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Virtual Reality For Anxiety Management: Exposure Mechanisms, Immersion, And Relaxation Effects In A Narrative Review

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ABSTRACT

Anxiety disorders are highly prevalent conditions that significantly affect individuals' emotional and physiological functioning. This study aims to narratively examine the effectiveness of various Virtual Reality (VR)-based interventions in reducing anxiety across different populations. A narrative literature review was conducted using Google Scholar and ScienceDirect in November 2025. The inclusion criteria consisted of empirical articles published between 2015 and 2024, employing VR interventions to reduce anxiety, and available in Indonesian or English. Of the 46 articles initially identified, 8 met the eligibility criteria and were analyzed. The results indicate that VR interventions including VR relaxation, Virtual Reality Exposure Therapy (VRET), VR-murottal, and VR-CBT produce significant reductions in anxiety, such as decreased pre-operative anxiety ($p = 0.000$) and increased self-confidence in individuals with social phobia. However, the effectiveness of VR varies across populations and modalities, and several limitations were noted, including heterogeneity in study designs and incomplete reporting of quantitative outcomes. Overall, VR demonstrates substantial potential as both a primary and adjunctive intervention for anxiety management, although further research with more standardized procedures is needed.

Introduction

Modern technology today become the part that is not inseparable from life humans, because almost all over activity Good study, work, and fulfil need daily continues to depend on technology develop rapid progress This No only make it easier various affairs, but also change method man communicate, which previously limited to letters, now shift to SMS, phone, email, and online conversations that create distance felt the more close. In the context of globalization, technology become indicator important progress a country, where the ability master and utilize it become reject measuring a developed country (Tamimi Fahmi, 2024).

Progress technology information that occurs very quickly has develop become strength big incoming to almost every room life human. Starting from the emergence of the internet until utilization intelligence artificial, this process no just bring up innovation new, but also productive view social changes and influences method We activities, interacting, and working. (Lubis & Nasution, 2021).

In today's digital age, people increasingly rely on the internet and social media for health information. While easy access offers many benefits, it also creates challenges like health anxiety due to information overload or inaccurate sources. *Health anxiety* referring to concerns excessive to condition body, which is now often exacerbated by *cyberchondria* namely habit browse information medical in a way repeated on the internet. Various study finds that social media users, especially individuals with levels neuroticism high, more prone to experience anxiety health the (Sarah et al., 2025).

According to (Jefrey, et al., 2018), Anxiety is reaction emotional marked by worry or vigilance to threats, both real and perceived or those of a nature imaginative, and when intensity too tall can hinder function somebody in life daily life. Disorders anxiety is conditioning mental health characterized by anxiety overreacting, responding behavior No comfortable, and difficult controlled moment face uncertainty, often giving rise to panic (Rusdi Ahmad, 2019). According to the World Health Organization (WHO), disorders This including problem mental health level high impact serious. So, Anxiety appears as response emotional to threat real and imaginative, and when ongoing excessive can changed become obstructions that hinder activity daily life. Disorders anxiety Alone marked by a difficult feeling of fear controlled as well as behavior No rational and recognized by WHO as problem mental health with prevalence tall as well as impact Serious for welfare individual.

In 2019 it was recorded approximately 301 million people worldwide experience it, including 58 million children and adolescents. In Indonesia, the number cases in adolescents Keep going increased; survey Surveymeter 2020 stated that 58% of the population experience disturbance anxiety, the Ministry of Health in 2021 reported that 47.7% of adolescents impacted, and I-NAMHS 2022 noted around 15.5 million teenager experience problem mental health in a year lastly, with anxiety as one of the dominant ones (Yusrani, et al., 2023) Research conducted by Parmasari et al. show that Of the 44 female students , 22.7 % were at the level normal anxiety , 20.5% experienced anxiety mild, 25% experienced anxiety moderate, 13.6% experienced anxiety heavy, and 18.2% were in the category very severe anxiety (Hakim et al., 2022). According to *World Health Organization* (WHO), disruption anxiety is one of the the most common mental

disorder in the world, with more of 359 million people experienced it in 2021 (WHO, 2025).

From research conducted by (Gaudatama et al., 2021), it can be concluded that the development of modern technology demands innovations in therapy that are safer, more comfortable, and more effective for both patients and professionals such as psychologists. The use of *Virtual Reality* (VR), especially Smartphone-Based *Virtual Reality* (S-VR), has been proven to be a safe and non-invasive non-pharmacological intervention to reduce anxiety, increase positive perceptions, and provide a more comfortable experience during stressful procedures, such as chemotherapy. The effectiveness of VR in reducing anxiety and providing a calming distraction shows that this technology has great potential for wider application, including in clinical psychology practice as a form of safer supportive therapy for patients and psychologists. Thus, in the current technological era, the use of VR is a relevant and promising solution to improve the quality of psychological and medical interventions.

Virtual Reality (VR) is generally understood as a representation of the real world built through an imaginative process, then projected through a technological device so that it appears as if it were real in the user's perception. Sherman and Craig (2003) define (Jerald, 2016)" *virtual"* as something that is present in essence or effect, but not in reality, while " *reality* " is understood as a state or quality that really exists. Based on this definition, *virtual reality* can be interpreted as existence in a certain condition or environment that is not actually real, but is displayed as if it were real. By (Jerald, 2016)explaining that *virtual reality* is a digital environment generated by a computer and can be experienced and interacted with by users as if the environment were truly real.

The use of VR technology not only provides a more engaging experience but also contributes to increased student engagement, motivation, and cognitive abilities. According to research conducted by (Menhard, 2024), the application of VR in the learning process can increase student motivation and participation by providing realistic and interactive simulations, thereby facilitating a deeper understanding of abstract concepts.

High engagement in the use of VR give description that technology This Not only relevant in context education, but also very potential for implemented in field mental health. A safe, controlled, and life-like virtual environment condition real allows users face situations that give rise to anxiety without must truly be in it. Thus, VR can give experience exposure important steps in lower anxiety and help individual manage response emotional in a way more adaptive. Through combination between aspect interactive, experience immersive, and flexibility

usage, VR becomes significant technology for support various form intervention psychological Good in context learning and therapy.

Although numerous studies have demonstrated the effectiveness of Virtual Reality in reducing anxiety, there is still no comprehensive synthesis comparing the different VR intervention modalities such as Virtual Reality Exposure Therapy (VRET), VR-relaxation, and combinations of VR with murottal or Cognitive Behavioral Therapy across clinical and non-clinical populations. Therefore, this study aims to synthesize the evidence on the effectiveness and modality variations of Virtual Reality–based interventions for anxiety among clinical and subclinical populations in publications from 2015 to 2024.

Method

The research method used is a qualitative approach through the literature study method with a narrative review design. According to Sugiyono (2023), study literature is method Data collection is carried out by means of examine various source relevant written like books, journals scientific, results research, articles, and other documents related to the current topic researched. Literature study used for getting runway theory, strengthening framework conceptual, as well as understand findings previously so that research conducted own base clear scientific. The article search was conducted using two databases, namely Google Scholar and ScienceDirect. The search process was carried out in November 2025 using the keywords: "virtual reality anxiety", "VR therapy", and "VR exposure therapy". The inclusion criteria for selecting articles were: (1) published between 2015–2024, (2) discussed the use of VR to reduce anxiety, (3) available in English or Indonesian, and (4) constituted empirical research. Meanwhile, the exclusion criteria included review articles, opinion papers, editorials, or publications that did not provide empirical data related to the effectiveness of VR.

From the initial search, 46 articles were identified. After screening titles and abstracts, 18 articles met the preliminary criteria. Following full-text reading, 10 articles were excluded because they did not clearly report intervention outcomes or were not aligned with the focus of this study. Therefore, a total of 8 articles were included in this review, consisting of 4 national and 4 international studies. Data extraction was conducted by recording essential information from each article, including the authors, year of publication, type of VR intervention, study population, research design, and main findings related to anxiety reduction. The data were analyzed narratively by grouping the findings based on VR modalities (such as VRET, VR-relaxation, VR-murottal, and VR-CBT) and their contexts of application. Although narrative reviews do not require rigorous quality appraisal,

each article was still evaluated for scientific adequacy based on methodological clarity, relevance of findings, and sufficiency of reported information.

Results and Discussion

The findings are summarized in the table 1. Below:

No	Authors (Year)	Population	VR Modality	Key Outcome	Quantitative Indicator
1	Susila et al. (2024)	Pre-operative patients (spinal anesthesia)	VR-relaxation	Significant reduction in pre-operative anxiety	*p = 0.000*
2	Mutianingsih & Hariyati (2018)	Social anxiety clients	VRET	Increased confidence, reduced social fear	Not reported
3	Nugroho et al. (2023)	Non-surgical adult patients	VR + Murottal (Ar-Rahman)	Decreased anxiety in ER patients	Significant difference (no p-value reported)
4	Nazzarudin & Putri (2024)	Anxiety disorder users	VR "Cosmic Space" relaxation	Improved relaxation and focus	Not reported
5	Carl et al. (2019)	Anxiety & phobia populations	VRET	Effective vs control groups	*VRET > Control, significant*
6	Fodor et al. (2018)	Anxiety & depression	VR interventions	Positive effect on anxiety & depression	Meta-analysis, significant
7	Wu et al. (2021)	Anxiety disorders	VR-CBT	Enhanced CBT outcomes	Significant improvement
8	Koo et al. (2020)	Pre-operative patients	VR interventions	Reduced anxiety	Meta-analysis, significant

Across the eight reviewed studies, all evidence consistently demonstrates that Virtual Reality (VR) is effective in reducing anxiety across different populations, modalities, and clinical contexts. In the four Indonesian studies, VR interventions—whether delivered as relaxation-based VR, Virtual Reality Exposure Therapy (VRET), or VR combined with murottal showed meaningful reductions in anxiety symptoms. For pre-operative patients undergoing spinal anesthesia, VR relaxation significantly reduced pre-procedure anxiety (*p = 0.000*), indicating its strong distraction and calming effects. Similar outcomes were observed in clients with social anxiety, where VRET enabled gradual exposure to feared social situations and contributed to increased self-confidence and reduced avoidance

behaviors. VR combined with murottal Surah Ar-Rahman was also found to decrease anxiety levels in non-surgical adult patients in emergency care settings. Additionally, the "Cosmic Space" VR application improved users' relaxation and attentional focus, indicating VR's potential not only for exposure therapy but also for relaxation-based interventions. International studies further strengthened these findings. Multiple meta-analyses reported that VRET significantly reduces anxiety and phobic symptoms compared to control groups and produces outcomes comparable to conventional face-to-face CBT. Studies also show that integrating VR with Cognitive Behavioral Therapy (VR-CBT) enhances treatment effectiveness because therapists can implement exposure in a controlled and structured virtual environment. Another meta-analysis highlighted the broader emotional benefits of VR, including reductions in general anxiety and depressive symptoms. Overall, VR emerged as both a primary and adjunctive therapy for anxiety reduction. Its effectiveness appears to be influenced by immersion level, degree of stimulus control, and the ability to replicate anxiety-triggering environments safely and progressivel.

Discussion

Based on results review to several research, it is seen that use Virtual Reality show pattern consistent effectiveness in lower anxiety in several population and context. According to study Susila et al. (2024) show that giving therapy Virtual Reality (VR) is influential significant in lower level anxiety patient pre-operative with spinal anesthesia. Findings This in line with understanding that anxiety pre-operative often appear consequence afraid to procedure surgery, pain, and uncertainty felt patient. In the context of said, VR works as distraction that is capable divert focus patient from the stimulus that causes anxiety going to a relaxing audio-visual experience. Decline significant anxiety in the group given VR, as indicated by a p-value of 0.000, strengthening that technology This effective as non- pharmacological interventions. Effects immersive from VR helps reduce activation physiological factors related to anxiety so that patient become calmer before action. Findings This strengthen that VR can used as safe and beneficial non - pharmacological interventions in preparation pre-operative. The use of VR helps divert attention patients and create a relaxing visual experience so that anxiety can decrease in a way significant. In patients adults, the effects still positive although No as large as in children. Findings This confirm that VR can made into effective non - drug interventions in management anxiety pre-operative at home Sick (Koo et al., 2020). Then in study Mutianingsih & Hariyati (2018) VR is proven effective For lower anxiety in clients with phobias social. VRET provides

safe and controlled exposure to situation feared social, so that client can face source of fear without risk danger real. Some peer - reviewed research in article also reported that VRET is capable increase participation social, reducing belief negative related fear, and increase ability face situation public, for example ability speaking in front of general after follow VRET session. Research results Nugroho et al. (2023) conducted on 24 groups patient non- surgical adults show Virtual Reality Therapy (VRT) combined with murottal Surah Ar-Rahman has been proven to be effective. give decline significant anxiety in patients non- surgical adults in the Installation Emergency Emergency. Effectiveness This especially caused by the mechanism distraction and effects relaxation that appears when patient exposed a relaxing virtual environment, so that response physiological anxiety can decrease in a way gradually. In addition, integration spiritual elements in the form of Murottal Al-Quran strengthens response calm psychological patient, because reading the verses of the Qur'an provide comfort emotional and increase sense of security internally. Findings This consistent with various study previously shown that murottal and religious audio therapy own impact significant in reduce anxiety in patients cancer, mother pregnant risky high, and patient pre-operative.

Study about "*Cosmic Space"* application shows that Use of Virtual Reality as a relaxation medium can help reduce tension and increase focus on users with impairments anxiety. A calming and immersive visual environment make users more easy reach condition relaxation, so that symptom anxiety can decreased. Findings This strengthen that VR is not only effectively used as therapy exposure, but also relevant as therapy relaxation independent that provides experience calm without triggers fear. This is show that VR has flexibility tall as non-pharmacological interventions in handling anxiety, in line with the trend use technology immersive in mental health (Nazzarudin & Putri, 2024). In research international also said that *Virtual Reality* proven effective lower anxiety. Based on study Carl et al (2019) which uses meta-analysis on groups control and experiment show that *Virtual Reality Exposure Therapy* (VRET) is very effective in lower anxiety and phobias If compared to the group control. Therapy This Work because VR is capable present scary situation in a way safe, so that users Can train face his fear in a way gradually. The research results also found that the effectiveness of VRET is almost same as therapy exposure directly but felt more comfortable for part patient. This is show that VR can become alternative therapy Practical and safe anxiety.

Virtual Reality combined with CBT (*Cognitive Behavior Therapy)* can also be used increase success therapy anxiety. VR helps provide environment more exposure realistic However still controlled, so that the CBT process is like

restructuring cognitive or exercise face afraid Can done with more effective. Many patients also feel more comfortable do exposure through VR compared to the real world. Findings This support use of VR as tool help traditional CBT therapy (Wu et al., 2021).

When analyzed by population, VR shows consistent benefits across diverse groups. Pre-operative patients benefit from reduced anticipatory anxiety due to VR's immersive distraction mechanisms (Susila et al., 2024; Koo et al., 2020). Clients with social anxiety demonstrate improvements in confidence and reductions in avoidance behaviors through VRET (Mutianingsih & Hariyati, 2018). Non-surgical patients in emergency care experience rapid emotional stabilization when exposed to VR–murottal (Nugroho et al., 2023). Individuals with generalized anxiety also benefit from relaxation VR and VR-CBT, as supported by findings from international studies, including Fodor et al. (2018).

Not only can reduce anxiety, But VR can also lower-level depression. Effects immersive VR helps users more focus on practice relaxation or scenario the therapy shown, so that emotion become more stable. Research this also shows that VR can made into choice intervention addition for disturbance more emotions broadly. In terms of Overall, VR has potential big as technology supporters' mental health (Fodor et al., 2018).

Of the eight reviewed articles, consistent found that effective Virtual Reality technology lower-level anxiety in various context and population. Some study shows the success of VR in divert attention patient from anxiety stimulus as well as create a calming experience. Research in Indonesia confirms effectiveness of VR for patient pre-surgery and clients with phobias social, whereas studies international strengthen findings This is in accordance with the results of a meta-analysis which shows decline anxiety significant equivalent to therapy conventional.

Findings from various study national show consistent pattern that use *Virtual Reality* effective in lower anxiety through mechanism distraction, exposure gradually, and effect relaxation. In patients' pre-surgery, VR is proven capable divert attention from the stimulus that causes anxiety and create a calming visual-audio condition, so that anxiety physiological can reduce in a way significant. The same effectiveness was also seen in non- surgical patients. when VR is combined with murottal, where immersive visual elements and spiritual audio stimuli produce decline more anxiety stron. Meanwhile, in clients with phobias social, the use of VRET helps they train face situation social in a way safe and controlled, so that courage, confidence self and ability face feared situation increase without risk real.

Result of study international the more strengthen findings by showing that VRET has effectiveness equivalent to therapy conventional, even more superior in matter control exposure and comfort participant therapy. The reviewed meta - analysis also confirmed that VR can lower anxiety in various form disturbance, good phobia specific and anxiety in general the integration of VR with other approaches such as CBT has been shown to create a therapy process more structured Because therapist can arrange situation trigger in a way gradual and appropriate need client. Overall findings This show that VR provides contribution important in management anxiety through safe, easy approach controlled, and according to needs various population involved in study.

When examined more deeply, the effectiveness of VR can be understood through several psychological mechanisms. The sense of presence and the controllability of virtual environments facilitate inhibitory learning, allowing individuals to realize that anxiety-provoking situations are not as threatening as previously perceived. In relaxation-based VR, anxiety reduction tends to be more acute because it primarily decreases physiological arousal, but it may not produce long-term change without cognitive restructuring. The integration of VR with murottal represents an important culturally grounded contribution, as Qur'anic recitation can strengthen safety signals, reduce hyperarousal, and enhance intervention acceptability among Muslim clients. On the other hand, challenges related to transferring gains from VR to real-world settings must be considered, as confidence developed in virtual environments does not always generalize directly to real situations without additional transitional steps. This indicates that VRET or VR-CBT remains necessary for achieving longer-term outcomes in social anxiety or generalized anxiety.

VR has the foremost advantage, namely control and exposure that can adjusted. One of the excess main VR in therapy anxiety is his abilities provide environment exposure *that* can be very controlled and adjusted. Therapist can design scenario trigger anxiety in a way progressive for example altitude, flights, crowds and regulating the "dose" of exposure in accordance ability client. This allows patient experience exercise exposure in safe space, without risk physique real that is possible exist in the real world. In addition, VR can also used for making repeat difficult situation or expensive to replicated in a way real (eg. climb the plane is in the building high), which can become obstacle in therapy conventional (Maples-Keller et al., 2017).

However, besides there is convincing advantages. VR remains There is shortcomings that become consideration. One of the lack mainly is need relatively expensive devices and require specification technical certain. Clinic small or

practitioner's individual often have trouble for provide VR headset, computer support, and special software therapy that costs No cheap. Besides the cost, using VR also requires ability technical so that the therapist can run the program well, so required training additional. Technical disturbances during a session can disrupt therapy and decrease the effectiveness of intervention.

Apart from the obstacle's costs and technology, VR also has the potential cause effect side physique for part users. Some patient experiencing motion sickness like nausea, dizzines, tension eyes, or fatigue after using a headset in quite a long time. Effect side This can bother comfort during therapy and limiting duration usage. In some case, experience too immersive intense can cause overstimulation, so that patient precisely feel more tense or no comfortable. This is show that use of VR requires careful control so as not to trigger reaction negative that can make things worse condition anxiety.

But from lack compared to therapy traditional, VR offers Lots advantages, such as therapist Can arrange exposure situations that give rise to anxiety in a way gradual and controlled, so that they Can train overcome afraid without must experience risk real. Immersive virtual environment gives strong distraction, helps lower tension physiological and make patient feel more relax. In addition, VR therapy is more economical costs and more practical compared to exposure directly, especially for difficult situation or expensive to replicated, such as flying phobia. VR also takes care privacy patient Because session therapy can do without, they must direct exposed embarrassing situation or dangerous. Technology This nature flexible, can used for various type anxiety, as well as allows measurement response patient in real-time so that evaluation therapy become more precise and efficient (Maples-Keller et al., 2017).

Discussion results This show that *Virtual Reality* own potential big for reduce anxiety as therapy. VR can used in Lots Of situations Because more safe, easy controlled, and helps people cope things that make they worried without must jump direct to situation real. Findings This show that VR can become choice addition for power health and psychology for give more therapy comfortable and attractive for clients. In addition, technology this also gives opportunity for study next so that VR therapy can made more effective and tailored to needs various population and context.

Although the findings of this review demonstrate consistent effectiveness of VR, several limitations should be noted. The included studies varied in design, sample size, and types of VR interventions, which limits the ability to make direct comparisons across results. Some articles also did not provide complete quantitative indicators and may contain publication bias, as most reported positive

outcomes. Additionally, the transfer of skills from VR environments to real-world situations has not been fully established, particularly among individuals with social anxiety or generalized anxiety. These limitations indicate the need for further research with more standardized procedures and larger samples to strengthen the generalizability of the findings. Research advanced can focused for repair quality virtual scenarios, enhancing level immersion, as well as adapt content therapy with characteristics and background behind different populations. With the development of more furthermore, VR has the potential used in a way wider No only as therapy main, but also as therapy complementary support method face face. This is show that VR is not only modern technology, but also tools that have mark strategic in advance practice psychology and approach intervention mental health for face increasing challenges complex in the future.

Conclusion

Virtual Reality (VR) has proven to be an effective, safe, and non-pharmacological modern intervention in reducing anxiety in various groups, including pre-operative patients, individuals with social phobia, and those with generalized anxiety disorder. Various forms of its application, such as *Virtual Reality Exposure Therapy* (VRET), VR-relaxation, the integration of VR with murottal, and the combination of VR with *Cognitive Behavioral Therapy,* have consistently demonstrated effectiveness in creating immersive experiences that can reduce the perception of threat and provide a calming distraction. In line with the increasing mental health challenges in the digital era, the use of VR is a practical solution that offers better exposure control and comfort without physical risks, making it worthy of being integrated into clinical psychology practice and medical interventions as part of today's mental health therapy innovation.

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