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IMAGE-BASED VIRTUAL REALITY STRESS THERAPY APPLICATION (VRT-stressNOmore): AN ALTERNATIVE TOOL FOR SELF THERAPY

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Abstract:

Students in university are experiencing increased stress levels due to their daily routines. Students can self-manage their everyday stress with the self-therapy application before it causes other problems requiring professional assistance. This study aimed to determine whether VRT-stressNOmore, an image-based virtual reality with a few realistic University Utara Malaysia environments, can reduce student stress. However, the evidence for image-based virtual reality as a self-therapy is still in the leakage phase. Therefore, the objectives are determining the features that support self-therapy, confirming the features through expert review, designing and developing, and conducting therapeutic test. Implementation of pre-production-post methodology to achieve the goals and objectives. During the week of final exams, 47 healthy undergraduates and 29 healthy postgraduates consented to participate in this study. The T-test result indicates the different values before and after experiencing VRT-stressNOmore, demonstrating the beneficial effect of reducing stress. However, additional research is necessary to confirm the potential and efficacy of VRT-stressNOmore as a self-therapy application for university students.

Keywords:

Students, Stress, Therapy, University,Virtual Reality

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Introduction

Stress is an unavoidable aspect of everyday life that typically affects people of all ages, genders, educational backgrounds, and socio-economic statuses. However, stress also affects university students' mild to severe mental health (Boals et al., 2020; Marthoenis et al., 2018). They face challenges in their studies, social lives, psychological health, and environments. These happened due to significant differences between the university's educational and school systems regarding teaching strategies and academic standards. Students must engage with society more, adapt to new technology, work fast while producing high-quality work, and stand up for themselves if they encounter unreliable surroundings (Boals et al.,2020; Merlo, 2020; Dotterer et al., 2020).

University students must prepare for their academic survival to reach an ideal career; the stress seems familiar. However, it is not surprising that how students learn the course material at the university level influences how much academic stress they experience. College students must control their pressure (Merlo, 2020). Forest therapy, or "shinrin-yoku," is a technique for reducing the stress that involves people taking walks in forests and admiring the natural surroundings (Alyan et al., 2021; Hohashi & Kobayashi, 2013). For people of all ages, this therapy is popular in Japan. Virtual therapy is an additional form of treatment. A virtual setting, like one from a video game or video, is used in virtual therapy to simulate a relaxing environment. Anyone can conveniently benefit from therapy treatment in a virtual environment in private dwellings (Zaharuddin et al., 2022; Alyan et al., 2021; Imran et al., 2014; Adevi et al., 2013; Annerstedt et al., 2013).

Motivation

Therefore, it is clear that efforts to prevent stress among university students from becoming more severe and later affecting the productivity and well-being of society. Different parties have taken several approaches to overcome this situation, producing significant results. This study believes virtual reality technology could offer alternative stress management methods. Using appropriate elements and characteristics in VR could make the user feel calm and happy, thus helping to overcome stress. Students with stress tend to have a negative emotional response that includes depression, tension, anxiety and other biological reactions that can affect their health. As a result, work quality and performance in various situations will decrease, impacting the productivity of a university (Mawanza, 2017; Subha & Shakil, 2009). Therefore, stress has to be managed in a very appropriate way to prevent it from causing other psychological and behavioral disorders. Some students know that they face a problem regarding stress, so they look forward to their therapy sessions. They take pleasure in communicating with an adult who can listen to them objectively and offer assistance with some of their issues. However, not all students are on board with therapy and persuading unwilling students to participate in counselling can feel like pushing a boulder up a hill. It is unlikely that a student will be motivated to improve if they see that they coerce into receiving treatment (Alyad et al., 2021).

Problem Statement

In managing stress among university students, face-to-face communication is one of the therapists' treatments. However, not all students are willing to have close meetings with a therapist because of different factors. Due to motivating students to attend therapy sessions, therapists have used virtual reality exposure treatment for years as an alternate method of treating mental health issues in a secure setting (Alyad et al., 2021; Zaharuddin et al., 2022).

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In addition to experimental virtual reality-based therapy, it is also easy to use since it does not require supervision, and users can enjoy using it in their leisure time (Mahalil et al., 2014). Many studies or products that involved stress treatment using virtual reality, such as Cave Automated Virtual Environment (CAVE) system rehabilitation and virtual reality Mobile Applications (Alyad et al., 2021). Despite the advantages of integrating virtual reality into stress therapy, several limitations involve a large amount of money. High-end virtual reality equipment requires for specific treatments installed at the therapy centre. The user sees this new technology as a complicated technique which discourages the users from instilling virtual reality-based therapy. Virtual reality is still unavailable to the general public due to prohibitive pricing and technological restrictions in the context of processor performance (Zaharuddin, 2021). As an alternative to the geometry-based virtual reality (GBVR) application, image-based virtual reality (IBVR) can provide a 3D virtual environment that is less expensive than GBVR. For example, only a standard processor needs to run an IBVR application in contrast with a GBVR application that requires a high-end processor. However, the evidence and the specific features of IBVR as a self-therapy are still in the leakage phase.

Objective

This study aimed to determine whether VRT-stressNOmore, an image-based virtual reality with a few realistic University Utara Malaysia environments, can reduce student stress. Therefore, the objectives of this study are to identify the features of VRT-stressNOmore in support of self-therapy, to verify the attributes of VRT-stressNOmore through expert review, to design and develop the VRT-stressNOmore prototype and finally, to run a therapeutic test on VRT-stressNOmore

Significance of the study

Researchers in cognitive psychology have found that using images in applications for high-education students helps lessen the mental strain designers experience when processing ideas. IBVR is an example of an application that displays a collection of 360 degrees images/panorama with which users can interact. This study proposes an alternative for stress management that focuses on preventive measures by introducing an IBVR application for self-therapy. This intervention allows for the creation of easy-to-use, immersive, and engaging personal stress rehabilitation suitable for students who are very busy and unable to go to natural places to relax. This intervention is more convenient access to stress rehabilitation; the user can use it daily, which is essential to keep the stress level low and prevent chronic stress.

This paper consists of section of literature review, research methodology, result and findings for all objectives and conclusion of this study.

Literature Review

Stress

For many young students, college or university may also be the most stressful year of their lives. There are many possible sources of suffering at any given time, such as academics, culture shock, finance, and social life, all combined to make the college experience more challenging (Boals et al.,2020; Marthoenis et al., 2018.). The apparent pressure for a college or university student is maintaining a solid GPA before graduation. Student grades can influence class rankings, graduate admissions, future financial aid, and possible job offer (Boals et

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al.,2020; Marthoenis et al., 2018). When GPA starts to fall from the target, a scholarship can cancel. Therefore, these students take each time completing assignments, quizzes and exams seriously. Another academic issue facing scholars is choosing a career path (Boals et al.,2020). Although many schools give students time before declaring a major, some programs require individuals to begin taking pre-requisite classes to graduate on time (Boals et al.,2020; Merlo, 2020; Dotterer et al., 2020). Unfortunately, some have parents who may pressure them to pursue a career path (Merlo, 2020).

Stress Therapy

Since long-term stress will do more harm than good, a person needs to control their stress level to avoid chronic stress, not only it benefits the individual healthy life. It also promotes the surrounding environment such as less person-hour loss from sick leaves (Seňová & Antošová, 2014) and less cost spending on health care (Mazur & Mazur-Małek, 2017). There are many ways to reduce a person's stress. By changing the lifestyle by doing some stress rehabilitation activity. These activities vary in effectiveness and effect based on the individual situation and personal references. Some of the stress therapy activities are

- **Relaxation Therapy**
  The basic idea behind relaxation therapy is to allow the body to relax and remove any tension that it currently has by either applying pressure to a specific muscle group to release the tension or by slow deep breathing to control oxygen flow. Relaxation-based therapy proved effective in reducing depression, anxiety, and stress. (Kashani, Babaee, Bahrami, & Valiani, 2012)

- **Self-therapy**
  Self-therapy provides an opportunity for everyone to overcome problems related to mental health and do the intervention by themselves. It is an alternative approach to reducing stress, anxiety or depression without personally meeting the therapist, which could be cumbersome in some situations. Traditionally, one of the clinical techniques used for reducing stress is called guided imagery therapy (GIT). In this technique, the therapist instructs the patient to imagine a relaxing scene, thus giving a sense of relaxation and subsequently reducing stress. The use of technology and other mediums such as books, tapes, CDs and computer applications like VR has further improved the potential and possibilities of GIT for self-therapy. However, clinical approaches and therapist intervention should always be the primary methods for any related mental illness.

- **Nature Therapy**
  One popular strategy to do relaxation-based therapy is interacting with nature, especially among the city/urban residents, mainly because the urban environment also contributes to mental disorders and health (Lederbogen et al., 2011). While the exact nature and green environment features, such as extensive woodlands, provide better restoration for stress (Tyrväinen et al., 2014). Forest therapy, or what the Japanese called it as Shinrin-Yoku, is a way to relax by walking in the forest. Shinrin-Yoku is considered very effective in relaxing the user and increasing a positive mood (Hohashi & Kobayashi, 2013). Additionally, Forest therapy help to lower the cortisol level, causing the stress level to go down thanks to the air emitted by the forest (Park et. al., 2010). Horticultural/garden therapy is a way to interact with nature through gardening or flower arrangement. The

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interaction and self-regulation of gardening help the person resolve more personal issues through emotional bonds with the place (Adevi, 2013).

- **Virtual Reality Stress Therapy (VRST)**
  Virtual reality technology also reduces individuals' stress by simulating a virtual environment, virtual therapy, to affect pleasant surroundings. This technology is an easy-to-use application with less supervision on how to use it. Besides, a person can use the application flexibly at their residence (Imran et al., 2014). Virtual reality accentuates many opportunities to do stress therapy because of its scalability. The researcher concludes that using virtual reality for stress therapy helps the user to achieve more significant stress reduction than treatment without Virtual reality (Imran et al., 2014).

Example of VR Stress Therapy

One key area of research in virtual therapy is the application of virtual treatment in dealing with stress. VR provides many opportunities to do stress rehabilitation because it is scalable. The researcher concludes that using VR for stress therapy helps the user to achieve more significant stress reduction than treatment without VR (Imran et al., 2014). Explanations towards those research/products involved with stress rehabilitation as described below.

Visually transforming artwork and guided imagery: Using relaxing images to stimulate comfortable feelings and reduce stress (Huss & Sarid, 2014). CAVE system Rehabilitation: Using cave technology to surround the user with a visually relaxing environment and sound. An example is using A realistic mixture of birdsongs and variations in the murmur of water (Annerstedt et al., 2013). VR Mobile App: VR mobile application allows users to use their phone and Mobile VR headset to enjoy the virtual environment provided in the apps.Guided Meditation VR: Guided Meditation VR is a mobile application. It offers a choice of meditation locations, including a forest path, a Japanese garden, a mountain peak, and a beach, with photo-realistic and computer-generated environments. The application measures also track the player's heart rate to show how much relaxation the player is getting. (Ninjas, 2017). Virtual reality Therapy New York City: VR Therapy NYC combine VR therapy with biofeedback. It works by showing the patient an environment that causes them anxiety/stress simultaneously; using biofeedback, the patient can control their stress level. If patients face a similar situation, they can manage their stress levels (Therapist New York, 2017). RelaWorld combines neuroadaptive and immersive virtual reality virtual reality meditation systems. The system measured the user's brain waves in real time and mapped the data into a visual effect inside a virtual environment. One of the study's conclusions is that the number of responses who felt relaxed after wearing the VR headset is as much as the neurofeedback condition (Kosunen et al., 2016).RelaxVR: This is a VR application that includes the use of 360 degrees video of relaxing scenery, guided meditation (or Yoga Nidra) and soothing music to increase the immersive experience and help the users feel relaxed. This application is compatible with a mobile phone and a VR headset such as Google Cardboard, Samsung Gear VR and Daydream. It is a paid application where the user can get it at 4.99$. DEEP VR: DEEP is a meditative VR game controlled by breathing, and the environment replicates the environment under the sea. The users need to have a VR headset like (Oculus Rift) and a custom DEEP controller to discover the virtual environment inside the game. DEEP embraces yogic respiratory techniques, which can reduce stress, anxiety and depression. The custom controller measures the user's diaphragm expansion to keep track of deep breathing motion. The game does not require the use of arms, legs or hands. ZendoVR: ZendoVR incorporated VR 360 degrees video

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with shapes, sounds and colours and latent heartbeat to provide a safe method of reducing stress ("ZendoVR," 2017). This application uses a VR headset and headphones to maximise the video's effect. Users' heartbeats will be lowered slowly and finally match the background heartbeat inserted in the ZendoVR. It is a monthly subscription-based service where the user needs to pay 8$ in return for four new relaxing VR videos every month. All in all, there are many available products in the market to help people with stress management using VR technology. However, the limitations of these applications are need expensive and high-end devices which are not easy to get and only available at a professional research centre. Most of the applications lack interactivity. The users are allowed to teleport from one location to another. However, the users cannot interact with the environment. The applications mainly guide users on breathing techniques and are relaxed only.

As an alternative method of stress reduction, a 360-degree virtual tour or known as IBVR typically employs two types of presence. The first is affective-motivational, which refers to the individual's feelings, emotions, and rewards in the virtual environment. The second type is a sense of existence/presence, which involves rapidly immersing the person's mind in the built-in virtual environment and gradually abandoning the individual's actual environment. However, affective-motivational states better influenced the production of presence than the sense of existence/presence (Alyan et. al., 2021). The component that significantly impacted stress reduction and pleasure with the 360 virtual tour experience was enjoyment and involvement. By defining the terms "feeling of presence" and "telepresence" and outlining how VR technology might affect a person's psychological and mental health, Alyan et al. (2021) published VR study findings. For reasons of practicality, many software developers (SD) emphasise the perception of a "real" environment in the VR platform when creating a 360-degree virtual tour. Instead of feeling like they are in the "actual place," users instead feel like they are "there." The SD must prepare to create a sensation of "being there" among the spectators to entice viewers to see their movies, just like the creators of Marvel/Warner Bros. cinematics. Respondents visiting a tourist attraction seek out the significance of "being there" instead of an "actual" presence in the location of their memories (Zainuddin et., al., 2022; Alyan et. al., 2021). Individuals preferred 360-degree content as an "ideal place" destination. For instance, they could see a vivid rainbow and a turquoise sky. These virtual tour encounters are rewarding since they are things they could never see more frequently in the "actual place" than in the "ideal place."

Image-based Virtual Reality (IBVR)

IBVR provides a promising solution for the time-consumption because the development of IBVR consumes less time as it only involves stitching a collection of photographs or images to develop a synthetic environment (Xiao, 2000). It is a VR application that provides a panorama with 360 degrees view (Chen, 1995) by combining several collected photographs using stitching software (Chen, 1995; Wan Norazlinawati, Wan Fatimah, Shahrina, Azrai, & Sivapalan, 2009). Panorama refers to a broad picture that can be seen as much width as the human eyes can see (Thompson, 2006). With low computer processing performance, IBVR can still provide a realistic virtual environment where users can navigate through a quality synthetic environment, even if it is not developed with geometric programming (Chen, 1995). With these characteristics, the development of the IBVR application requires much less time than the GBVR application. Most authors describe IBVR by highlighting the elements of realistic panoramic views and the interaction function. Hence, it can be summarised that IBVR

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refers to a type of VR application that combines several natural panorama virtual environments with which the users can interact.

Besides the realistic panoramic view that provides realism to the virtual environment, the navigation functions are another essential feature in creating the virtual world in IBVR. Primarily, there are three navigation functions available in IBVR that assist users in navigating or exploring the virtual environment, which is (i) panning and tilting, (ii) zooming in and out and (iii) hotspot (CompuPhase, 2000). Panning and zooming are fundamental for navigating or exploring 2D and 3D information (Cooper, Reimann, Cronin, & Noessel, 2014). The panning function in IBVR grants a user control of the view in a certain degree of rotation, whether from vertical or horizontal directions. Panning can be applied to all types of panoramic images in IBVR. The second navigation function of IBVR is zooming in and out. The zoom-in is mainly used to enlarge an image or look at the image more clearly. In comparison, the zoom-out function is used to shrink the view of an image. The third navigation function is the hot spot. It is used to spot specific areas in the virtual environment to perform certain actions or navigations (Chen, 1995; Chiang et al., 1997). In conducting activities, the hotspot function enables users to move from one environment to another (Chen, 1995; Geng, Pan, Li, & Yang, 2000), which looks like a virtual tour (Geng et al., 2000). While for navigation, the hotspot function is used initially for zooming in and out of the virtual environment. Besides that, this function has also been developed for other navigational purposes.

IBVR is characterised by two main features: a realistic virtual environment and an interaction function. The availability of multiple virtual domains and interaction functions in IBVR makes it possible to provide excellent user experiences in exploring the application. Despite the limitations of IBVR in terms of low interactivity compared to GBVR, it can still offer a good user experience with an emphasis on spatial presence. Generating spatial presence does not require high interactivity in an application, but users should experience presence from the spatial environment (Bleumers, Broeck, Lievens, & Pierson, 2012; Wirth et al., 2007). Next, in the following section, some reviews on VR applications are provided to look into the advancement and capabilities of VR in various fields, specifically in mental health.

Research Gap

People with stress tend to have a negative emotional response that includes depression, tension, anxiety and other biological reactions that can affect their health. As a result, work quality and performance in various situations will decrease, impacting an organisation's productivity (Mawanza, 2017; Subha & Shakil, 2009). Therefore, stress must be managed in a very appropriate way to prevent it from causing other psychological and behavioral disorders. In therapy session, a therapist instructs clients to imagine a relaxing scene or experience (Overholser, 1991). However, some clients may have different experiences that make it challenging to anticipate the scenarios or images that could trigger discomfort. Sometimes the patients are inclined to misinterpret the therapist's instructions and consequently imagine negative scenarios (Nadia & Dayang, 2018). Therefore, instead of using the patient's imagination and memory, IBVR could be used as an alternative to providing images that can induce relaxation and enhance positive emotions. The virtual calm scenario in IBVR can facilitate the relaxation process for the user to overcome stress. Thus, with the IBVR application, people will have more options for managing their stress in everyday life before it causes other problems that need professional help.

Journal of Information System and Technology Management
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Research Methodology

For this study, a semi-working prototype was developed for therapeutic testing. The prototype is an IBVR application intended to be used for self-therapy. It aims to help users feel calm, thus reducing or avoiding the possibility of feeling stressed. In this chapter, the process of developing the prototype is described. The development has involved VR application developers who built the IBVR self-therapy based on the components and elements included in the proposed model. The development process is classified into three main steps namely (i) pre-development, (ii) development and (iii) post-development. These steps are described in the following sub-sections.

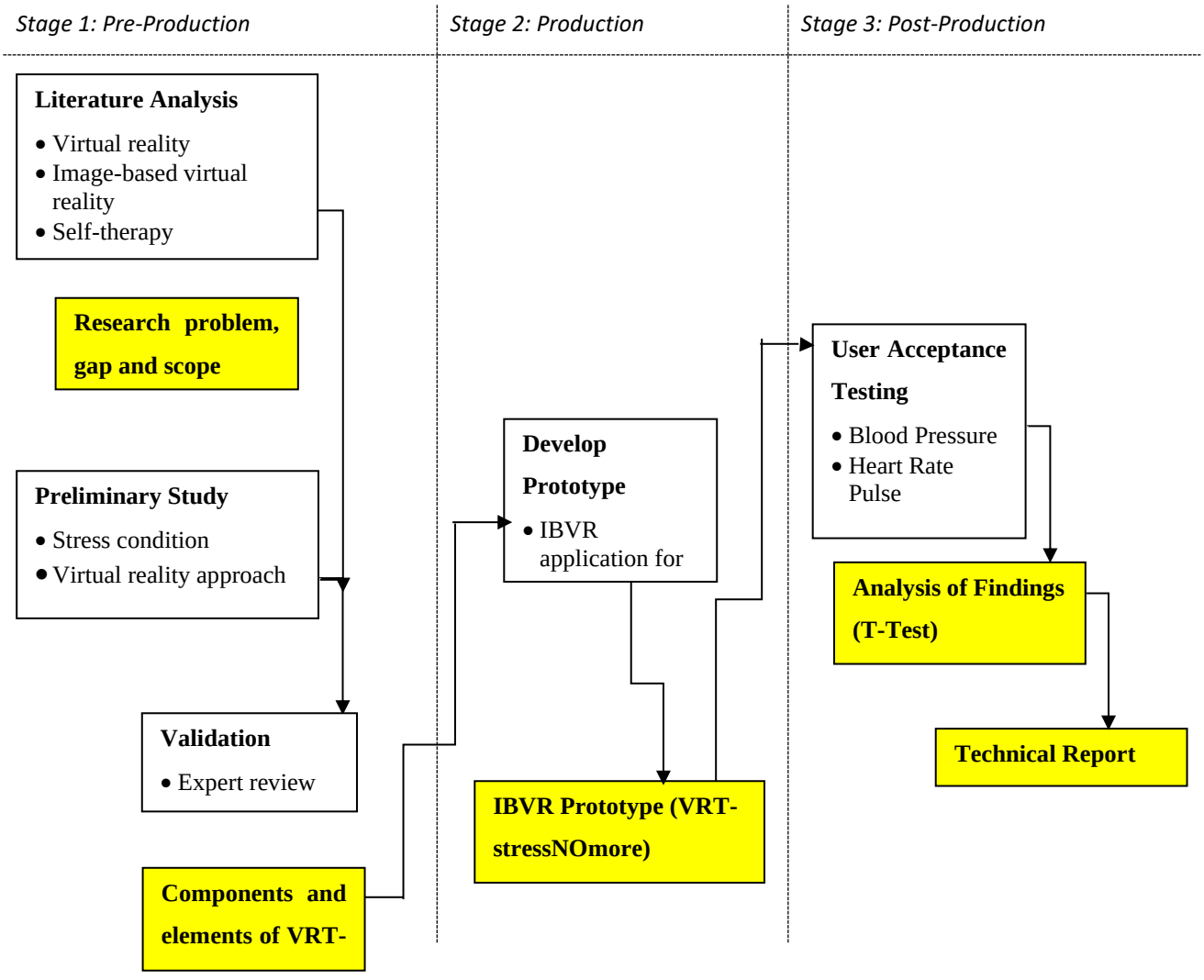

Figure 1: The Development Process

Pre-Production: Requirement Gathering Stage

Different applications will probably have additional requirements because of different contexts with other technologies and, most likely, with different groups or users. Thus, a preliminary analysis is an activity that looks into these differences, analysing the similarities and dissimilarities based on the low-fidelity prototypes due to the lack of IBVR application for self-therapy. The low-fidelity prototype could be paper or a primary application to indicate the

Journal of Information System and Technology Management
JISTM
EISSN: 0128-1666
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DOI: 10.35631/JISTM.729020

design direction. It could include visual, audio, colours, menus and control elements. It is instrumental in analysing and gathering requirements at the early design stage, although it doesn't provide detailed navigation and interaction. On the other hand, the high-fidelity prototype is an operating working prototype with full navigation and interaction in which users can interact with it as an actual product. For this preliminary study, a low-fidelity prototype represents a system look and feel that aims to demonstrate the system's utility or suitability. Using a prototype to establish a design can exhibit robust evidence to show that a design works and is helpful as intended. A low-fidelity prototype also indicates the system's potential to achieve an expected performance (Peffers et al., 2012). In this study, a small group of UUM students interact with the VRT-stressNOmore low-fidelity prototype. The main objective is to identify the suitable features of VRT-stressNOmore that can reduce stress. After the students experience a VRT-stressNOmore low-fidelity prototype of VRT-stressNOmore, a short interview is chosen to understand the respondents' opinions regarding the features that can reduce their stress. As a result, the most appropriate components and elements are feasible for developing the VRT-stressNOmore. Literature and existing studies indicate that VR technology is utilised for utilised purposes, particularly in psychology. However, most studies involve highly interactive types of GBVR. In light of this, a preliminary study is to investigate the potential and applicability of IBVR as a stress reliever, even though it has fewer interactive characteristics than GBVR.

To conduct a preliminary study, a prototype IBVR application was created for feedback on IBVR. The application contains several panoramic views and natural sounds integrated into other features such as menus, buttons, and hotspots. The study was conducted at Universiti Utara Malaysia on 10 undergraduate and graduate students in the laboratory and library. Table 1 provides information about the participants in the preliminary study.

Table 1: Details of Respondents of Preliminary Study

Items	Details
Age	18 to 45 years old
Number of Male Students	5
Number of Female Students	5
Number of Undergraduate Students	6
Number of Postgraduate Students	4

After identifying components and elements for the VRT-stressNOmore, the next activity is consultation with the therapists to obtain suggestions on the features that can reduce stress. The aim is to get formal confirmation and verification of the components' suitability in developing the proposed model. The comments and recommendations from the therapists are considered critical as their input can be the reference in the VRT-stressNOmore development.

The expert review step is to gather ideas, agree on concepts, and appraise the elements for the VRT-stressNOmore development collected from the preliminary analysis. Ten therapists who experienced conducting therapy sessions among high-education students participated in this step. They watched the VRT-stressNOmore low-fidelity prototype and reviewed the initial analysis result. After discussion, the practice is to analyse therapists' suggestions analyse enhancing the performance of the VRT-stressNOmore as an alternative tool to reduce stress.

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Production: Prototype Design and Development

The development step incorporates the content preparation activity that includes taking pictures and selecting suitable sounds through recordings or readily available sources to integrate into the prototype. This step also involves creating a high-fidelity prototype that visualises the screen layouts, flows, and navigation, combining the interaction function and all other characteristics of VRT-stressNOmore that were determined earlier in the expert review step. In the development phase, the working VRT-stressNOmore high-fidelity prototype uses the selected software to apply all elements collected from the expert review step. When the VRT-stressNOmore high-fidelity prototype is ready, an experimental study to check for quality and identify errors.

Post-Production: Prototype Evaluation and Analysis

Implementation of the experimental study during the examination week and respondents were selected using a convenience sampling technique. For graduate students, specifically PhD candidates, those who will soon have their oral examination were selected. Before using the IBVR application, participants received an explanation of the application and had their blood pressure (BP), and heartbeat pulse measured. The respondents then interacted with and utilised the IBVR application for a while. After completing the application, their blood pressure and heart rate pulse were taken to clarify whether there was a different result after the respondents experienced VRT-stressNOmore verified the features through expert review.

Findings

Identify the Features of VRT-stressNOmore in Support of Self-therapy

The analysis result in the preliminary study is listed below.

- Scenery

The scenery of the virtual environment in the IBVR for self-therapy should contain actual images of nature with a clean and beautiful panoramic view. The sequence of the pictures (storyline) should be acceptable, straightforward and easy to understand. Appropriate additional objects in the panoramic view could also enhance users' feeling of being in the virtual environment. Furthermore, including simple animation in the visual display of the environment could also create more sense of presence for users.

- Sound

The scenery in IBVR combines photographs that display the actual views of nature. Recorded natural sound could provide more sense of being in the virtual environment by syncing with the visual display and the additional objects in the scenery.

- Narration

For therapy, a recorded therapist's voice or narration include in IBVR to assist the user in relieving stress. The narration should contain the standard elements in the verbal guide, which are deep breathing, relaxation exercise and suggestions for desired changes based on the problems to be solved.

- Function and Navigation

The IBVR should have a hotspot function that enables users to shuttle from one scene to another. It allows the users to navigate and explore the virtual environment. A brief description or information should also be added to the hot spot so that users can understand its function. Another essential feature of IBVR is the panning function which enables users to view the virtual environment from left to right and vice versa. Users can use the auto or manual panning function according to their preferences.

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Verify the Features Through Expert Review

The classification results indicate that one generic components are compulsory which are images of peaceful nature, while the others recommend in the VRT-stressNOmore which are natural/ambient sounds and image variations. By adapting those elements VRT-stressNOmore, it could restore an individual mood, recover energy and vitality. In addition, nature-incorporated therapy can create a sense of refreshing and it helps to rejuvenate and replenish an individual spiritual energy. Nevertheless, the processes mentioned above are vital to ensure that the patients can clear their mind and feel relax. It is important to understand that nature stress therapy does not require aggressive exercise like jogging or running because the therapy emphasises on establishing the patients understanding the importance to reconnect with the nature.

Design and Development of a Virtual Tour Application

This intervention is a prototype of self-therapy by implementing a virtual reality panorama 360 degrees. These panoramas involve accurately spherical panorama images representing the real-world location that allows user-controlled interactivity in a virtual reality digital platform with 360 degrees of visibility. In developing this virtual reality 360 degrees panorama image, the six places are Puncak Vista, Bukit Bunga Raya, Taman Buluh, Hidden Lake, Padang Sasar, and Tasik Guthrie. Interaction function including panning, zoom in-out, hotspot and navigation button. The objective of the intervention is to reduce the user's stress. By watching panoramic virtual environments in UUM, user experience calmness which can reduce stress. This project includes six natural places in UUM: Puncak Vista, Bukit Bunga Raya, Taman Buluh, Hidden Lake, Padang Sasar, and Tasik Guthrie. For capturing the environment in 360 degrees and producing an 18MP image, the GoPro Fusion 360 camera is used. After capturing the pictures of all six natural places, VRT-stressNOmore is developed using Easypano Tourweaver. A few hotspots are included in each virtual location.This intervention allows for the creation of easy-to-use, immersive, and engaging personal stress rehabilitation suitable for people who are very busy and unable to go to natural places to relax. This intervention is more convenient access to stress rehabilitation; the user can use it daily, which is essential to keep the stress level low and prevent chronic stress.

Run a Therapeutic Test

Literature and existing studies have found that VR technology is acceptable for therapy purposes, especially in psychology, but most studies involve highly interactive VR, mainly developed with GBVR. As such, the main aim of this study is to investigate the potential and applicability of IBVR as stress relief, even though it has fewer interactivity characteristics when compared to GBVR.

BP and heartbeat pulse are related to relaxation and stress in some way, as proven by some researchers through their studies. For example, Santaella et al. (2006) indicated that exercise or relaxation positively affects hypotensive as it can decrease systolic and diastolic BP during mental stress. Similarly, Kep (2018) concluded that progressive relaxation has some effects on reducing systolic and diastolic blood pressure levels in hypertension patients. There is a significant correlation between stress and blood pressure which indicates that the level of BP during a stressful situation is higher than in a normal condition (Gasperin, Netuveli, Dias-da-Costa, & Pattussi, 2009; Mayo Clinic, 2019; Rau, 2006; Suter, Maire, Holtz, & Vetter, 1997). The respondents are 47 undergraduates and 29 postgraduates. Hence, the results summarises

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Volume 7 Issue 29 (December 2022) PP. 222-241
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the mean and standard deviation results of systolic, diastolic, and heartbeat pulse before and after respondents interact with the IBVR application among undergraduate and post graduates UUM students.

Table 2: Blood Preassure (BP) and Hearbeat Pulse Result for Undergraduate and Postgraduate

	Before Experiencing VRT-stressNOmore		After Experiencing VRT-stressNOmore	
	Undergraduate	Postgraduate	Undergraduate	Postgraduate
Mean Systolic BP	117.74	117.6	107.64	109.97
Standard deviations (SD)	5.980	6.645	10.377	6.585
Mean Diastolic BP	69.43	69.38	64.47	66.41
Standard deviations (SD)	5.166	4.515	7.395	4.272
Mean Heartbeat Pulse	71.43	78.00	67.17	74.52
Standard deviations (SD)	8.531	9.532	8.063	8.716

The mean result for systolic BP before using the IBVR application for undergraduate students is 117.74 and 117.66 for postgraduate students. At the same time, the mean result for systolic BP after using the IBVR application for undergraduate students is 107.64 and 109.97 for postgraduate students. In addition, you can see from the standard deviations (SD) that the variation in the data before using the IBVR application for postgraduate students (SD = 6.645) is more than for undergraduate students (SD = 5.980). While the standard deviation that the variation in the data after using the IBVR application for postgraduate students (SD = 10.377) is more than for undergraduate students (SD = 6.585). The mean diastolic BP before using the IBVR application for undergraduate students is 69.43 and 69.38 for postgraduate students. After using the IBVR application for undergraduate students, the mean diastolic BP is 64.47 and 66.41 for master students. From this, you also can see the standard deviations that the variation in the data before using the IBVR application for postgraduate students (SD = 4.515) is less than for undergraduate students (SD = 5.166). The standard deviation of the data variation after using the IBVR application for postgraduate students (SD = 4.272) is less than for undergraduate students (SD = 7.395).

The mean heartbeat pulse before using the IBVR application for undergraduate students is 71.43 and 78.00 for postgraduate students. After using the IBVR application for undergraduate students, the mean heartbeat pulse is 67.17 and 74.52 for master students. From result, the standard deviations that the variation in the data before using the IBVR application for postgraduate students (SD = 9.532) is more than for undergraduate students (SD = 8.531). The standard deviation that the variation in the data after using the IBVR application for postgraduate students (SD = 8.716) is more than for undergraduate students (SD = 8.063).

Results showed that Levene's test checks the null hypothesis that the variances of the two groups are equal, the first-row value of the output of comparing two groups which are undergraduates and postgraduates, due to the inviolate equal variance. In comparing undergraduate and postgraduates, the p-value of systolic BP before using the IBVR application is 0.835, and the

Journal of Information System and Technology Management
EISSN: 0128-1666
JISTM
Volume 7 Issue 29 (December 2022) PP. 222-241
DOI: 10.35631/JISTM.729020

p-value of systolic BP after using the IBVR application is 0.167. For diastolic BP before using the IBVR application, the p-value is 0.425. Lastly, the heartbeat pulse before using the IBVR application is 0.354, and the p-value of the heartbeat pulse after using the IBVR application is 0.291. Meanwhile, the value from the second row of the output of undergraduates and postgraduates is taken because the p-value of diastolic BP after using IBVR applications showed that the variances of the two groups are not equal because they are less than 0.05.

As conclusion, for all three findings which is taken before and after using the IBVR application such as systolic BP [before t(74)= 1.319,*p* = 0.191/ after t(74)= -0.832, *p* = 0.408], diastolic BP [before t(74)= 1.048, *p* = 0.298 / after t(73.77)=-1.453, *p* =0.150], and heartbeat pulse [before t(74)= -1.693, *p* = 0.095/ after t(74)= -1.413 *p* = 0.162] showed that an independent t-test found this pattern of the data to be significant.

Results showed that Levene's test checks the null hypothesis that the variances of the two groups are equal, the first-row value of the output of comparing undergraduate and postgraduates as referred, due to the inviolate equal variance. In comparing undergraduates and postgraduates, the p-value of systolic BP before using the IBVR application is 0.835, and the p-value of systolic BP after using the IBVR application is 0.167. For diastolic BP before using the IBVR application, the p-value is 0.425. Lastly, the heartbeat pulse before using the IBVR application is 0.354, and the p-value of the heartbeat pulse after using the IBVR application is 0.291. Meanwhile, the value from the second row of the output of comparing undergraduates and postgraduates is taken because the p-value of diastolic BP after using IBVR applications showed that the variances of the two groups are not equal because they are less than 0.05.

As conclusion, for all three findings which is taken before and after using the IBVR application such as systolic BP [before t(74)= 1.319,*p* = 0.191/ after t(74)= -0.832, *p* = 0.408], diastolic BP [before t(74)= 1.048, *p* = 0.298 / after t(73.77)=-1.453, *p* =0.150], and heartbeat pulse [before t(74)= -1.693, *p* = 0.095/ after t(74)= -1.413 *p* = 0.162] showed that an independent t-test found this pattern of the data to be significant.

Table 3: Blood Preassure (BP) and Hearbeat Pulse Result for Male and Female Students

	Before Experiencing VRT-stressNomore		**After Experiencing VRT-stressNomore**	
	Male	Female	Male	Female
Mean Systolic BP	118.69	116.83	107.69	109.28
Standard deviations (SD)	5.751	6.520	7.928	8.563
Mean Diastolic BP	70.03	68.85	65.03	65.38
Standard deviations (SD)	4.681	5.077	6.390	6.531
Mean Heartbeat Pulse	72.03	75.65	68.44	71.35
Standard deviations (SD)	9.060	9.534	8.762	9.113

The number of male students was 36, and the numbers of female students were 40, which involved three findings of systolic BP, diastolic BP, and heartbeat pulse of respondents, which was taken before and after they used the IBVR application. The mean of systolic BP before using the IBVR application for male students is 118.69 and 116.83 for female students, while the mean of systolic BP after using the IBVR application for male students is 107.69 and 109.28 for female students. Furthermore, the standard deviations that the variation in the data before

Journal of Information System and Technology Management
JISTM
EISSN: 0128-1666
Volume 7 Issue 29 (December 2022) PP. 222-241
DOI: 10.35631/JISTM.729020
using the IBVR application for male students (SD = 5.751) is less than for female students (SD = 6.520). The standard deviation of the data's variation after using the IBVR application for male students (SD = 7.928) is less than for female students (SD = 8.563).

Meanwhile, the mean of diastolic BP before using the IBVR application for the male students is 70.03 and 68.85 for the female students, while the mean of diastolic BP after using the IBVR application for male students is 65.03 and 65.38 for the female students. The standard deviation that the variation in the data before using the IBVR application for male students (SD = 4.681) is less than for female students (SD = 5.077). The standard deviation of the data variation after using the IBVR application for male students (SD = 6.390) is less than for undergraduate students (SD = 6.531).

The mean heartbeat pulse before using the IBVR application for the male students is 72.03 and 75.65 for the female students, while the mean value of heartbeat pulse after using the IBVR application for the male students is 68.44 and 71.35 for the female students. The standard deviation of the data variation before using the IBVR application for male students (SD = 9.060) is less than for female students (SD = 9.534). The standard deviation that the variation in the data after using the IBVR application for male students (SD = 8.762) is less than for female students (SD = 9.113).

Results showed that Levene's test checks the null hypothesis that the variances of the two groups are equal, so the equal variances are not violated; thus, the value from the first row of the output for female and male is taken. Meanwhile, the p-value of systolic BP before using the IBVR application is 0.534, and the p-value of systolic BP after using the IBVR application is 0.605. For diastolic BP before using the IBVR application, the p-value is 0.397, and 0.961 for the p-value of diastolic BP after using IBVR applications. Lastly, the heartbeat pulse before using the IBVR application is 0.364, and the p-value of the heartbeat pulse after using the IBVR application is 0.537.

Therefore for all three findings which is taken before and after using the IBVR application such as systolic BP [before $t(74)= 1.319, p = 0.191$/ after $t(74)= -0.832$, $p = 0.408$], diastolic BP [before $t(74)= 1.048$, $p = 0.298$/ after $t(74)= -0.234$, $p = 0.816$], and heartbeat pulse [before $t(74)= - 1.693$, $p = 0.095$/ after $t(74)= -1.413$ $p = 0.162$] showed that an independent t-test found this pattern of the data to be significant.

The study findings are based on the BP and heartbeat pulse results taken before and after the respondents used or interacted with the IBVR application. BP and heartbeat pulse are related to relaxation and stress in some way, as proven by some researchers through their studies. For example, Santaella et al. (2006) indicated that exercise or relaxation positively affects hypotensive as it can decrease systolic and diastolic BP during mental stress. Similarly, in his study, Kep (2018) concluded that progressive relaxation has some effects on reducing systolic and diastolic blood pressure levels in hypertension patients.

On the other hand, there is a significant correlation between stress and blood pressure in; some studies indicated that the level of BP during a stressful situation is higher than in a normal condition (Gasperin, Netuveli, Dias-da-Costa, & Pattussi, 2009; Mayo Clinic, 2019; Rau, 2006; Suter, Maire, Holtz, & Vetter, 1997). This result shows that using this IBVR application with specific characteristics can positively impact the users' emotions by stimulating relaxation

Journal of Information System and Technology Management
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Volume 7 Issue 29 (December 2022) PP. 222-241
DOI: 10.35631/JISTM.729020
feelings, thus reducing stress. This further support the initial idea of this study in applying IBVR for self-therapy to reduce stress. Nevertheless, the real focus is on the spatial presence element that acts as one of the main criteria in IBVR that could evoke the feeling of relaxation and reduce stress.

Conclusion

Some studies were made on the effectiveness of VR in stress therapy and inferred significant stress reduction from using VR in stress therapy compared to treatment without VR (Mahalil et al., 2014). The idea of 'being in' a computer-generated virtual world has much potential for usage in various contexts, including health. This study concludes that IBVR can be a substitute tool to promote calmness. In contrast, IBVR immersed users with a collection of 360-degree panorama photographs that can help with relaxation techniques to reduce stress. The elements necessary to be adapted to IBVR for preventing stress are a calm natural scenery/panorama, ambient natural sound and a collection of 360-degree panorama. In particular, the findings of this study will aid application developers in creating an IBVR tool for self-therapy to reduce stress. In addition, the proposed VRT-stressNOmore concepts and components will contribute to psychological research and development. In addition, the tangible prototype developed in this study will be helpful in the mental health community for evaluating the potential of IBVR technology as an alternative stress management strategy. The findings of this study will aid in enhancing the well-being of society and, as a result, boost national productivity through mentally healthy human resources. Being in nature could restore an individual's mood and recover energy and vitality. In addition, nature-incorporated therapy can create a sense of refreshing, and it helps to rejuvenate and replenish an individual spiritual energy (Annerstedt et al., 2013; Li et al., 2016).Nevertheless, the processes mentioned above are vital to ensure that the patients can clear their minds and feel relaxed. It is essential to understand that nature stress therapy does not require aggressive exercise like jogging or running because it emphasises establishing the patient's understanding of the importance of reconnecting with nature. There are also other health benefits from nature stress therapy which includes (Hansen, Jones, & Tocchini, 2017; Li et al., 2016) which are decrease in pulse rate, decrease in urinary dopamine, increase in adiponectin in serum and increase in feelings of vigour in the POMS test in middle-aged males with higher blood pressure.

Adopt Nature Stress Therapy in the application to be developed; the conventional stress therapy technique needs to be understood. The therapy incorporates all the natural elements in stress therapy, like trees, flowers and sounds of animals in nature. Furthermore, there are other essential procedures that the patient needs to follow. The author conducted thorough research on natural stress therapy, increasing the effectiveness of the treatment for the stress patient. The conventional processes of forest bathing encompass the following (Li, 2018); Walk with a guide and follow the trained forest therapist to make the patient comfortable, walk inside the natural environment (forest), interact with the elements in nature, such as butterflies, rivers, flowers and tree bark, take a deep breath and the smell of nature and listen to the natural sound.

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