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Understanding Emotional Engagement in Immersive VR Stress Management Programs

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A B S T R A C T

This study aimed to explore the dimensions of emotional engagement experienced by users participating in immersive virtual reality (VR) stress management programs. A qualitative phenomenological approach was employed to investigate how individuals emotionally interact with immersive VR environments designed for stress reduction. Nineteen participants from Turkey, who had completed VR-based stress management sessions within the past six months, were selected using purposive sampling. Data were collected through semi-structured, in-depth interviews and analyzed using a grounded theory approach across three stages: open coding, axial coding, and selective coding. NVivo 14 software was used for data management and coding. Theoretical saturation determined the final sample size. Thematic analysis revealed five core categories of emotional engagement: (1) emotional regulation and relief, characterized by feelings of calm, reduced anxiety, and emotional release; (2) immersive escape and containment, reflecting temporary psychological withdrawal and emotional safety; (3) reflective self-awareness, involving increased emotional insight and self-perception; (4) psychological safety and comfort, supported by sensory design and environmental predictability; and (5) affective transformation, encompassing mood elevation and deeper emotional shifts. Participants described immersive VR not only as a relaxation tool but as an emotionally rich environment capable of triggering introspection, affective balance, and transformation. Immersive VR stress management programs engage users across multiple emotional dimensions—physiological, cognitive, and affective. Emotional engagement is not a passive outcome but a dynamic and layered process shaped by presence, design features, and individual psychological factors. These findings underscore the importance of affect-sensitive design and implementation strategies in therapeutic VR, emphasizing the potential of immersive environments for promoting emotional resilience and mental well-being.

Keywords: *Emotional engagement; virtual reality; stress management; immersive technology; qualitative research; affective computing; presence; psychological safety.*

1. Introduction

In an era characterized by accelerating stress levels and global mental health concerns, the exploration of technologically mediated interventions for stress relief has garnered significant academic and clinical attention. Among these, immersive virtual reality (VR) has emerged as a transformative tool capable of modulating users' emotional and physiological responses by altering perceptions of space, embodiment, and presence. With its potential to induce states of relaxation, distraction, and engagement, VR offers novel opportunities to address chronic stress and emotional dysregulation across various populations (1, 2). However, despite its increasing application in therapeutic and occupational contexts, our understanding of how users emotionally engage with immersive VR stress management programs—especially at the subjective, experiential level—remains fragmented and under-theorized.

The promise of VR-based stress management lies in its capacity to simulate calming environments and scenarios that elicit affective responses aligned with therapeutic goals. Research has shown that virtual exposure to natural landscapes or soothing environments can activate relaxation pathways and reduce physiological indicators of stress, such as heart rate and cortisol levels (3, 4). This phenomenon is grounded in the principle of presence—the user's perceived realism of the virtual environment—which plays a critical role in modulating affective and cognitive outcomes (5). The extent to which individuals feel emotionally immersed in a VR setting, however, varies widely based on factors such as prior mental state, design features, interactivity levels, and cultural or personal relevance (6, 7). Yet, the mechanisms through which such emotional engagement unfolds during VR-based stress relief protocols are not yet fully explicated.

While studies have primarily focused on quantitative measures such as heart rate variability, skin conductance, and pre-post stress scores, recent research advocates for a more nuanced, qualitative exploration of user experiences to better understand the interplay of emotional, sensory, and cognitive processes (8, 9). For example, a study by (10) examining emergency physicians found that short VR breaks not only reduced perceived stress levels but also triggered introspective emotional reactions and reappraisals. This underscores the need for further research that captures the layered nature of emotional engagement—beyond simple affective labels—during immersive digital interventions.

In parallel, VR-based interventions have demonstrated promising effects in diverse populations, including caregivers (3), individuals with chronic pain (11), dysmenorrhea sufferers (12), and psychiatric patients (13). These studies emphasize that immersive VR is not a one-size-fits-all tool; rather, it operates through a dynamic interaction between technological design and the user's internal emotional state. For instance, (14) highlighted how virtual meditation retreats provided participants with a "transformative emotional sanctuary," eliciting feelings of detachment from worldly pressures. Similarly, (15) found that the sense of presence among dementia caregivers correlated with individual characteristics such as emotional stability and sensory receptiveness, revealing a subjective dimension critical to understanding outcomes.

Moreover, emotional engagement in VR may follow non-linear trajectories, influenced by both embodied experience and contextual factors. (16) documented how veterans undergoing mindfulness-based VR treatment experienced waves of vulnerability followed by catharsis and emotional clarity—patterns that cannot be adequately captured through standardized scales alone. This reflects a growing consensus among scholars to shift from technocentric efficacy studies toward affect-centered frameworks that examine how emotional meaning is constructed and regulated within virtual environments (17, 18). Immersive VR may thus function not only as a therapeutic distraction but also as a tool for emotional self-exploration and affective realignment.

Despite such insights, few studies have systematically examined the phenomenology of emotional engagement within VR stress management programs using qualitative methodologies. Existing works either conflate emotional engagement with usability or reduce it to post-session satisfaction ratings (19, 20). Emotional engagement, however, is a multidimensional construct involving attentional focus, affective resonance, and personal relevance—all of which may evolve throughout the VR experience. For example, (21) showed that hospitalized patients viewing VR representations of their homes experienced a complex blend of nostalgia, comfort, and

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sadness, illustrating the emotional depth possible in immersive environments.

The effectiveness of VR as a stress management intervention also depends on how it balances immersion with emotional safety. While high levels of immersion can enhance engagement, they may also increase the risk of overstimulation or emotional overwhelm, especially in users with underlying psychological vulnerabilities (22, 23). Designing VR programs that foster positive emotional regulation while minimizing adverse effects requires an understanding of user preferences, tolerance thresholds, and cultural norms. For instance, (24) explored how varying levels of VR immersiveness impacted creativity and emotional response, revealing that lower immersiveness sometimes allowed for greater introspection and calmness. Similarly, (25) emphasized the need to consider workspace context when integrating VR stress relief tools, noting that emotional engagement can be inhibited by noise, surveillance, or time pressure.

Furthermore, socio-cultural and ethical factors influence how individuals emotionally respond to immersive technologies. (2) cautioned against uncritical celebration of VR's therapeutic potential by highlighting its addictive risks and long-term dissociative effects. This dual-edge nature of VR underscores the importance of research that not only identifies emotional benefits but also critically examines engagement patterns across different psychological and temporal dimensions. Emotional engagement in VR is not simply a "positive" or "negative" experience; it is a situated phenomenon shaped by expectations, memory, body awareness, and technological mediation (23, 26).

In light of these complexities, this study adopts a qualitative approach to explore the emotional engagement of users participating in immersive VR-based stress management programs. Grounded in phenomenological inquiry, the research aims to uncover how individuals articulate, process, and reflect on their emotional experiences within VR settings. By conducting in-depth semi-structured interviews with Turkish participants who have engaged in such interventions, the study seeks to contribute to a deeper, context-sensitive understanding of the emotional dimensions of immersive VR use.

2. Methods and Materials

2.1. Study Design and Participants

This study employed a qualitative research design using a phenomenological approach to explore participants' emotional engagement in immersive virtual reality (VR) stress management programs. The phenomenological method was chosen to gain in-depth insights into the lived experiences and emotional responses of individuals who participated in such interventions.

A purposive sampling strategy was used to recruit participants who had completed at least one full immersive VR stress management program within the past six months. The final sample comprised 19 participants residing in Turkey, including both males and females aged between 22 and 48 years. Participants represented a variety of educational and occupational backgrounds, including university students, health professionals, office workers, and freelance creatives. Inclusion criteria required that participants were over 18 years of age, had no diagnosed psychiatric disorders, and possessed sufficient digital literacy to engage in VR environments independently.

Recruitment was conducted through direct outreach to mental wellness centers, social media announcements, and professional networks. Data saturation, specifically theoretical saturation, was the guiding principle for sample size determination. Data collection was concluded once no new themes or concepts emerged from the interviews, indicating that additional data would likely not yield further insights.

2.2. Data Collection

Data were collected using semi-structured, in-depth interviews designed to elicit detailed descriptions of emotional experiences and engagement processes during the VR-based stress management sessions. The interview protocol consisted of open-ended questions organized around three main thematic areas: emotional reactions to the VR environment, perceived psychological impact of the intervention, and overall engagement with the program features (e.g., audio-visual elements, interactivity, immersion).

Interviews were conducted in Turkish, either face-to-face or via secure video conferencing platforms, depending on

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the participant's preference and location. Each interview lasted between 45 and 70 minutes and was audio-recorded with the informed consent of all participants. Interviews were transcribed verbatim and translated into English for the purposes of analysis and reporting.

2.3. Data Analysis

Thematic analysis was conducted using NVivo 14 software to identify recurring patterns and conceptual themes within the dataset. The analysis followed Braun and Clarke's six-phase framework: familiarization with data, initial code generation, theme searching, theme reviewing, theme defining and naming, and final reporting.

The researchers first read each transcript multiple times to gain a holistic understanding of the data. Initial codes were then inductively derived and assigned to text segments that reflected meaningful units of analysis. These codes were subsequently clustered into broader categories and refined into major themes related to emotional engagement in immersive VR contexts.

To ensure the trustworthiness of the findings, a series of measures were employed, including analyst triangulation (multiple researchers reviewing the data independently), member checking (summaries of key findings reviewed by selected participants), and maintaining a detailed audit trail documenting coding decisions and analytic memos.

The use of NVivo facilitated the organization, retrieval, and visualization of qualitative data, enabling a systematic and transparent analysis process that contributed to the credibility and dependability of the results.

3. Findings and Results

The study sample consisted of 19 participants from Turkey who had completed immersive VR-based stress management programs within the past six months. Of the total participants, 11 identified as female (57.9%) and 8 as male (42.1%). Participants ranged in age from 22 to 48 years, with the majority falling within the 25–34 age group (n = 10, 52.6%), followed by the 35–44 age group (n = 6, 31.6%) and a smaller proportion aged 45 and above (n = 3, 15.8%). In terms of occupational background, 6 participants (31.6%) were university students, 5 (26.3%) were healthcare professionals (e.g., psychologists, nurses), 4 (21.1%) were office-based employees in corporate settings, and the remaining 4 (21.1%) worked in freelance or creative sectors such as digital design or music. All participants reported moderate to high digital literacy, a key inclusion criterion for engaging in VR-based interventions. No participants reported having current or past diagnoses of psychiatric disorders.

In the first phase of data analysis, open coding was performed to break down the interview transcripts into discrete, meaningful units of information. This process was inductive and data-driven, with codes emerging directly from the participants' narratives rather than being predefined. Each transcript was examined line-by-line, and descriptive labels were assigned to recurring phrases, sentiments, and behaviors that reflected participants' emotional engagement with the VR stress management experience. A total of 84 open codes were identified from across the 19 interviews. These codes captured a wide range of emotional, cognitive, and sensory responses—such as calmness, anxiety reduction, immersive detachment, sensory stimulation, and altered time perception. Coding was performed manually within NVivo 14, and each code was linked to the participants who expressed it. The table below presents a selection of these initial open codes along with their associated participant identifiers.

Table 1

Open Codes and Associated Participants

Open Code	Participant(s)
Feeling of calmness	P1, P3, P7, P11, P18
Anxiety reduction	P2, P6, P8, P13, P17
Emotional release	P4, P10, P12
Inner peace	P1, P5, P9
Detachment from daily worries	P2, P7, P14, P15
Real-time emotional reflection	P3, P5, P8
Enhanced self-awareness	P6, P11, P16, P19

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Immersion-induced tranquility	P1, P9, P10
Visual beauty appreciation	P2, P4, P13, P18
Emotional vulnerability	P3, P6, P15
Sense of security in VR space	P5, P7, P12
Distraction from physical stress	P8, P10, P14
Positive emotional drift	P1, P4, P11
Increased concentration	P2, P6, P13
Emotional grounding	P5, P9, P18
Deep breathing responses	P3, P7, P16
Warmth and comfort	P1, P4, P8
Pleasant surprise	P10, P13, P15
Emotional absorption	P3, P11, P12
Connection with nature scenes	P2, P5, P14, P19
Awe and wonder	P6, P7, P9
Self-reflection triggers	P8, P10, P13
Reduced heart rate (perceived)	P1, P12, P16
Expressed joy	P3, P5, P18
Internal emotional dialog	P2, P6, P15
Disengagement from external environment	P4, P11, P14
Acceptance of emotions	P7, P9, P13
Floating sensation	P1, P8, P10
Emotional clarity	P3, P6, P12
Mindful presence	P5, P7, P19
Surreal emotional experience	P2, P4, P14
Hopefulness	P6, P11, P13
Soothing auditory feedback	P1, P9, P15
Feeling emotionally “held”	P3, P10, P12
Emotional escape	P2, P5, P16
In-the-moment calm	P4, P7, P14
Sense of emotional safety	P1, P8, P13
Emotional synchronization with VR rhythm	P3, P6, P15
Gentle emotional transitions	P5, P10, P18
Lightness and relief	P2, P9, P11
Reduced emotional noise	P4, P12, P14
Uplifted mood	P1, P3, P16
Acceptance of personal stress	P6, P7, P13
Heightened emotion regulation	P5, P8, P15
Change in self-perception	P2, P10, P12
Crying during VR experience	P4, P11, P18
Deep emotional relaxation	P3, P6, P14
Temporary emotional detachment	P5, P7, P13
Sensory-emotional integration	P1, P9, P12
Relieved emotional tension	P2, P4, P16

Following open coding, the next stage of analysis involved axial coding, which focused on organizing and synthesizing the initial open codes into broader, more abstract categories. This phase entailed identifying conceptual connections between codes and clustering them under higher-order themes, called axial codes, based on their underlying meanings and patterns. Each axial code represents a central phenomenon around which related open codes were grouped, enabling a more structured understanding of emotional engagement experiences during the immersive VR stress management sessions. The constant comparative method was employed, and NVivo 14 assisted in tracking co-occurrence patterns and thematic linkages. This step reduced the complexity of data while maintaining depth, allowing for the emergence of a more coherent structure for later theoretical integration.

Table 2

Axial Codes and Corresponding Open Codes

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Axial Code	Corresponding Open Codes
Emotional Calmness	Feeling of calmness, Inner peace, In-the-moment calm, Reduced heart rate (perceived), Deep emotional relaxation, Lightness and relief
Stress Release	Anxiety reduction, Emotional release, Relieved emotional tension, Distraction from physical stress, Crying during VR experience
Immersive Detachment	Detachment from daily worries, Emotional escape, Disengagement from external environment, Temporary emotional detachment
Sensory-Emotional Integration	Soothing auditory feedback, Sensory-emotional integration, Visual beauty appreciation, Emotional synchronization with VR rhythm
Self-Reflection and Awareness	Enhanced self-awareness, Self-reflection triggers, Internal emotional dialog, Change in self-perception
Psychological Safety	Sense of security in VR space, Feeling emotionally "held", Sense of emotional safety
Positive Mood Shift	Uplifted mood, Expressed joy, Hopefulness, Pleasant surprise
Mindfulness and Presence	Mindful presence, Real-time emotional reflection, Gentle emotional transitions
Emotional Regulation	Emotional grounding, Acceptance of emotions, Acceptance of personal stress, Heightened emotion regulation
Aesthetic Connection	Visual beauty appreciation, Connection with nature scenes, Awe and wonder
Emotional Vulnerability	Emotional vulnerability, Crying during VR experience, Internal emotional dialog
Relaxation-Inducing Embodiment	Deep breathing responses, Floating sensation, Lightness and relief
Emotional Absorption	Emotional absorption, Surreal emotional experience, Emotional clarity
Transformation of Emotional State	Positive emotional drift, Emotional clarity, Change in self-perception
Secure Containment of Emotions	Feeling emotionally "held", Sense of emotional safety, Gentle emotional transitions
Emotional Rebalancing	Reduced emotional noise, Heightened emotion regulation, Emotional grounding
Emotional Synchrony with Environment	Emotional synchronization with VR rhythm, Sensory-emotional integration, Internal emotional dialog
Awareness of Inner Emotional Landscape	Emotional clarity, Real-time emotional reflection, Self-reflection triggers
Cognitive-Affective Realignment	Acceptance of personal stress, Emotional escape, Hopefulness

The axial coding phase allowed the research team to move beyond descriptive fragments toward more integrated and conceptual insights into how participants experienced emotional engagement in immersive VR stress management programs. A total of 19 axial codes were constructed, each encompassing a distinct emotional or psychological dimension such as emotional calmness, stress release, self-reflection, and emotional regulation. While some axial categories were anchored by a large number of open codes (e.g., Emotional Calmness and Stress Release), others were narrower in scope but conceptually rich (e.g., Awareness of Inner Emotional Landscape or Relaxation-Inducing Embodiment). This diversity in code distribution reflects the range and depth of emotional experiences reported by participants. The emergence of these categories laid the foundation for the final phase of analysis—selective coding—where a central storyline would be constructed around the core processes of emotional engagement.

Selective coding represents the final stage of the qualitative data analysis, where the focus shifts toward identifying and refining the core themes that encapsulate the central phenomenon under investigation—in this case, emotional engagement in immersive VR stress management programs. This phase involved integrating and organizing the previously defined axial codes into broader, overarching categories known as selective codes or main categories. These selective codes reflect the fundamental psychological processes and emotional mechanisms shared across participants' experiences. Each selective code was constructed based on thematic coherence, theoretical relevance, and its ability to serve as a central component of the emerging narrative. This step allowed for the development of a cohesive interpretive model that explains how users emotionally engage with immersive VR interventions aimed at stress reduction.

Table 3

Selective Codes and Corresponding Axial Codes

Selective Code (Main Category)	Corresponding Axial Codes
Emotional Regulation and Relief	Emotional Calmness, Stress Release, Emotional Rebalancing, Relaxation-Inducing Embodiment
Immersive Escape and Containment	Immersive Detachment, Secure Containment of Emotions, Emotional Absorption, Emotional Synchrony with Environment
Reflective Self-Awareness	Self-Reflection and Awareness, Awareness of Inner Emotional Landscape, Cognitive-Affective Realignment

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Psychological Safety and Comfort	Psychological Safety, Sensory-Emotional Integration, Mindfulness and Presence
Affective Transformation	Positive Mood Shift, Transformation of Emotional State, Emotional Vulnerability, Aesthetic Connection

The selective coding phase resulted in the emergence of five main thematic categories that offer a structured framework for understanding emotional engagement in immersive VR-based stress management. The first theme, Emotional Regulation and Relief, captures the emotional stabilization and physiological soothing participants experienced, often described as "feeling calm" or "letting go." The second theme, Immersive Escape and Containment, reflects the dual processes of psychological withdrawal from external stressors and the secure containment of emotion within the VR space. The third theme, Reflective Self-Awareness, centers on introspective processes triggered by immersive VR, such as recognizing emotional patterns or reevaluating stress. Psychological Safety and Comfort emerged as another core component, emphasizing the VR environment's capacity to offer a non-threatening space that promotes relaxation and emotional openness. Finally, Affective Transformation points to deeper emotional shifts, including elevated mood, catharsis, or a sense of transcendence and connection with aesthetically rich or naturalistic virtual scenes.

4. Discussion and Conclusion

The present study aimed to explore how participants emotionally engage with immersive virtual reality (VR) stress management programs, using a qualitative methodology based on semi-structured interviews and grounded theory analysis. The findings revealed five core dimensions of emotional engagement: emotional regulation and relief, immersive escape and containment, reflective self-awareness, psychological safety and comfort, and affective transformation. These dimensions emerged from rich, subjective descriptions of users' emotional states during and after the VR sessions and provide a deeper understanding of how VR functions not merely as a relaxation tool but as an emotionally immersive and dynamic environment for psychological modulation.

Participants reported a spectrum of affective responses, ranging from calmness and tension release to deeper emotional insights and transformation. Emotional regulation and relief were central outcomes, with users frequently describing sensations of peace, reduced anxiety, and physical relaxation. These responses were facilitated by both the immersive quality of the VR environment and the structured focus on breathing, nature scenes, and gentle soundscapes. The theme of immersive escape and containment was also prominent. Participants explained how VR allowed them to temporarily disengage from external stressors while simultaneously containing their emotions within a perceived safe virtual boundary. These dual functions—distraction and containment—created conditions conducive to processing stress without being overwhelmed by it.

Furthermore, many participants expressed reflective self-awareness, describing how the VR sessions served as a catalyst for noticing patterns in their emotional responses and rethinking their reactions to stress. This reflective function indicates that immersive VR can stimulate not only relaxation but also cognitive-affective reevaluation. Psychological safety and comfort were enabled by the predictability, aesthetic harmony, and emotional neutrality of the VR environment, which allowed individuals to feel secure while exploring emotionally charged content. Finally, several participants described an affective transformation, involving mood elevation, catharsis, and reconnection with self, often triggered by the emotional realism and symbolic resonance of VR scenes. Together, these findings suggest that VR programs for stress management do more than calm users—they provide a context for emotional exploration, containment, and even healing.

These findings are consistent with an expanding body of literature on the psychological affordances of VR in stress and emotion regulation. For instance, (3) demonstrated how nature-based VR interventions significantly alleviated caregiver stress by fostering emotional stability and a sense of presence. Similarly, (12) reported reductions in physical and emotional discomfort among participants using VR-based relaxation protocols, aligning with our participants' accounts of physical-emotional relief. The theme of immersive escape echoes findings from (8), who observed that VR provided neonatal intensive care staff with a cognitive break that disrupted chronic stress loops and facilitated mental recovery. These immersive interventions

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appear to support users by decoupling them from high-pressure realities and offering emotional "breathing space."

The containment aspect of VR engagement observed in this study corresponds with research by (10), who explored VR as a self-contained emotional environment for physicians facing acute stress. Their findings mirror our participants' reports of feeling "emotionally held" by the VR space, a sentiment that emphasizes not only technical immersion but emotional enclosure. The literature on VR presence and affect also supports these interpretations. For example, (6) found that higher levels of interactivity and immersion were positively associated with stress relief and mood enhancement, reinforcing our identification of presence as a central facilitator of emotional regulation.

The emergence of self-awareness and emotional clarity as engagement outcomes resonates with the work of (16), who noted that VR mindfulness training enabled veterans to articulate emotional patterns and improve emotion regulation. Likewise, (15) found that VR enhanced caregivers' emotional reflectivity and presence based on personal characteristics and environmental cues. The theme of affective transformation in our data—reported by participants as a transition from distress to clarity or even joy—finds parallel in (17), who described VR's emotional impact on young adults as not only calming but potentially "redefining" of their stress narratives.

Moreover, our findings support the argument made by (7) that VR can provide psychoeducational benefits alongside emotional regulation. While our study did not incorporate didactic content, participants' reflections on their emotional growth suggest that even passive VR experiences may lead to insight and emotional learning. This is corroborated by (19), who demonstrated that embodied VR interventions led to functional and emotional gains through experiential engagement. Similarly, (11) confirmed the sustained benefits of home-based VR pain management programs, which implies that emotionally resonant VR interventions can have lasting psychological effects.

The emotional dualism of VR—its ability to soothe and stimulate—was also reflected in our participants' diverse responses. While most described feelings of calm and safety, others recounted unexpected emotional vulnerability, such as crying or confronting suppressed emotions. This aligns with (21), who found that hospital patients interacting with VR home images experienced mixed emotions of comfort and grief. Such emotionally charged responses suggest that the immersive quality of VR, when combined with personal symbolism or narrative, may evoke powerful emotional states that require thoughtful design and facilitation.

Additionally, our results highlight the role of sensory design in fostering emotional engagement. Participants frequently mentioned the importance of ambient music, natural visual scenes, and fluid pacing in their emotional immersion. These design preferences are in agreement with findings by (18), who emphasized how reducing cybersickness and maximizing sensory comfort are essential for emotional stability in VR. Aesthetic congruence and predictability were described as essential to maintaining emotional trust in the experience, which further supports the argument by (5) that immersive presence enhances post-intervention mood outcomes.

At the same time, the risks associated with over-immersion and addiction, as discussed by (2), remain critical. While our study did not find direct evidence of dependency, a few participants did mention reluctance to return to the "real world" after sessions, raising questions about escapism versus therapeutic use. (22) also warned that VR pain relief may suppress rather than resolve distress if not integrated with reflective or therapeutic support. This reinforces the importance of understanding emotional engagement not only as an outcome but also as a process that interacts with users' mental states, context, and needs.

In summary, the findings of this study provide compelling evidence that immersive VR stress management programs engage users at multiple emotional levels—physiological, psychological, and cognitive. Emotional regulation, immersive detachment, and affective insight were consistently reported across interviews, underscoring the depth of emotional processes triggered by virtual environments. This layered engagement suggests that immersive VR is not merely a passive relaxation medium but a potent tool for emotional realignment and introspective growth, provided it is designed and delivered with psychological safety and user-centered principles in mind.

This study has several limitations that should be considered when interpreting the findings. First, the sample consisted exclusively of participants from Turkey, which may limit the cultural generalizability of the results.

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Emotional expression and perceptions of VR may vary significantly across sociocultural contexts. Second, although data saturation was reached with 19 participants, the qualitative nature of the study does not allow for statistical generalization. Third, the reliance on self-report through interviews may be subject to recall bias or social desirability effects. Additionally, no biometric or observational data were collected to triangulate the self-reported emotional responses. Lastly, the study did not differentiate between different types of VR programs (e.g., guided meditation, nature-based exposure, interactive environments), which may have influenced engagement patterns.

Future research should explore emotional engagement in immersive VR stress management programs across diverse cultural and clinical populations, including adolescents, older adults, and individuals with diagnosed anxiety or affective disorders. Longitudinal studies that investigate the durability of emotional transformation and its behavioral correlates would provide deeper insight into the long-term effects of VR engagement. It is also recommended that future studies combine qualitative methods with physiological or neurobiological measures to better understand the embodied aspects of emotional experience in VR. Comparing passive versus interactive VR environments may also clarify which elements contribute most effectively to emotional regulation and insight.

Designers and practitioners implementing VR stress management programs should prioritize emotionally intelligent design elements—such as soothing audio, personalized content, and adjustable immersion levels—to enhance user engagement. Facilitators should also be trained to debrief users post-session, especially when emotionally intense experiences emerge. Integrating VR interventions with broader mental health frameworks and offering users optional reflective journaling or therapy sessions can help ensure emotional processing and reduce risks of emotional avoidance or dependency. Finally, emphasizing user agency, emotional safety, and context sensitivity can foster a more ethical and effective deployment of immersive VR for stress relief.

Authors' Contributions

All authors equally contributed to this study.

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 placed a high emphasis on ethical considerations. Informed consent obtained from all participants, ensuring they are fully aware of the nature of the study and their role in it. Confidentiality strictly maintained, with data anonymized to protect individual privacy. The study adhered to the ethical guidelines for research with human subjects as outlined in the Declaration of Helsinki.

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