategies	Time	1584.92	2	792.46	21.03	<.001	.429
	Group	944.75	1	944.75	25.16	<.001	.473
	Time × Group	1320.38	2	660.19	19.66	<.001	.412
	Error	1054.63	56	18.84			

The repeated measures ANOVA revealed significant main effects of time and group for both somatic anxiety and coping strategies (all $p < .001$), along with significant time × group interactions, suggesting that the intervention had a unique effect over time on the experimental group. For somatic anxiety, the interaction effect was strong ($F = 23.19$, $p < .001$, $\eta^2 = .462$), while for coping strategies it was also robust ($F = 19.66$, $p < .001$, $\eta^2 = .412$), indicating meaningful clinical and statistical improvements (Table 2).

Table 3

Bonferroni Post-hoc Test Results for Within-Group Comparisons

Variable	Group	Comparison	Mean Difference	p
Somatic Anxiety	Experimental	Pre vs. Post	10.07	<.001
		Post vs. Follow-up	-0.82	.419
		Pre vs. Follow-up	9.25	<.001
	Control	Pre vs. Post	1.25	.297
		Post vs. Follow-up	-0.43	.563
		Pre vs. Follow-up	0.82	.341
Coping Strategies	Experimental	Pre vs. Post	16.59	<.001
		Post vs. Follow-up	-1.47	.388
		Pre vs. Follow-up	15.12	<.001
	Control	Pre vs. Post	1.32	.311
		Post vs. Follow-up	0.29	.774
	Pre vs. Follow-up	1.61	.288	

Bonferroni-adjusted comparisons confirmed that the experimental group experienced significant changes from pretest to posttest in both variables: somatic anxiety ($\Delta M = 10.07$, $p < .001$) and coping strategies ($\Delta M = 16.59$, $p < .001$). These improvements remained stable at follow-up. The control group did not show significant differences across any time point comparisons, indicating the changes in the experimental group were attributable to the intervention (Table 3).

4. Discussion and Conclusion

The present study aimed to evaluate the effectiveness of an eight-session Virtual Reality Relaxation Training (VRRT) program on reducing somatic anxiety and enhancing coping strategies among young adults in Armenia. The results indicated statistically significant improvements in the experimental group compared to the control group across both dependent variables. Participants who underwent VRRT demonstrated a marked reduction in somatic anxiety scores and significant improvements in adaptive coping mechanisms, effects that were maintained during the five-month follow-up. These findings contribute to a growing body of evidence supporting the use of immersive VR interventions for psychological well-being.

The reduction in somatic anxiety observed in this study aligns with prior research that emphasizes the physiological benefits of VR-based relaxation. Notably, studies have shown that exposure to calming virtual environments can activate parasympathetic responses, leading to lower heart rate, reduced muscle tension, and overall improvements in bodily stress indicators (Lepilkina et al., 2023; Zaki et al.,

JPPR Journal of Personality and Psychosomatic Research
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2024). Our results are consistent with findings by Amiri et al. (2023), who demonstrated significant reductions in preoperative anxiety among cardiac surgery patients after brief VR exposure (Amiri et al., 2023). Similarly, Hosseini et al. (2024) reported that VR relaxation scenarios significantly decreased anxiety in patients undergoing hemodialysis procedures (Hosseini et al., 2024). In both cases, the somatic symptoms of anxiety—such as rapid breathing, muscle tightening, and dizziness—were notably diminished, mirroring the outcomes of the present trial.

Additionally, our results reinforce evidence that VRRT can improve individuals' coping abilities. Participants in the intervention group showed significantly greater use of task-oriented and problem-focused strategies post-intervention. These findings are supported by the work of Gungor et al. (2022), who found that virtual reality use in an educational laboratory setting enhanced participants' self-concept and coping confidence when handling anxiety-inducing tasks (Gungor et al., 2022). The immersive nature of VR allows users to simulate stressful events in a controlled environment, facilitating the rehearsal of adaptive behavioral and emotional responses (Wang et al., 2022). Moreover, the guided nature of the sessions, combining VR imagery with breathing and progressive muscle relaxation, likely contributed to participants' enhanced emotional regulation, a key mechanism underlying adaptive coping.

Our findings also corroborate the work of Lepilkina et al. (2023), whose pilot study showed that VR-based relaxation significantly alleviated anxiety and asthenia symptoms in a general hospital setting (Lepilkina et al., 2023). Their use of structured virtual environments to deliver sensory modulation and induce calm parallels the design of our protocol, supporting the idea that multi-session VRRT programs yield robust and sustained outcomes. Moreover, our long-term follow-up data demonstrate the durability of these benefits, supporting arguments made by MacDonald (2024) regarding the long-lasting impact of short VR exposure when structured around cognitive-emotional targets (MacDonald, 2024).

The observed improvement in coping strategies over time may also be attributed to the VRRT's integrated approach, which allowed participants to practice emotional regulation in progressively challenging scenarios. This is consistent with findings by Kumar (2023), who emphasized that VR environments designed with escalating levels of emotional complexity enhance internal coping resources in individuals with social anxiety (Kumar, 2023). In our study, participants engaged in mindfulness, visualization, and cognitive restructuring tasks across sessions, which likely fostered skill generalization beyond the virtual context.

Furthermore, the sustained effects at the five-month follow-up support the hypothesis that repeated exposure to calming and structured VR environments can lead to neural adaptation and recalibration of anxiety-related responses. Such conclusions are echoed in studies on mindfulness-based VR by Mao et al. (2024), where cancer patients undergoing chemotherapy reported continued decreases in anxiety and fatigue weeks after the intervention ended (Mao et al., 2024). While most past VR studies focused on short-term pre-procedural stress, our findings demonstrate that when VR is delivered systematically over time, it facilitates more enduring emotional and cognitive transformations.

In comparing the experimental group with the waitlist control group, the data further illustrate the necessity of immersive and active interventions. While the control group showed minimal changes in anxiety or coping, the VRRT group demonstrated clear within-group improvements. This supports the position that passive strategies or delayed care are insufficient to address anxiety in dynamic, high-stress environments (Natali et al., 2024; Rougereau et al., 2023). Moreover, VR appears to function not merely as a distraction, but as a contextualized learning tool that enables users to connect physiological states with cognitive interpretation and behavior (Smith et al., 2022).

Another important insight is the alignment of our findings with research by Huang et al. (2022), who identified that metaverse-based VR experiences in sports settings reduced performance anxiety and enhanced mental well-being via immersive engagement (Huang et al., 2022). While our study did not utilize metaverse integration, the core mechanisms—deep immersion, mood modulation, and bodily awareness—were similarly leveraged to reduce anxiety and build resilience. Furthermore, our structured use of a safe place visualization technique echoes the approach taken by Natali et al. (2024) in addressing food anxiety in anorexia patients, showing that even condition-specific anxiety can be managed via universal VR principles when delivered with proper therapeutic framing (Natali et al., 2024).

From a hardware and software perspective, the findings are also in line with Arnfred et al.'s (2023) review on effective design features for VR therapy (Arnfred et al., 2023). Our protocol followed their guidelines on session duration, interactivity, and the use of audio-visual congruence to enhance presence and emotional impact. As

JPPR
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the field matures, adherence to such standards will be critical for ensuring both clinical efficacy and replicability.

Finally, the cultural context of this study—conducted in Armenia—adds an important dimension to the literature, which has often been limited to North American, East Asian, or Western European populations. The positive results suggest that VRRT can be culturally adaptable and relevant across diverse populations. This echoes the findings of Jamal et al. (2024), who reported effective anxiety reduction in VR interventions among cardiac patients in Southeast Asia, as well as those of Вакуленко (2024) and Іванова (2023), who explored the role of immersive technologies in mental health interventions across Eastern Europe (Jamal et al., 2024; Вакуленко et al., 2024; Іванова, 2023).

Despite the strengths of the study—including a randomized controlled design, multi-session protocol, and five-month follow-up—several limitations should be acknowledged. First, the sample size (n=30) was relatively small, which may limit the generalizability of the findings. While statistical significance was achieved, future research with larger and more diverse populations is necessary to confirm and expand upon these results. Second, the study relied on self-report measures for both somatic anxiety and coping strategies. Although these tools were validated, self-report instruments may be subject to social desirability or recall bias. Third, although the follow-up period was longer than most VR studies, it remains uncertain how long the effects of VRRT persist beyond five months without continued booster sessions. Finally, while participants were screened for major psychiatric disorders, other variables such as baseline coping styles, personality traits, and technology familiarity were not controlled for and may have influenced outcomes.

Future studies should aim to expand on this work in several ways. First, researchers could conduct longitudinal trials over one year or more to evaluate the long-term efficacy and relapse prevention potential of VRRT in managing somatic anxiety. Second, integrating physiological monitoring—such as heart rate variability, cortisol levels, or EEG markers—could enrich our understanding of how VR impacts the autonomic nervous system in real time. Third, future investigations could explore comparative effectiveness by evaluating VRRT against other interventions such as traditional CBT, biofeedback, or pharmacological treatments. Additionally, researchers may wish to investigate the dose–response relationship, exploring how the number, duration, or intensity of sessions impacts effectiveness. Lastly, studies should include cross-cultural validation and multi-lingual adaptations of VR environments to ensure broader accessibility and relevance.

Given the evidence from this and related studies, mental health practitioners, wellness coaches, and educators may consider incorporating VR-based relaxation training into standard treatment or support protocols, especially for individuals experiencing high levels of somatic anxiety. The flexibility of VR allows for easy integration into clinical, academic, and workplace settings, particularly with the increasing availability of portable headsets. Additionally, the immersive nature of VR can be useful for clients who are resistant to traditional talk therapies or who require somatic grounding techniques. Institutions may also explore offering VRRT as a preventive intervention to support stress management, particularly during transitions such as exam periods, job changes, or medical procedures.

Authors' Contributions

Authors contributed equally to this article.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

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Declaration of Interest

The authors report no conflict of interest.

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Ethics Considerations

The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants.

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