EFFECT OF VR-BASED MINDFULNESS INTERVENTION ON FEAR AMONG ADULTS

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Abstract. *This study explores the integration of Virtual Reality (VR) and mindfulness techniques to address fear among adults, a novel approach leveraging advancements in immersive technologies. VR-based interventions have shown potential in various therapeutic settings, but their application in mindfulness counseling remains underexplored. The research aims to evaluate the effectiveness of VR-based mindfulness interventions in reducing fear responses among adults. Objectives include examining physiological and emotional changes pre- and post-intervention and exploring participants' subjective experiences. A pre- and post-experimental design was employed with a sample of 20 college students aged 21–30. Participants underwent a structured VR experience, including exposure to both fear-inducing and calming mindfulness scenarios. Data were collected using structured questionnaires, Likert-scale ratings, and narrative feedback. Paired t-tests and qualitative analysis were used to analyze the data. The study found a statistically significant reduction in fear levels post-intervention, with participants reporting increased relaxation and reduced bodily tension after the mindfulness VR experience. Narrative analysis revealed enhanced emotional stability and a sense of grounding among participants. VR-based mindfulness interventions effectively moderate fear responses and provide grounding through immersive relaxation techniques. The findings highlight the potential of integrating VR into counseling settings to address stress and anxiety. Further studies should explore long-term impacts, scalability across diverse populations, and the integration of complementary technologies such as blockchain for secure data management and enhanced therapeutic outcomes.*

Keywords: *Virtual Reality; VR Based intervention; Blockchain; Counselling; Mental health.*

JEL Classification: D91, H55, M14

Formulas: 0; fig.: 1; table: 1; bibl.: 18

Introduction. Advancement in the field of technology has led to various innovations in multiple domains including mental health. While exploring latest innovations in technology it was seen that virtual reality (VR) and blockchain technology are the two prominent and emerging ideas which can be implemented.

Literature Review. Virtual reality (VR) is the use of computer modeling and simulation that enables a person to interact with an artificial three-dimensional (3-D) visual or another sensory environment (Lowood, 2024). Where as Blockchain is a digital record that stores different kinds of data (Rodeck & Curry, 2022).

Virtual reality is gradually gaining attention in the field of psychology. The sense of telepresence created by VR can be proven promising in the treatment of various mental health challenges like anxiety disorder, stress-related disorders (e.g. PTSD), phobias, eating disorders, addiction, autism, etc. and there have been various supportive researches on the effectiveness of virtual reality in different therapeutic interventions (Riva & Serino, 2020).

A study was conducted to evaluate the effectiveness of new innovations. The major findings of the study focuses on the importance of understanding and assessing the effectiveness of upcoming new innovations. Similarly, current research also focuses on understanding the effectiveness of VR based interventions in the field of mental health. (Gupta et al., 2021)

As per a systematic literature review conducted on Virtual reality as a technology in the treatment of anxiety disorders, it was stated that VR provides an experience of a sense of presence through a computer-generated three-dimensional environment. The outcome of this review mentioned that VR allows the patient to have control over their sensory stimulation and when and how they would deliver the sensory stimulus hence it can be used as a part of therapeutic intervention. VR can be used for a wide range of psychiatric disorders but the article specifically lays attention on using VR as an exposure-based intervention for anxiety disorder (Maples-Keller et al., 2018). Another detailed study and literature review was conducted on VR-based mindfulness which stated that VR-based mindfulness consists of VR meditation and mind-body exercises. The review indicates that VR mind-body exercises result in increasing mental health and physical health of older adults.

However, the study states that VR-based mindfulness in combination with other forms of exercise can promote mental well-being of older adults and recommends future research on the same (Gao et al., 2024). According to a 2-week VR intervention used to manage the level of depression, anxiety, and stress conducted with university students in China, mindful VR and relaxing music VR decreased the level of depression, anxiety, and stress.

The study mentioned that Mindfulness VR and Relaxing Music VR had proved to be an effective psychological intervention in negating negative emotions. Hence, the study recommends future research focusing on enhancing the Mindfulness VR intervention which can benefit further. Apart from that, further research can also be conducted to study the long-term impact of the interventions on negating negative emotions (Zheng et al., 2024). Park et al. refer to 36 studies on virtual reality treatments

in psychiatry that showed VR reduces pain and stress, and more than supports and treats anxiety disorders, phobias, and PTSD.

The authors also suggested that VR may have potentially positive effects on depression, cognition, social behavior functions, and dementia, MCI, schizophrenia, and autism. Although VR systems may cause user addiction and motion sickness, they can offer controlled sensory stimuli and possibly function as innovative clinical tools for patients who have certain psychiatric symptoms (Park et al., 2019). A study was conducted to understand the effectiveness of systematic desensitization through virtual reality for mitigating public speaking anxiety. Data was collected from a laboratory user study with 25 participants. The paper highlights the previous studies demonstrating the role of VR training in reducing public speaking anxiety (PSA). Various methods like social stimuli, audience (real or unreal), etc. were used to understand PSA triggers. As previous work highlighted in the study proved constant exposure to PSA triggers through VR scenarios could help in decreasing anxiety levels, opening up an opportunity to use it in a therapeutic intervention.

Additionally, the study also emphasized the importance of the optimal number of session for accurate data prediction along with acoustic and physiological features being the predictors of changing levels of PSA (Ebers et al., 2020). This study on 65 final-year students explores virtual reality therapy as a potential intervention for stress reduction. Stress was induced among the students by the Stroop task and a virtual environment involving natural sounds and forest-like environment was designed to promote feeling of relaxation. EEG readings indicate a calming effect of VRT amongst the mildly stressed group. However, there was no drastic difference observed between the control and experimental groups highlighting the importance of considering the personal preferences and experience of the individual, as the effectiveness of virtual reality in mitigating stress might vary from person to person (ESwaran et al., 2018). A pilot study was conducted on 42 GAD patients from three public centers in Zaragoza, Spain. This study aims to understand the efficiency of mindful-based interventions (MBIs) with the integration of virtual reality to treat Generalized Anxiety Disorder (GAD). As GAD patients face challenges like attention deficit, making them more prone to drop out of treatment, study highlighted the positive impact of VR integration in improving adherence rate among the group receiving Virtual Reality DBT® Mindfulness Skills. In this study, MBIs are also observed to be helpful in depression, emotional regulation, and various aspects of mindfulness, and integration of virtual reality is proven to improve the efficacy of existing interventions like MBI by improving patient engagement among GAD patients. Hence, this integration can also have positive treatment outcomes and effects on other mental health challenges (Navarro-Haro, 2019).

Blockchain is a digital record that stores different kinds of data. A new block is created and added to the chain whenever new data is added. To ensure this digital record is identical everywhere, all network nodes update the copy of this record. The reason why blockchain is considered extremely safe is due to how new blocks are created (Rodeck & Curry, 2022). Majorly associated with cryptocurrency, the blockchain technique is a problem solver for various fields like banking, supply chain monitoring,

voting, etc. A review article stated that blockchain technology is primarily used and claimed to be helpful in the financial industry yet it can be used in various industries. It states that supporting the architecture of blockchain, it contains a lot of potential to bring changes and advancements in the fields of medical, clinical and life sciences (Justinia, 2019). A descriptive research was conducted to study blockchain technology to build a psychological blockchain. The study clearly mentioned how blockchain technology can be a breakthrough innovation in the field of psychology if it was integrated with the behavioral domain to be used for marketing. The key finding of the study included how the components such as trust, confidence, and intention are hierarchically in order with respect to the hierarchy of decentralization, interaction, and learning process (Sahoo and De, 2023).

Another study fills the gap by analyzing cognitive factors that influence adoption contingent upon user characteristics. A cross-sectional survey of 506 participants further indicates that perceived threat vulnerability, response cost, efficacy, and self-efficacy influence adoption intentions, moderated by knowledge and innovativeness. These results offer practical implications on developing and marketing blockchain technologies, providing context for user views on adopting blockchain technologies, especially in relation to issues of data privacy and security (Davit Marikyan et al., 2022). A study conducted among 424 healthcare workers from Andhra Pradesh, demonstrates that a really significant problem area requires further extensive research in health informatics, data science, and ethics to adequately ensure blockchain-based EHR is employed for effective use. Some of the concerns addressed in this paper include the impact that blockchain has on the environment, access to healthcare, and trust of patients in relation to care received. It generally adds research on blockchain regarding health. EHRs have replaced physical patient records due to the convenience of avoiding data duplication, but there are challenges like poor interoperability and privacy concerns. Therefore, blockchain offers a solution to these problems by improving EHRs through their interoperability as well as preserving privacy (Seva Rangnekar et al., 2023).

Another paper discusses data protection of patients in the mental health sector using blockchain technology. A blockchain-based shared case registry model was suggested that uses blockchain technology features for creating secure psychiatric data. The model focuses on data protecting integrity and confidentiality along with unauthorized access. It was also highlighted that the model will promote smoother data exchange between different healthcare systems leading to effective treatment outcomes. This would support collaborations among different healthcare providers resulting in comprehensive care for patients with mental health challenges. The study emphasizes the potential use of blockchain technology in any areas of healthcare that require secure data management. (Nehal et al., 2023).

A combination of these game-changing technologies VR and blockchain may provide more advanced and effective interventions in the mental health industry.

One of the studies explored the effectiveness of using a metaverse based on blockchain and Non-Fungible Tokens (NFTs) for treating claustrophobia by creating an engaging and secure environment. The approach aims to support traditional methods

to treat claustrophobia by using blockchain for data management and using NFTs to increase patient participation as there has been evidence of these factors improving patient motivation, participation, and data security. Evaluation of the design also highlighted that it is effective against various security threats. The study emphasized that this design can address existing limitations in claustrophobia exposure therapy, such as challenges in creating realistic and controlled environments. Being flexible in nature, it can also be adapted for various other exposure therapies like social anxiety, different phobias, etc. Using blockchain will allow us to manage the data securely. (Ahmad et al., 2024).

All the findings in this study highlight the limited research in India and recommend conducting more research about virtual reality in therapeutic intervention. Similarly there is no research focusing on VR and the potential of blockchain in the field of psychology. Even though there are previous studies indicating clear use of VR based therapeutic interventions, it has been limited to clinical settings; however, exploration of the same is required in counseling while training certain skills like mindfulness, gratitude, stress, and anxiety management, etc. Therefore the current research aims to conduct an exploratory study to understand the effectiveness of VR-based therapeutic intervention in counseling by incorporate the concept of blockchain.

Aims. The research aims to study the effect of VR based mindfulness intervention on fear among adults.

Methodology. The study uses pre and post experimental design to study the effect VR based mindfulness therapy on fear induced behavior among adults.

Sample. The target population for this study were college going young adults pursuing post-graduation in various fields. 20 college going participants between the age group of 21-30 years from different fields from Bangalore were invited to participate in the study based on a screening conducted through a checklist which helped to assess the physical and emotional readiness of the participants. The one in an emotionally neutral state and showed readiness were further considered for data collection. Purposive sampling was used for this research.

Phase-1. Participants were asked to fill in a structured questionnaire in order to check their physical and emotional preparedness for the experiment. The participants who showed physical and emotional readiness were only selected for the main experiment. In total 30 individuals went through the screening process from which only 20 participants were selected based on their responses to the questionnaire.

Phase 2. Later, selected participants were made to be seated comfortably. They were asked to wear VR equipment. The researchers demonstrated how to wear the VR and the operation of VR was briefed to the participants.

A virtual boundary was drawn around the participants and they were asked to stand within the boundary. Then the participants were asked to play the video which was displayed on their VR device. The video was around 2 mins 30 secs long where the participants felt they were standing in the middle of a living room where they could experience paranormal activities going on around them. Through this video the participants were exposed to an unpleasant and fearful experience. A pre-test questionnaire was given to the participants after the VR experience and the participants

were asked to fill in their responses to measure the fear and narrate their experience of the video.

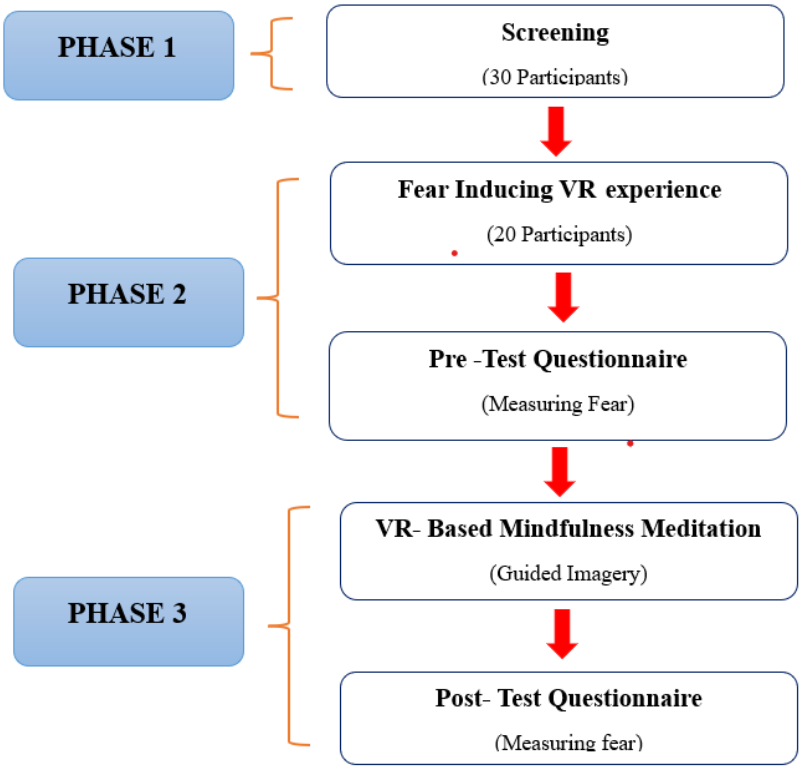

Figure 1. Shows the flow of the process used for data collection

Phase 3. Participants were again asked to wear the VR device and they were made to stand within the virtual boundary created through VR. This time participants were asked to play another video which was 5 mins long consisting of mindfulness meditation through guided imagery where individuals felt like they were sitting on a pleasant beach. Through this video the participants were exposed to a pleasant experience which helped them to feel relaxed and grounded. After viewing this video another structured questionnaire was given to record participants' responses post the pleasant video experience and to check if there is change in the level of fear they felt previously. Lastly the participants were asked to describe their experience and feeling after the mindfulness meditation.

Scoring. A Pre and post questionnaire was provided to the participants to measure their fear. The questionnaire consisted of a 5 point likert scale (1= Low and 4= high) where the fear was measured based on four parameters which included ‘ Relaxed state, Tension in the body, Breathing and awareness of the thoughts. Along with this the questionnaire also consisted of an open ended question focusing on the participants overall feelings and experience pre and post the VR based mindfulness intervention.

Data Analysis. Collected data was analyzed using paired t test and narrative analysis. The recorded data was coded and a t value was extracted by comparing the pre and post experience data. The subject data was identified and common patterns and themes were extracted related to their experiences.

Results. Table 1 shows the difference between two mean scores on fear with the VR based mindfulness intervention.

The results reveal a statistically significant difference in the fear response of the participants before and after the VR based mindfulness intervention. The parameters of measuring fear were Relaxed, Breathing, Tension in the body, Awareness of thoughts.

Table 1: Shows the average mean score of the parameters measured

Parameters	Pre-test	Post test	t Values	P value
Relaxed	3.9	2.75	0.362681	< 0.05
Tension in the body	1.8	4		
Breathing	3.1	2.9		
Awareness of the thoughts	3.8	3.8		

Source: developed by the authors

The participants' emotional and physical response was measured by Likert scale from 1 to 5, where 1 indicates the lowest intensity and 5 is the highest. The average pre-test value for 'Relaxed' is 3.9 and post-test value is 2.75. The average pre-test value for "Body tensions" is 1.8 and the post-test shows an increase to 4, , suggesting the high levels of fear and bodily tension after the VR experience.

Concerning "breathing", the scale ranges from shallow as showing 1 to shallow breathing and, 5 as deep breathing. The average score of 3.1 before VR experience was recorded and after experience, however, it becomes about 2.9 with reduced levels indicating a drift to be on the shallower side as caused by the experience.

They were also asked to rate, pre-test mean score was at 3.9, which meant a medium sense of relaxation. After undergoing VR experience, it went down to a post-test score of 2.75, showing decrease in relaxation. Lastly, awareness on thoughts was measured, pre and post-test scores did not change meaningfully since they remained at 3.8, meaning no meaningful change in the result of the VR experience in cognitive awareness.

The obtained t value is 0.36 with the P value of 0.05. This suggests that VR based mindfulness therapy is effective in reducing fear responses in participants.

The VR based grounding exercise was applied to assist grounding to regain a relaxed state. Narrative analysis was used to gather feedback. The VR based guided meditation exercise for grounding and relaxation had a great impact on the relief of tightness in the body in participants by reducing their fear and becoming more centered. Through narrative analysis, it depicts that most participants felt calmer and balanced after this experience. A Participant stated, "I felt safe and calm on the beach.". Another recalled that he was now "more perceptive and consciously aware of his inner experience" and even went ahead to describe how he was able to regain a sense of balance because the anxious thoughts in his head, which had been wandering with various considerations he had about his life, regained the sense of equilibrium. Another participant also claimed to have "relaxed gradually" as she reflected on the final video

for about 30 seconds. Image of the sea soothed her, causing her to feel fully present and had completely allowed herself to the experience.

Discussion. The findings of this study emphasize the idea that VR-based intervention delivered in counseling might potentially serve as an effective intervention for managing stress and anxiety. Results confirmed previous studies that depicted efficiency in the moderation of negative emotional states by VR. For example, studies from Park et al. (2019) and Zheng et al. (2024) demonstrated how VR can be created as an engaging environment that could also serve as a source of some alleviation of the symptoms of anxiety and depression by suggesting moments of relaxation or mindfulness. In this current research, using blockchain technology, it shows the brain works just like the block chain technology. This study aimed by using the block of data from the brain, we stimulated the reactions using the VR, to help participants to manage with stress and anxiety. Further supported the practicability of the VR intervention in therapeutic settings.

This research contributes to the growing body of literature around VR applications in therapeutic interventions, emphasizing its application beyond the clinical scenario-specifically in counseling for the management of stress and anxiety. Further, the incorporation of blockchain technology introduces a new dimension to intervention by ensuring participants' data security, an issue that raises considerations about privacy and protection of data regarding mental health care.

Limitations:

1. The limited access to VR restricted the sample size of 20 participants. Future research studies can focus on larger participants, which may reflect diversity and examine longer term results to VR based interventions in counseling settings.
2. The study only considered immediate post-intervention effects, and future studies should judge whether these effects are sustainable over time.

Conclusion. The present study provides preliminary evidence about the efficiency of VR-based therapeutic interventions in reducing negative emotional responses among young adults. Coupled with the fact that blockchain technology would be integrated to offer further layers of data security, such research promises an important step toward mitigating privacy issues in therapeutic settings. The results are encouraging, more research is warranted to understand the long-term implications of the intervention, using VR, and its scale-up ability among divergent populations. It may be that increased use of such technologies in counseling could open doors to completely innovative, safe, and effective interventions.

Author contributions. The authors contributed equally.

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