Virtual Reality Exposure Therapy for Acrophobia: Designing a Game Application

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Info Artikel

Abstract

Anxiety disorders are the most common type of mental disorder Almost 18.1% of adults experience anxiety disorders, with the specific phobia subcategory being understudied. Studies indicate that the prevalence of specific phobias ranges from 3% to 15% worldwide, with phobias of heights and animals being the most common. While exposure therapy for anxiety disorders has strong evidence, not many therapists use this method. In this study, we employed an exposure therapy method that involved gradual and repeated exposure to a feared stimulus, resulting in changes in cognition, behavior, and emotional and physical responses. The study developed the exposure therapy method as Virtual Reality Exposure Therapy (VRET), utilizing an interactive and engaging 3D environment to facilitate new learning and provide an immersive experience for users. The research also leveraged VRET technology to assist in training, evaluating, delivering, and supervising psychotherapy skills. Our study resulted in a prototype of VRET that offers a more specific and detailed therapeutic tool for acrophobia in the form of game. The compatibility test results show that the iPhone XR 2021 and Poco X3 Pro 2021 can build applications 5 minutes faster than the Poco M3 2021 and 15 minutes from the Realme 3 2021. The Poco X3 Pro 2021 application installation process is 1 to 2 seconds faster than the iPhone XR 2021 and Poco M3 2021. Realme 3 2021 is 9 seconds slower than Poco X3 Pro 2021.

Abstrak

Gangguan kecemasan adalah jenis gangguan mental yang paling umum. Hampir 18,1% orang dewasa mengalami gangguan kecemasan, dengan subkategori fobia spesifik sedang dipelajari. Studi menunjukkan bahwa prevalensi fobia spesifik berkisar antara 3% hingga 15% di seluruh dunia, dengan fobia ketinggian dan hewan adalah yang paling umum. Sementara terapi pemaparan untuk gangguan kecemasan memiliki bukti kuat, tidak banyak terapis yang menggunakan metode ini. Dalam penelitian ini, kami menggunakan metode terapi pemaparan yang melibatkan pemaparan bertahap dan berulang terhadap stimulus yang ditakuti, menghasilkan perubahan dalam kognisi, perilaku, dan respons emosional dan fisik. Studi ini mengembangkan metode terapi pemaparan sebagai Virtual Reality Exposure Therapy (VRET), menggabungkan lingkungan 3D yang interaktif dan menarik untuk memfasilitasi pembelajaran baru dan memberikan pengalaman mendalam bagi pengguna. Penelitian ini juga memanfaatkan teknologi VRET untuk membantu melatih, mengevaluasi, menyampaikan, dan mengawasi keterampilan psikoterapi. Studi kami menghasilkan prototipe VRET yang menawarkan alat terapi yang lebih spesifik dan terperinci untuk akrofobia dalam bentuk permainan. Hasil uji kompatibilitas menunjukkan bahwa iPhone XR 2021 dan Poco X3 Pro 2021 dapat membangun aplikasi 5 menit lebih cepat dari Poco M3 2021 dan 15 menit dari Realme 3 2021. Proses instalasi aplikasi Poco X3 Pro 2021 lebih cepat 1 hingga 2 detik dibandingkan iPhone XR 2021 dan Poco M3 2021. Realme 3 2021 lebih lambat 9 detik dari Poco X3 Pro 2021.

1. INTRODUCTION

Nearly 18.1% of adults experience anxiety disorders [1]. However, researchers have not extensively studied the subcategory of anxiety disorders known as specific phobias [2]. Anxiety disorders have a worldwide prevalence of 7.3% [3]. but specific phobias range from 3% to 15%, with height and animal phobias being the most common [2]. Anxiety symptoms can cause significant distress, reduce the quality of life, increase stress levels, and increase the risk of several co-occurring physical conditions, such as chronic pain [4]. Given anxiety's significant impact on mental and physical health, it requires effective treatment. However, despite the prevalence of anxiety disorders, many people affected remain untreated [5], [6].

Exposure therapy is a well-established treatment for anxiety disorders, but therapists do not widely use it due to some misunderstandings that limit its availability [7], [8]. This therapy gradually exposes patients to the stimuli they fear, changing their cognition, behavior, and emotional and physical responses. The stimuli can be anything from living organisms to inanimate objects, situations, activities, thoughts, mental images, physical symptoms, or affective experiences [9] [10]. Research has shown that exposure therapy effectively treats anxiety disorders, particularly phobias. However, patients often fear exposure therapy, and adjusting the exposure can be challenging [11], [12]. Making clear mental images during imaginal exposure becomes more complicated with age. Despite its proven effectiveness, these obstacles contribute to the underutilization of the exposure therapy [13].

VR technology has the potential to aid in the training, evaluation, delivery, and supervision of psychotherapy skills [14]. Additionally, patients can have emotionally and physiologically evocative experiences through VR, making it a valuable tool in the mental health care [15]. *Virtual Reality Exposure Therapy (VRET) allows therapists to quickly implement individualized, phased, and controlled immersive exposures that are often more acceptable to patients than in vivo or imaginal exposures* [7]. VRET enables users to practice behavioral skills in a safe environment under the guidance of a therapist. It has effectively treated social anxiety, Post-Traumatic Stress Disorder (PTSD), and panic disorder. Clinically, VRET is a practical and evidence-based treatment that makes exposure therapy more manageable and acceptable to therapists and patients [16].

Therapists' slow adoption of new technologies is an obstacle to the full use of VR in therapy, despite its advantages in treating phobias [14]. Overcoming this barrier requires increasing therapist knowledge and training on VRET and addressing concerns about costs and benefits. The availability of VR products and applications and patient demand for VRET therapy can also help overcome this barrier [17]. Another obstacle is the need for continued research and development to expand the use of VR in different clinical settings. VR may not be suitable for all patients, and more clinical content is necessary for personalized treatment [18].

Virtual Reality Exposure Therapy (VRET) is needed because it has lower risks than exposure therapy in a natural environment. This study aims to develop a mobile application prototype with a 3D environment for height phobia. This app incorporates gamification elements to create new and immersive experiences for people with phobias.

1. RESEARCH METHODS
1.1 Stages of Virtual Reality Application Development

Application development refers to previous research [19]. For Virtual Reality (VR) application development, the first step is to choose specific objectives that can be simulated through computer devices, followed by selecting the 3D interactive model to simulate the destination (Figure 1). After checking the feasibility of VR implementation, the stages include:
1. determining the level of realism,
2. choosing the level of user interaction and immersion,
3. selecting the appropriate hardware and software for programming,
4. creating the virtual world model and program interactivity, and
5. testing the VR device on a group of users to confirm the achievement of goals.

The most crucial technical aspect of VR development includes the level of user interaction and control, hardware, and software for VR programming.

1.2 Testing

The testing process involves using the black box method, which focuses on software functionality, particularly input, and output [20]. Functional testing aims to evaluate how well the application performs as expected. Along with functionality testing, a compatibility test is also conducted on mobile devices to ensure that the application operates smoothly with specific specifications.
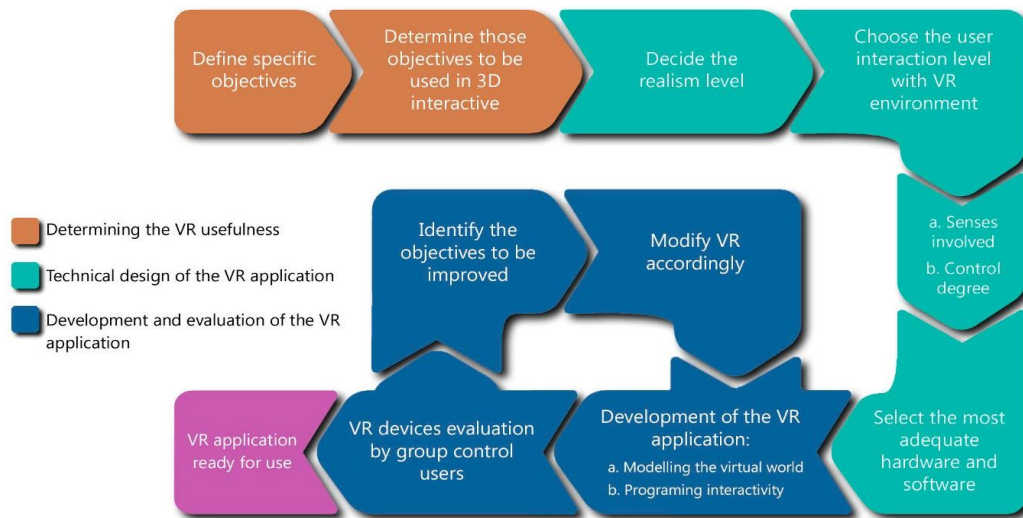
Figure 1. Virtual Reality Application Development Stage

3. RESULTS AND DISCUSSION

3.1 Implementation Result
Environment Scene and Game Levels
In the game (Figure 2), the player can select one of six different environments, each containing a series of game levels. The environments are designed using 3D models of several locations in Indonesia, each with a specific height. These models showcase notable landmarks, including the Merah Putih Bridge, Ampera Bridge, Kutai Kartanegara Bridge, Yogyakarta Monument, Palembang Clock Tower, and National Monument (MONAS). The environments are organized such that each location in the game corresponds to a specific level and elevation, providing a unique and engaging experience for players as they progress through the game. Using 3D models in the game design allows for a more immersive and interactive experience for players, providing a sense of realism that enhances the overall gaming experience. The heights of various landmarks in Indonesia are as follows: the Merah Putih Bridge stands at 121 meters, the Ampera Bridge at 63 meters, the Kutai Kartanegara Bridge at 70 meters, the Yogyakarta Monument at 77 meters, the Palembang Clock Tower at 65 meters, and the National Monument (MONAS) at 132 meters. Figure 3 displays each game level based on landmarks.

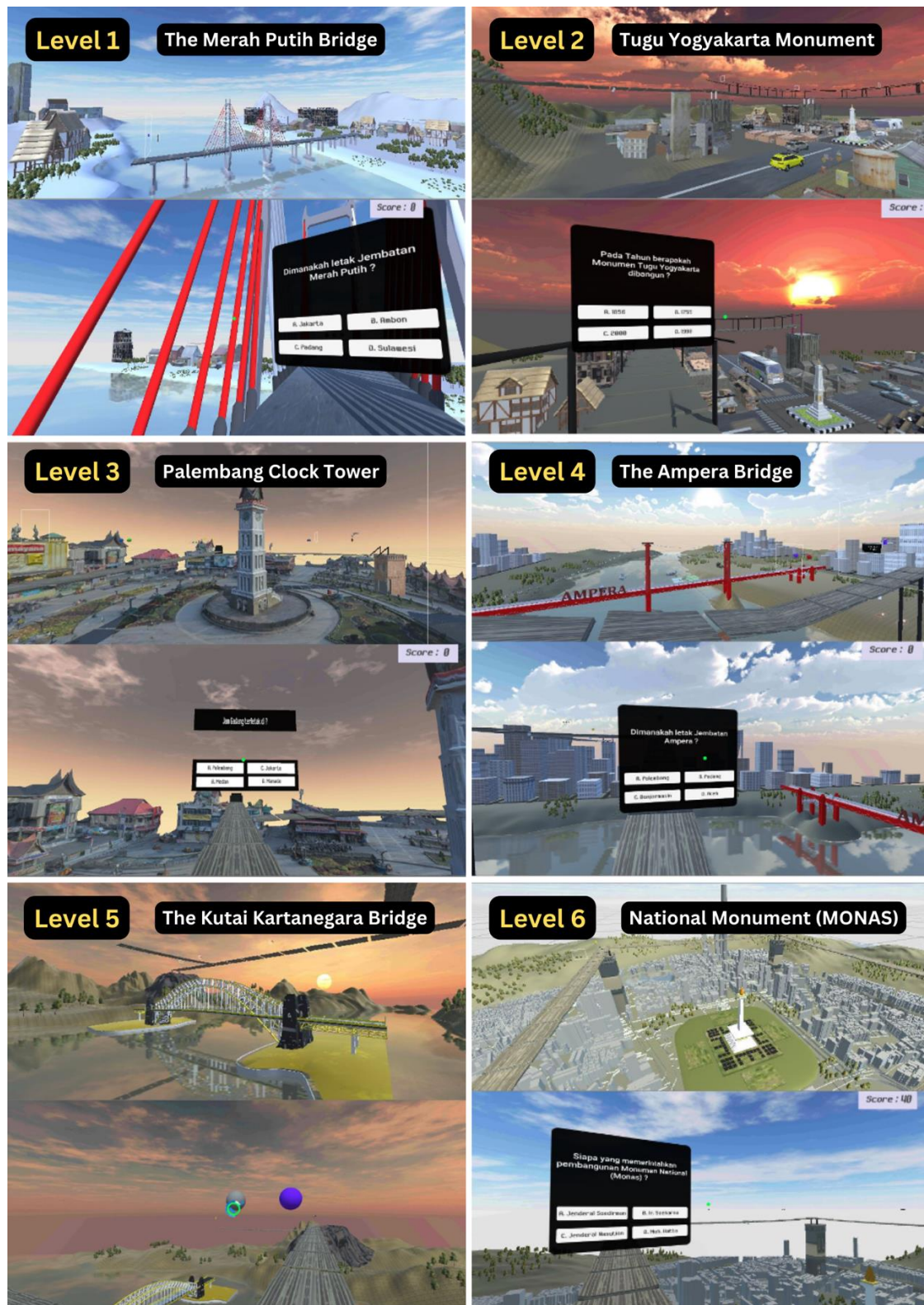Figure 2. Environment Scene

Figure 3. Game Levels

3.2 Functionality Test Results

Functional Testing is a test carried out to determine whether the application's functional requirements are running well. Functional Testing can be seen in Table 1.

Table 1. VR Functionality Test

No	Environment	Component	Test results	Information
1	Lobby Room Scene	Main Menu	Succeed	The Main Menu appears when the application is first started
2	Lobby Room Scene	Information Menu	Succeed	The information menu appears after the Main Menu
3	Lobby Room Scene	Information Menu/Spot Level	Succeed	The Place Information Menu appears after the Information Menu
4	Lobby Room Scene	Elevator panel	Succeed	The Elevator panel to the next scene appears when selecting the Play button menu
5	Scene Level 1 - 6	Colider	Succeed	The collider function works fine
6	Scene Level 1 - 6	Sphere 3D Object Challenge	Succeed	Successfully displayed the question when the user pointed the pointer at the 3D sphere object by selecting the correct color according to the clue
7	Scene Level 1 - 6	Canvas Questions & Panel Answers	Succeed	All questions and answer panels successfully appear in each scene
8	Scene Level 1 - 6	*Answer Button*	Succeed	The answer button interaction was successfully used in selecting answers
9	Scene Level 1 - 6	*Answer Button animation*	Succeed	The animated answer button interaction successfully appears when the user chooses the right or wrong answer
10	Scene Level 1 - 6	*Gaze Timer Interaction*	Succeed	The Gaze Timer interaction appears successfully when the pointer is pointed at the button
11	Object 3D	All 3D Objects in Acrophobia Virtual Reality app.	Succeed	All objects can display 3D shapes well
12	*Audio*	*Audio Backsound*	Succeed	Can display / run audio backsound
13	*Audio*	*Audio Dubbing*	Succeed	Can display/run audio dubbing

3.3 Compatibility Test Results

The purpose of compatibility testing is to ensure that the application performs as anticipated across all environments (platforms) that it is designed to run on. Cross-browser and cross-platform testing are both names for compatibility testing. As can be seen in table 2, the authors of this virtual reality software have tested its compatibility with various smartphones.

Table 2. VR Compability Testing

No	Device	Specifications	Test Type	Information
1	Realme 3 2021	Prosesor: MediaTek Helio P60, Octa Core 2.0 GHz, GPU: ARM Mali-G72, Sensor: Gyroscope, RAM: 4 GB	Application built	75 minutes
			Installation	80 seconds
			Application Loading	25 seconds
			Button	Duration when the user hovers the pointer over the button, it will take 2 seconds (gaze timer loading process) to open the selected button

			3D Object	All object 3D running well
			Audio	Running well
			Rendering performance	Rendering capabilities are sufficient, and the FPS is quite stable built application
2	Poco M3 2021	Prosesor: Qualcomm SM6115 Snapdragon 662 (Octa-core 4x2.0 GHz Kryo 260 Gold & 4x1.8 GHz Kryo 260 Silver), GPU: Adreno 610, Sensor: Gyroscope, RAM: 6 GB	Application built	65 minutes
			Installation	18 seconds
			Application Loading	6 seconds
			Button	Duration when the user hovers the pointer over the button, it will take 2 seconds (gaze timer loading process) to open the selected button
			3D Object	All object 3D running well
			Audio	Running well
			Rendering performance	Rendering capabilities are sufficient, and the FPS is quite stable built application
3	Poco X3 Pro 2021	Prosesor: Octa-core (1x2.96 GHz Kryo 485 Gold & 3x2.42 GHz Kryo 485 Gold & 4x1.78 GHz Kryo 485 Silver), GPU: Adreno 640, Sensor: Gyroscope, RAM: 8 GB	Application built	60 minutes
			Installation	14 seconds
			Application Loading	2-3 seconds
			Button	Duration when the user hovers the pointer over the button, it will take 2 seconds (gaze timer loading process) to open the selected button
			3D Object	All object 3D running well
			Audio	Running well
			Rendering performance	Rendering capabilities are sufficient, and the FPS is quite stable built application
4	Iphone XR 2021	Prosesor: Hexa-core (2×2.5 GHz Vortex + 4×1.6 GHz Tempest), GPU: Apple GPU (4-core graphics), Sensor: Accelerometer, Gyro, Siri, RAM: 3 GB	Application built	60 minutes
			Installation	15-20 seconds
			Application Loading	3 seconds
			Button	Duration when the user hovers the pointer over the button, it will take 2 seconds (gaze timer loading process) to open the selected button
			3D Object	All object 3D running well
			Audio	Running well
			Rendering performance	Rendering capabilities are sufficient, and the FPS is quite stable built application

4. CONCLUSION

According to the study's findings, virtual reality using gamification designed to treat height phobia has been effectively developed. The games have six different environments, each with six levels representing varying heights. The functionality and compatibility testing of the games were successful, and the games are currently operating well. The iPhone XR 2021 and Poco X3 Pro 2021 can build applications in 60 minutes, outperforming the Poco M3 2021 at 65 minutes and the Realme 3 2021 at 75 minutes. Application installation testing, Poco X3 Pro 2021 outperformed other devices with a speed of 14 seconds. Meanwhile, the Realme 3 2021 takes 80 seconds to install. For testing the ability to load applications, the iPhone XR 2021 and Poco X3 Pro 2021 outperformed the others with a speed of 3 seconds. However, additional testing on individuals with acrophobia is needed to determine the efficacy of these game applications as a therapy tool for treating height phobia.

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