Immersive Virtual Reality Applications for Mental Health Awareness: A Case Study Using 3d Narrative Boards

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ABSTRACT

This paper presents the development and evaluation of an immersive virtual reality (VR) application designed to raise mental health awareness through 3D narrative boards. Utilizing Unreal Engine and 3D modeling software, we constructed realistic scenarios depicting the lived experiences of individuals facing depression. The system enables users to interact with immersive environments from a first-person perspective, with narrative elements guiding the user's understanding of mental health challenges. A usability study was conducted involving target users who experienced the VR application and subsequently completed the System Usability Scale (SUS) questionnaire. The results demonstrated high usability, user engagement, and strong potential for fostering empathy and awareness regarding depression. This research highlights the advantages of integrating VR, 3D character animation, and interactive storytelling into educational tools for mental health. The findings underscore the effectiveness of applied computer and information science techniques in creating impactful health education resources. This approach provides a novel platform for future mental health campaigns and represents a significant step towards the digital transformation of public health education.

Keywords: virtual reality, mental health, depression, 3D narrative boards, user engagement, empathy, applied computer science, system usability.

INTRODUCTION

Mental health disorders represent one of the most pressing global health challenges of the 21st century. The prevalence of conditions such as depression continues to rise, affecting individuals of all ages and contributing significantly to the overall burden of disease and disability worldwide (World Health Organization, 2022; National Institute of Mental Health, 2023). According to recent estimates, 10–20 percent of children and adolescents globally experience some form of mental health issue, and one in four children live with a parent who has a mental health disorder. The shortage of qualified mental health professionals—in some regions as low as one for every 10,000 people—has left large segments of the population underserved (World Mental Health Day, 2023).

A critical barrier to addressing mental health needs is the continued lack of public awareness and understanding, particularly regarding depression. Depression is often misunderstood as merely persistent sadness; however, its symptoms can be subtle, varied, and difficult for both sufferers and observers to recognize (Kovacs, 2007). As a result, many individuals go undiagnosed or unsupported, exacerbating their

condition and diminishing quality of life (Mental Health Foundation, 2022). Traditional outreach campaigns have largely relied on static, two-dimensional media such as posters or videos to raise awareness, but these methods often fail to convey the depth and complexity of psychological experiences. This limitation can hinder the development of empathy and comprehensive understanding among the public or even professionals (MindOwl, 2024).

Recent advances in computer and information science, particularly the advent of immersive VR technologies, offer promising alternatives to conventional approaches. VR enables users to interact within highly realistic, simulated three-dimensional environments, facilitating a level of experiential learning and empathy-building previously unattainable with traditional media (Goldman, n.d.). Importantly, as Freeman et al. (2017) emphasize, VR's ability to create controlled, immersive worlds makes it a powerful tool for targeted psychological interventions and new learning; these virtual environments can deliver therapeutic strategies that are difficult or impossible to recreate in real life, with potential for consistent, readily available delivery even beyond research laboratories, now extending into homes and mental health clinics. While VR has been increasingly adopted in fields such as gaming, simulation training, and education, its application to mental health education, and more specifically to public awareness initiatives, remains underexplored. Notably, relatively few studies have directly assessed the effectiveness of VR as a tool for fostering understanding and empathy for individuals living with depression (8 Outstanding Video Games that Tackle Mental Health, 2024).

Therefore, this paper addresses the gap by developing and evaluating an immersive VR application that employ 3D narrative boards to convey the lived experiences of individuals with depression. By enabling users to engage interactively with narrative-driven scenarios within a virtual space, this approach seeks to bridge the "empathy gap" often observed in public comprehension of mental health issues.

The primary hypothesis guiding this research is that interactive, narrative-based VR experiences can significantly enhance mental health awareness and empathy, compared to traditional static media. The study's objectives are threefold: (1) to design and implement a VR system integrating 3D narratives representative of depressive episodes; (2) to evaluate the system's usability and user engagement among targeted participants; and (3) to assess the potential of VR-driven interventions for educational and public health campaigns addressing mental health.

Background Study

VR has evolved markedly over the past few decades, transitioning from early conceptualizations like Morton Heilig's Sensorama to sophisticated, consumer-ready headsets. Major breakthroughs in hardware, graphics, and mobile computing—such as those seen in the Meta Quest 2—have expanded VR's accessibility and impact, allowing users to experience fully immersive, interactive 3D environments.

Mental health disorders, notably depression, represent a significant global health concern, impacting thoughts, emotions, behaviors, and daily functioning across all demographics. Depression, also known as major depressive disorder, is a prevalent mood disorder marked by persistent feelings of sadness, hopelessness, and disinterest. Common symptoms include continuous sadness, negative outlook, irritability, loss of interest in activities, fatigue, sleep disturbances, appetite changes, difficulty concentrating, and thoughts of self-harm.

Figure 1: Examples of 2D images illustrating key signs of depression, including negative outlook, sadness,

appetite changes, and loss of interest in activities.

Traditional mental health awareness efforts often rely on static, 2D representations, such as images and videos, to illustrate symptoms and experiences of depression in Figure 1. For instance, posters and infographics depict various symptoms and preventive strategies in Figure 2 (a), while animated or explainer videos seek to describe how depression affects thoughts and behaviors Figure 2 (b). Although these tools can convey information, they may fall short in capturing the emotional depth and day-to-day complexity of living with depression.

Figure 2: Traditional 2D materials illustrating depression symptoms and awarenes

Recent technological advancements enable the use of fully immersive VR to combine sensory feedback and interactive 3D storytelling for mental health awareness. Unlike static images or videos, VR environments allow users to interact directly with scenarios that simulate depressive experiences, offering the potential to foster empathy and deeper mental health literacy. However, the use of immersive VR remains underutilized in mental health education, with most awareness initiatives still relying on conventional, less interactive formats.

Given these developments, there is an evident need for rigorous empirical assessment of VR-based interventions within public health education. This study seeks to investigate the effectiveness of a purpose-built VR application featuring 3D narrative boards, aiming to provide a more engaging and empathetic learning experience about depression than traditional media. By addressing this research gap, the project contributes to the advancement of applied computer science in the realm of mental health awareness and supports the design of next-generation educational technologies.

Recent empirical studies highlight the potential of immersive VR interventions to enhance knowledge, empathy, and attitudes toward mental illness. For example, a scoping review by Tay, Xie & Sim (2023) reported that AR/VR-based interventions showed positive effects on knowledge (66.7 %), attitudes (62.5 %), empathy (100 %), and reduced stigma (71.4 %) for populations engaging with mental health content. Similarly, Zare-Bidaki et al. (2022) conducted a pre-post experiment with medical students and found that adding a VR simulation module significantly increased empathy and reduced stigma compared to traditional methods. Moreover, a recent randomized intervention (Tay et al., 2025) demonstrated that immersive VR experiences can shift attitudes and enhance empathy toward individuals with psychotic disorders. In education

more broadly, Marougkas et al. (2023) provide a comprehensive review of how learning theories have been integrated into VR systems, reinforcing the importance of pedagogical grounding in designing effective VR environments.These studies support the rationale that immersive VR has promise not just for usability but for meaningful psychological and attitudinal impacts, justifying its exploration in mental health awareness contexts.

METHODOLOGY

This section details the development methodology for establishing a fully-immersive VR environment aimed at raising mental health awareness—particularly about depression—through narrative-driven experiences and advanced user interactivity. The methodology emphasizes the technical workflow for creating the virtual world, 3D assets, animations, and interactive features.

Immersive Virtual Reality Environment Development

The foundational step involved designing a realistic and cohesive virtual environment using advanced 3D modeling and game development tools. Blender was employed to create and animate detailed 3D models of characters and settings, including the primary character's home and outdoor scenes. These assets were then imported into Unreal Engine, where they were integrated into a vibrant, interactive world enhanced with realistic textures, dynamic lighting, and environmental details.

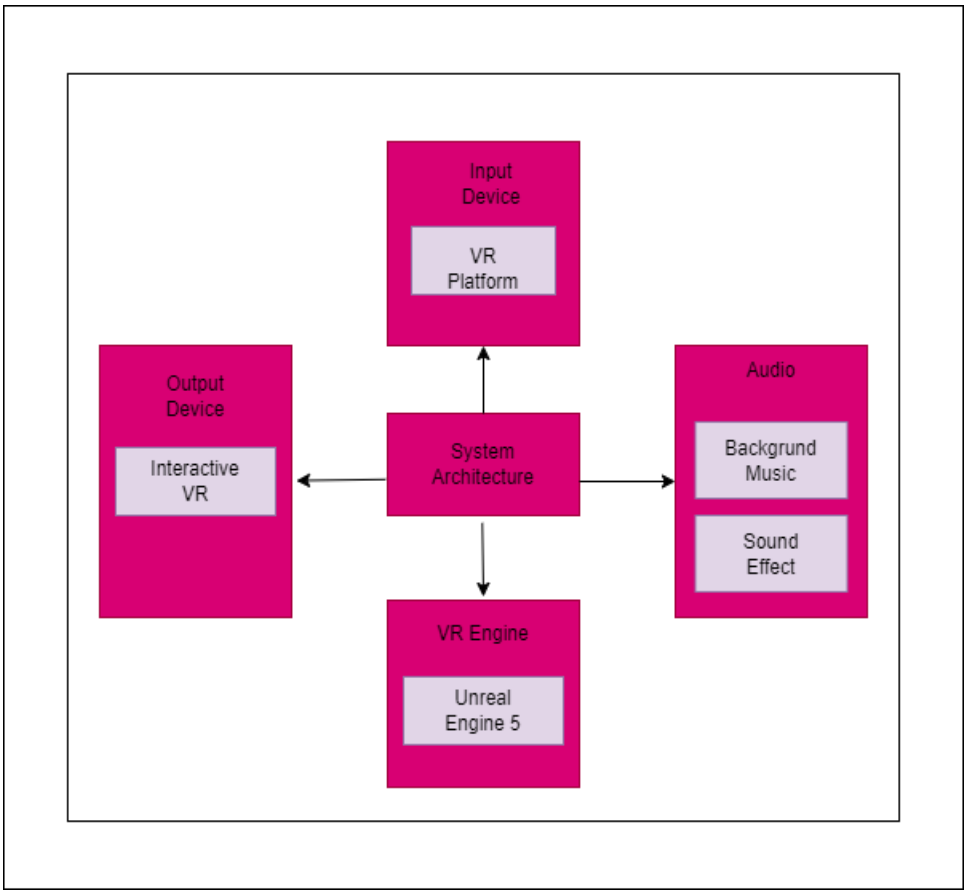

Figure 3: System architecture for developing and delivering the immersive VR environment.

To clearly illustrate the development and functionality of the immersive VR environment described in Phase 1, the system architecture shown in Figure 3 was implemented. This architecture demonstrates how each core component—input and output devices, audio, and the VR engine—integrates to support the creation and operation of the interactive virtual world.

In this phase, 3D models of characters and environments were created in Blender and then imported into

Unreal Engine for further development. The VR engine (Unreal Engine 5) serves as the backbone of the system, enabling realistic rendering, animation, and real-time interactivity within the virtual environment. The VR platform, as the primary input device, allows users to navigate and interact with the world, engaging with narrative boards and other educational elements. Output devices deliver the final immersive experience to the user, translating system interactions into interactive VR content. Audio components—including background music and sound effects—are synchronized through the architecture to enhance realism and emotional engagement.

This interconnected architecture ensures that 3D assets, user interactions, and contextual storytelling elements work seamlessly together, resulting in a cohesive, realistic, and deeply engaging VR environment for mental health awareness.

3D Modeling and Asset Creation

The creation of the immersive VR environment relied heavily on a robust and detailed 3D modelling and asset development process. This began with the use of Blender to model base meshes for all primary characters, objects, and environmental features. Each mesh was carefully sculpted and refined to ensure expressive and realistic character design, as well as to accurately depict key settings—such as interior rooms and cityscapes.

Texturing and rigging were the next critical steps. Realistic surface textures were applied to give each model depth and lifelike appearance. Skeletal structures were created for all animated characters, enabling fluid and believable movement throughout the virtual environment. Animation preparation involved binding (skinning) the characters to their respective skeletons and adding control rigs for natural posing and dynamic in-game interactions.

Once modelling, texturing, and rigging were complete, all assets were imported into Unreal Engine. Here, shaders, lighting setups, and physics properties were configured to maximize realism and immersion. Attention was also focused on optimizing models to maintain high visual fidelity without sacrificing performance in the VR setting. Figure 4 shows the entry screen highlighting the focus on raising mental health awareness using virtual reality and 3D narrative boards. Meanwhile, Figure 5 shows an in-game environment demonstrating the consultation scene and Figure 6 shows the outdoor scenario showing the primary character and narrative board that guides users through the emotional journey of the character and contextualizes the user's experience in the environment.

Figure 4: Main page of the VR application.

Figure 5: In game environment

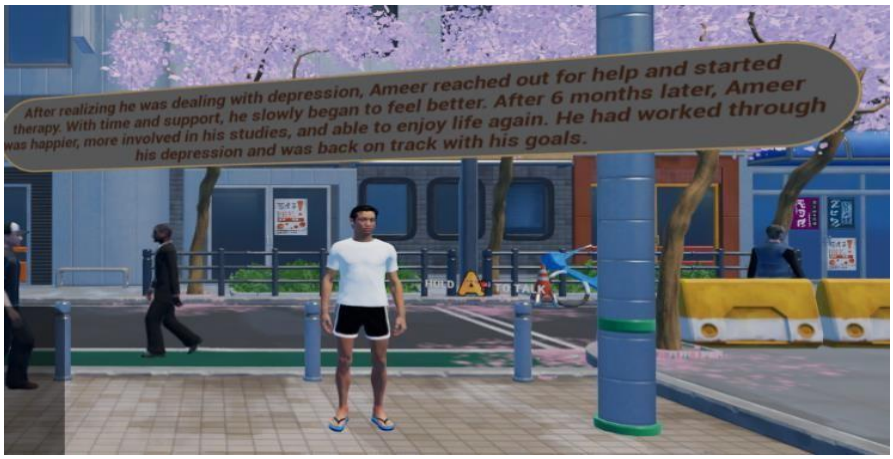

Figure 6: Outdoor scenario.

Throughout these stages, careful attention was placed on asset optimization to ensure smooth real-time interaction, seamless transitions, and an immersive, engaging user experience. This systematic approach to 3D modelling and asset creation laid a strong foundation for the narrative and educational goals of the project.

Animation and Real-Time Interactivity

The final phase of the development process focused on animating the VR environment and enabling real-time user interactivity to create an engaging and immersive experience. Animation workflows were carried out using Unreal Engine's comprehensive toolset. Level Sequences provided a timeline-based editing environment for orchestrating complex character actions, environmental transitions, and the flow of narrative events. By setting keyframes, animators defined natural poses and transitions, ensuring the depiction of lifelike movement and genuine emotional responses from the characters.

To enhance interactivity, Unreal Engine's Blueprint visual scripting system was implemented. This enabled objects and characters within the virtual scene to dynamically respond to user input and environmental triggers similar to prior work exploring natural and voice-based interaction in mixed reality environments (Ishigaki et al., 2024). For example, users could initiate conversations, trigger visual cues, or influence in-game events through their actions, making the environment responsive and participatory.

The result is a richly animated and interactive virtual world where users are not passive observers but active participants in the mental health awareness journey. Figure 7 illustrates a user interacting in real time with the environment and virtual characters within the scene. This integration of animation and interactive elements

provides a seamless narrative flow, immersing users in the educational content and deepening their understanding of mental health experiences.

Figure 7: Real-time user interaction with a virtual character in the VR environment.

Evaluation and Data Collection

The evaluation of the immersive VR application was conducted as a pilot usability study to assess the system's functionality and user experience. A total of 31 participants which are students and young adults were invited to experience the VR environment, after which they completed the System Usability Scale (SUS) questionnaire. The SUS is a standardized 10-item tool widely used to measure perceived usability, learnability, and system integration. This initial evaluation provided baseline evidence of the system's ease of use and potential for broader application.

In addition to usability, participants were asked to provide open-ended feedback regarding engagement, perceived empathy, and clarity of the narrative content. These qualitative insights complemented the SUS scores by highlighting user perceptions of the application's educational value.

Limitations and Future Evaluation Plan

It is important to note that this study focused only on usability; therefore, no direct pre/post measures of mental health awareness, empathy, or attitudinal change were included. As such, the findings should be interpreted as preliminary and exploratory. To strengthen future evaluations, additional validated instruments are recommended, such as:

- Mental Health Knowledge Schedule (MAKS) – to assess knowledge and awareness.
- Empathy Quotient (EQ) – to measure changes in empathy.
- Attitude Toward Mental Health Questionnaire (ATMHQ) – to capture shifts in perception and stigma.
- Future studies should also adopt a mixed-methods approach, combining quantitative questionnaires with qualitative interviews or focus groups to provide deeper insights into user experiences and long-term impact.

RESULTS

The effectiveness and usability of the immersive VR mental health awareness system were evaluated using the System Usability Scale (SUS) as shown in Table 1, a standardized user experience assessment tool. After exploring the VR environment, participants completed the 10-item SUS questionnaire, rating aspects such as

ease of learning, efficiency, confidence in use, and overall satisfaction.

Table 1: System Usability Scale (SUS) Statements

No	Statement
1	I found the system too complex.
2	I would like to use this system often.
3	I would need help from a technical person to use this system.
4	I found the system easy to use.
5	I found too much inconsistency in this system.
6	I found the functions in this system well integrated.
7	I found the system awkward to use.
8	I would learn to use this system very quickly.
9	I needed to learn a lot before I could use this system.
10	I felt very confident using the system.

The SUS results indicate that users generally perceived the VR system as simple, manageable, and not technically demanding. Negatively worded items such as "I found the system too complex" (SUS1), "I would need help from a technical person to use this system" (SUS3), and "I found too much inconsistency in this system" (SUS5) received strong disagreement from participants, showing that they did not view the system as confusing or difficult to operate. Similarly, SUS7 and SUS9 also reflected that users did not experience awkwardness or require extensive learning to use the system effectively.

Meanwhile, positively worded items such as "I would like to use this system often" (SUS2), "I found the system easy to use" (SUS4), "I found the functions in this system well integrated" (SUS6), "I would learn to use this system very quickly" (SUS8), and "I felt very confident using the system" (SUS10) received moderate scores. This suggests that although the system is generally easy to use, participants may not consider it as a tool intended for long-term or repeated use, which is typical for VR applications developed for awareness and educational purposes.

Overall, the SUS findings support the reviewer's observation that the system demonstrates high usability, strong integration of functions, and an intuitive interface that allows users to focus on the narrative and emotional elements of the experience without distraction.

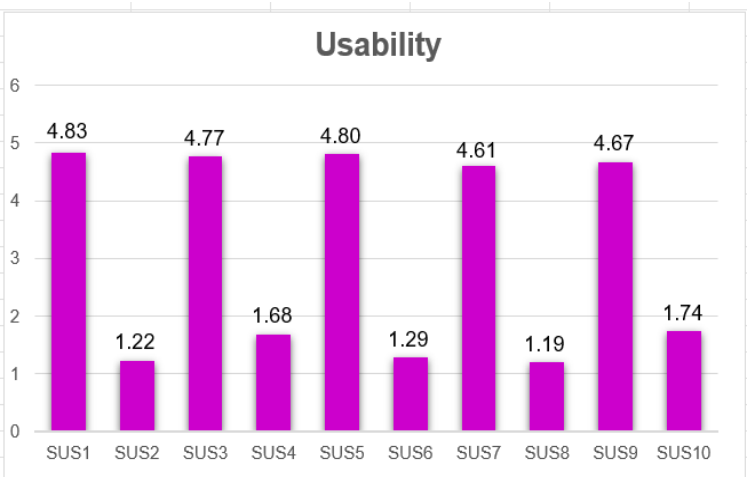

Figure 8: System Usability Scale (SUS) results, displaying participant responses for each usability component.

These findings support the primary hypothesis that a well-designed immersive VR system can be accessible and educational for a broad audience. The positive evaluations—particularly regarding system simplicity and integration—corroborate the effectiveness of the development approach. Compared with traditional 2D materials, participants reported that VR's interactivity and immersive narrative provided greater engagement and clarity regarding mental health experiences.

It should be noted that the study's scope is limited by its specific participant demographic and testing setting. Broader validation across multiple user groups and longer-term studies could offer further insights into system usability and impact. Additionally, the current results primarily reflect immediate user reactions; assessing knowledge retention and behavioural or empathetic change over time are recommended areas for future research.

In summary, this immersive VR environment shows strong potential as a user-friendly and effective educational tool for mental health awareness campaigns, suggesting valuable applications in public health, education, and community outreach contexts.

DISCUSSION

The reviewer highlighted that the VR application demonstrates high usability and strong potential for educational impact. This is supported by the SUS findings, which show that users faced minimal difficulty navigating the system and engaging with the narrative. High usability enhances user immersion and allows participants to focus on understanding the emotional aspects of depression portrayed in the VR experience. This suggests that the system effectively supports mental health awareness by offering an accessible, empathetic, and user-friendly learning environment.

The SUS findings further reinforce the system's effectiveness, as users reported that the VR application was easy to navigate, coherent, and did not require technical support. The strong disagreement with negatively worded items indicates that users did not perceive the system as confusing or inconsistent. Although moderate scores were recorded for positively worded items, this trend is typical for VR applications intended for short-term educational use. Overall, the SUS results validate the system's usability, supporting the reviewer's observation that the VR design effectively facilitates learning and enhances user engagement in understanding mental health issues.

CONCLUSION

This study presented the development and pilot evaluation of an Immersive Virtual Reality Applications for Mental Health Awareness: A Case Study Using 3D Narrative Boards application designed to raise awareness of mental health issues, with a particular focus on depression. The project demonstrated that VR can provide an engaging and empathetic learning experience, allowing users to better understand the challenges faced by individuals with mental health conditions. Positive feedback from participants suggests that immersive approaches may serve as powerful complementary tools to traditional awareness campaigns.

Despite these achievements, the study had several limitations. The evaluation was limited to usability testing, and the VR experience offered only a restricted range of interactive scenarios. Technical challenges such as hardware compatibility also affected accessibility. These limitations highlight the need for further refinement of the system, broader content development, and more rigorous empirical studies to assess changes in awareness, empathy, and attitudes.

Overall, the project contributes to the growing body of work exploring immersive technologies in mental health education aligned with recent XR applications in communication, education, and interactive 3D environments (Ishigaki et al., 2024). By making the application publicly accessible, it lays the groundwork for wider adoption and further research into how VR can foster understanding, reduce stigma, and promote positive mental health awareness across diverse audiences.

Ethics Statement

As this pilot usability study did not involve sensitive personal data or medical interventions, formal ethics board approval was not required according to the institutional guidelines of [University Name]. Nevertheless, all participants were briefed on the study aims and procedures, and informed consent was obtained prior to participation. No generative artificial intelligence (AI) tools were used in the drafting or editing of this manuscript.

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