Exploring the Impact of User Experience Elements on Virtual Reality for Emotion Regulation Through mVR-Real App

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Abstract—**Virtual reality, a rapidly advancing technological development, has significantly evolved over the past few years, offering immersive experiences through headsets, gloves, or controllers that engage users in dynamic and captivating environments. Its applications span various fields, including video games, healthcare, education, and training simulations. However, there remains a gap in utilizing virtual reality for adolescent emotion regulation. This study explores the mVR-REAL app, designed to enhance social-emotional learning in teenagers by improving emotion regulation. Social-emotional learning is an educational approach aimed at developing essential socio-emotional skills in adolescents. Sixteen participants engaged with the mVR-REAL app through virtual scene episodes using the Meta Quest 2 headset. The emotional responses and user feedback were measured using pre and post-test questionnaires with a Likert scale such as, strongly agree, agree, neutral, disagree and strongly disagree. A numerical value was assigned to each hypothetical option on the scale. Analysis conducted with SPSS software revealed statistically significant improvements in user experience following the use of mVR-REAL. The findings suggest that mVR-REAL has the potential to enhance user experience, evoke strong emotional responses, and foster greater engagement compared to traditional applications. These insights will inform future large-scale testing of mVR-REAL, emphasizing the importance of emotional design, as well as psychological and cultural factors, in the development of virtual reality apps for emotion regulation. However, time-related challenges were identified due to the restricted duration of the VR session, highlighting the need for further research and refinement in future virtual reality app development.**

Keywords—Virtual reality; app; user experience; emotion regulation; social-emotional learning

I. INTRODUCTION

Virtual reality (VR) is an advanced technology that creates a realistic and all-encompassing experience by simulating various settings and activities. The term "virtual reality" refers to a computer-generated simulation of a three-dimensional setting [1] or experience [2] that enables the user to interact with the simulation in a manner that is convincingly real or physical by employing specialized hardware such as a headset, gloves, or sensors. This cutting-edge technology generates sensory stimuli, serving as a transformative tool for enhancing emotion regulation (ER) practices, offering unique immersive environments that facilitate emotional experiences and coping strategies.

Emotion regulation (ER) encompasses the activities by which humans observe, assess, adjust, and control their emotional encounters and displays. This phenomenon can manifest in both conscious and unconscious states and involves the manipulation of emotions and expression, leveraging social-emotional learning. Social-emotional learning (SEL) refers to a process that promotes the development of essential interpersonal and affective abilities in individuals [3]. SEL has gained prominence in recent years as a vital component of education and individual development.

Over the years, there has been wide research conducted on the VR app across multiple fields involving healthcare and psychology. However, there is a limited study utilizing VR that is dedicated to the development of SEL in adolescents to enhance ER. This gap is significant because adolescents face unique emotional and social challenges during their developmental stages. Effective SEL interventions during this period are crucial for fostering resilience, empathy, and interpersonal skills [4]. If VR can demonstrably boost these skills, it may result in more engaging and meaningful educational experiences that adequately prepare adolescents for real-world interactions. Therefore, we proposed a study of an app called mVR-REAL. Mobile virtual reality to read and learn emotion regulations or mVR REAL is a VR app that is designed specifically for adolescents aged between thirteen and fourteen in the public secondary school in Malaysia. The goal of developing this app was to promote social-emotional learning in adolescents to improve emotion regulation. Focusing on adolescents is crucial as this developmental stage is marked by significant emotional and social changes. During adolescence, individuals are particularly susceptible to stressors that can impact their mental health. By utilizing VR in ER and SEL practices tailored for adolescents, educators and mental health professionals can provide targeted support that addresses the unique challenges faced during this period. Engaging adolescents through immersive experiences not only enhances their learning but also promotes a deeper understanding of their emotions and social interactions.

mVR-REAL explores the vital role of SEL in fostering good mental health by using a VR technology. SEL helps promoting self-awareness, emotional regulation, interpersonal skills, and resilience, and ultimately contributing to overall mental well-being. The findings suggest the element factors of user experience on emotion regulation are emotional and psychological.

II. LITERATURE REVIEW

A. Virtual Reality in Healthcare

VR has been employed in diverse contexts, encompassing therapy [5], education [6], and medical [7], to help individuals regulate their emotions in real-world situations. Studies have shown that VR can be effective in reducing negative emotions [8], such as anxiety, stress, and anger, as well as increasing positive emotions, such as empathy and relaxation. VR has the capacity to completely transform and reshape various aspects of society. Emotion regulation interventions by providing a more accessible, engaging, and personalized experience for individuals. As the technology continues to advance, VR may become a more widespread and valuable tool for improving emotional well-being. It is intended to produce an experience that is so immersive and realistic that it seems very much like either the real world or a world that the user has imagined. Virtual reality can be used for a variety of purposes, including education, training, rehabilitation, and even entertainment. A key component of virtual reality is the user's ability to interact with the virtual environment [9].

As a result, virtual reality saw explosive growth across a wide range of industries. Education [10], film [11], music [12], cultural tourism [13] and medical [14] are just a few sectors where VR has already been significantly impacted. VR is an expanding area of research that has the potential to revolutionize mental health examinations [15]. VR finds applications across various industries, including gaming, education, training, healthcare, culture [13], and entertainment, offering unique opportunities for experiential learning, skill development, and creative expression [16]. With the ongoing advancement of VR technology, there is significant potential for it to bring about a revolutionary transformation in how people perceive, interact with, and experience digital content, paving the way for new and innovative forms of storytelling and human-computer interaction. VR applications have grown into a crucial component of our everyday existence, with a variety of apps available across various platforms. However, ensuring the success of a VR app in a competitive market requires meticulous testing and refinement. Preliminary testing, a vital phase in the app development process, serves as a bridge between initial development and widespread release. This study explores the significance of experimental testing for mobile VR applications, its design, methodologies, benefits, and the impact it has on user experience.

By leveraging the established benefits of VR in healthcare, educators can develop innovative SEL and ER programs that resonate with adolescents' experiences. Despite the increasing prevalence of mental health issues among youth, the incorporation of VR into educational methodologies presents a promising opportunity to improve emotional intelligence and resilience. In summary, the mVR-REAL in healthcare not only demonstrate its capacity to influence emotional responses but also provide a robust framework for its use in promoting SEL and ER among adolescents.

B. Social-Emotional Learning and Emotion Regulation

SEL enables individuals to understand and manage their emotions, build positive relationships, demonstrate empathy and compassion, and exercise prudent judgment [3]. This educational method is comprehensive and acknowledges the importance of mental agility and social consciousness in promoting both mental health and academic achievement. An organization called CASEL has established a CASEL SEL framework for developing essential life skills [17] that revolve around recognizing and managing emotions, building healthy relationships, making responsible decisions, and cultivating resilience. It is typically integrated into curricula and educational programs to promote the emotional intelligence and mental health of individuals across all age groups [18]. SEL is an essential factor in facilitating individual development, mental health, and academic achievement. By focusing on emotional intelligence and social skills [19], SEL helps students develop resilience, cope with stress, and improve problem-solving abilities [20]. It fosters a positive school climate, reduces incidents of bullying, and enhances overall classroom engagement. Furthermore, SEL is not limited to academic settings; it has broader applications in various aspects of life, including the workplace, family dynamics, and community interactions [21]. Individuals who have strong social-emotional skills are better equipped to navigate challenges, communicate effectively, and build meaningful relationships, ultimately contributing to a more compassionate and harmonious society. SEL in adolescents is a critical component of their overall development and well-being. Teenagers is a phase characterized by profound physical, emotional, and cognitive variations, and SEL helps adolescents navigate this challenging phase successfully. SEL includes a variety of abilities and qualities that empower young individuals to comprehend and handle their emotions, establish constructive connections, make accountable choices, and cultivate a robust sense of self-worth and compassion.

The study of emotion is a central area of investigation in numerous scientific and humanistic fields [22]. Emotion regulation skills are crucial for developing better well-being in the transition from adolescence to adulthood. Silvers describes emotion regulation (ER) as a set of both implicit and explicit abilities that enable individuals to observe, assess, and adjust their emotional reactions in alignment with their objectives [23]. During adolescence, the ability to regulate emotions often undergoes significant improvement for many individuals. However, for other young people, adolescence can be a time when emotion regulation difficulties begin or develop [23]. It is widely acknowledged that the capacity to control one's emotions is a crucial component of both mental [24] and general well-being [25]. A person's ability to manage their emotions, which are dynamically used throughout everyday situations, is a form of ER.

The correlation between emotion control and mental health is crucial. Emotion management is essential to maintaining good mental health and overall wellness. Deficits in the ability to adaptively deal with challenging emotions can lead to various mental disorders such as depressive disorders, borderline personality illness and eating disorders [26]. Emotion regulation tactics like rethinking thoughts and expressive suppression are related to psychological outcomes [27], such as cognitive restructuring, which involves revising a situation to alter its emotional impact, is related to better psychological health and expressive suppression, preventing the outward expression of

emotions, is linked to decreased mental wellness [27]. Adaptive strategies like suppression are associated with these adverse effects. Lack of management of emotions can lead to reduced overall well-being that includes both pleasure-oriented and meaning-oriented elements [28]. Enhancing well-being among those with mental health issues can be attained by enhancing their emotion management abilities. In short, managing emotions is a crucial mechanism that influences mental health. Focusing on emotion regulation during therapy shows promise in reducing suffering and enhancing overall quality of life [26].

C. User Experience Elements

Twenty years of emphasis on user experience (UE) has resulted in a variety of digital devices that assist individuals in perceiving, comprehending, and communicating emotions [24]. The success of a VR app depends on the quality of the content, user experience, and technical execution. The objective of the study is to investigate the UE elements of virtual reality for ER through mVR-REAL app experimental test. Preliminary testing of research protocols, also known as pilot testing, is an essential precursor to any research undertaking. This phase allows researchers to fine-tune their procedures, detect possible complications, and improve the overall integrity of their study design.

Emotional design is a concept in user experience and product design that focuses on creating products, interfaces, or environments that elicit specific emotional responses from users. The term "ER" in psychology describes a group of both conscious and unconscious methods that humans employ to diminish, sustain, or amplify positive or negative emotions [29], which leads to promoting an individual's well-being [30]. Psychological pertains to the field of psychology and behaviour, encompassing the thinking procedures and functions that impact individual and collective experiences. This field encompasses multiple facets of mental activity, emotional awareness, enthusiasm, and interactions with others, aiming to comprehend how these factors contribute to human thought patterns and actions.

Additionally, psychology can describe anything related to the mental and emotional aspects of an individual or group, including the effects of thoughts and feelings on behaviour and well-being [31]. In the context of user experience (UE) design, psychological elements refer to aspects of human cognition, emotion, and behaviour that influence how individuals perceive and interact with a product, service, or interface. Understanding these psychological elements is crucial for creating designs that are user-friendly, engaging, and effective. Psychological principles perform an essential function in UE design by impacting how users perceive, interact with, and respond to digital products and interfaces. The element factors of user experience on emotion regulation, specifically focusing on the emotional and psychological aspects, suggest significant correlations between the UE of the app and its impact on users' emotional and psychological well-being [32]. The emotional design of a user interface, including visual elements and colour schemes plays a crucial role in influencing users' emotional states [33].

Cultural aspects in app design are critical considerations that go beyond mere aesthetics [34]. They encompass a deeper understanding and integration of cultural elements to create an inclusive and user-friendly experience for individuals from diverse backgrounds. For instance, in Malaysia uses the Malay language as the first language. In the consideration of building the app, we have selected the Malay language as the language used in the whole app representation. We can create products that resonate with a global audience, fostering positive user experiences across diverse cultural contexts through integrating these cultural considerations into the app design process.

III. METHODOLOGY

A. Participants

Participating in the study are sixteen students who are currently enrolled in secondary school in a public school in Malaysia. The subject's range in age from thirteen to fourteen years old during the study.

B. Ethics Statement

The study was conducted on March 17, 2023, comprising eight males and eight females, all fourteen-year-old secondary school students. Informed consent was obtained from all participants, and because the study involved minors, written parental consent was also secured from their parents or guardians. Participants were monitored for emotional well-being throughout the intervention, with arrangements in place to refer any identified emotional issues to the school counsellor. All data collected during the study were securely stored and maintained under strict confidentiality for the entire duration of the research. This study has earned over the Research Ethics Committee's approval, The National University of Malaysia with the ethics approval number, UKM PPI/111/8/JEP-2023-111. The Malaysian Ministry of Education has also given its permission (KPM.600-3/2/3-eras (15996)).

C. Instruments

The study involved a VR tool named Meta Quest 2 (MQ2) previously known as Oculus Quest 2. MQ2 is a virtual reality headset developed by Oculus, which is a subsidiary of Facebook which now Meta Platforms, Inc. It's a standalone VR headset that offers wireless and untethered virtual reality experiences. The MQ2 features improved hardware specifications, higher resolution displays, and enhanced processing power compared to its predecessor, the original Oculus Quest. There were three Meta Quest 2 headsets that is used by one per participant. We first pre-installed mVR-REAL apps for the pilot test. We conducted a pilot/feasibility study as an initial measure towards subsequently carrying out a comprehensive trial [35].

Participants are generally given explicit instructions on how to interact with the VR experience. There is also an initial tutorial that guide participant on how to navigate the VR space and use controllers effectively. The participants were given a briefing regarding the apps which includes a questionnaire administered before and after a test. Comparison of pre- and post-test surveys are valuable tools for assessing changes in knowledge, attitudes, behaviours, or other variables before and after an intervention.

The pre-test comprising fifteen questions on the effectiveness of the apps, and the same set of fifteen questions were handed out as a post-test questionnaire to evaluate the app's

efficacy once again after the VR session. The initial step involved conducting a systematic literature review (SLR) on VR for SEL to identify key themes, gaps, and findings in existing research related to VR applications in SEL and ER. From the SLR, specific elements that consistently emerged as crucial for effective SEL and ER interventions were identified. These included emotional awareness, coping strategies, social interactions, and empathy development. The questions were derived from a prior SLR to investigate these elements further, ensuring relevance to the study's objectives. The questionnaire conducted based on Alqahtani's method represents a valuable approach to gaining insights into various aspects of user experience [36]. Participants were given the opportunity to use the mVR-REAL after completing a pre-test questionnaire. The session took place in the school auditorium. A VR element that lasts approximately three to five minutes per scene is included in the episode. Pre and post-test questionnaires are valuable tools for assessing changes in knowledge, attitudes, behaviours, or other variables before and after an intervention.

Table I indicates a set of question for pre and post-test questionnaire. The questions are designed based on an element that found in the previous study of the systematic literature review [37]. The answer provides a multiple-choice Likert scale namely, strongly agree, agree, neutral, disagree and strongly disagree. A value in numbers was allocated to each notional choice on the scale. A Likert scale is a prevalent rating system used to measure attitudes, opinions, or perceptions [38]. It typically consists of a statement followed by a range of response options that reflect varying degrees of agreement or disagreement.

TABLE I. PRE AND POST-TEST QUESTIONNAIRE

Number	Question
1.	Sound plays a role in understanding something that is not clear
2.	Pictures make a design interesting
3.	Certain methods are required to convey information
4.	Effective interaction affects the presentation of a good story
5.	The physiology of body movement helps me act better
6.	I believe facial expressions and gestures are the result of understanding something
7.	I do not really know how to deal with stress
8.	I always hide my fear
9.	I often cannot control my anger
10.	I believe I have a wide variety of emotions
11.	I believe my behavior is influenced by my emotions
12.	I will show happiness if I feel calm
13.	I believe peace can make me happy

D. Data Analysis

The SPSS, short for Statistical Package for the Social Sciences, is a highly popular software application utilized extensively in the realm of research and data analysis. SPSS offers an interface that is easy to use and facilitates data input, manipulation, analysis, and visualization, all of which contribute to the successful discovery of insights. The acquired data was analysed using the SPSS method and paired sample t-test. The paired sample t-test was selected for this investigation because it is appropriate for comparing the means of two related groups, specifically measurements obtained from the same subjects before and after an intervention. Comparison of pre and post-test surveys provide a robust method for evaluating the impact of interventions and tracking changes in variables over time. The t-test result revealed statistically significant differences in the results users experienced after interacting with the mVR-REAL The apps enhance the user experience and facilitate participants' comprehension of emotion regulations.

IV. FINDINGS

A. User Experience Impact Based on Paired Sample T-Test

The paired samples t-test was conducted to evaluate the effectiveness of the VR intervention on SEL and ER among adolescents. The key results include the means, standard deviations, and t-values, which provide insights into the impact of the intervention. By evaluating the average scores from the pre and post-tests, a paired samples t-test was performed.

Table II shows the outcomes of the descriptive analysis using matched sample statistics on the data. The median number represents the calculated mean of the data. The desired amount might be derived over summing all the numbers provided in the data and thereafter dividing the result by the total number of variables.

TABLE II. MATCHED SAMPLE DATA

Matched Samples Data					
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pre-test	3.7417	15	.60774	.15692
	Post-test	3.9625	15	.44809	.11570

The mean score represents the average performance of participants on SEL and ER assessments before and after the VR intervention. The mean score in the pre-test is 3.74 and median score during the post-test is 3.96, this indicates an improvement in participants' skills.

The standard deviation measures how much individual scores deviate from the mean. A smaller standard deviation suggests that participants' scores are closely clustered around the mean, while a larger standard deviation indicates more variability in responses. For instance, the standard deviation before the intervention was .60774 and after was .44809, which suggests that participants became more consistent in their scores following the VR experience. The following demonstrates the fact that there are distinct variations in the descriptive results obtained from user experiences.

The variable N represents the quantity of information collected for every parameter. In the current study, a maximum of fifteen participants were included in the research sample, denoted by the value of N in the table. The variation of the data around the median is revealed by the typical variation. Data is considered more diverse when its standard deviation is large, and inversely. The mean is not a good indicator of the data quality if the standard variance is higher than the mean. The median value is an accurate reflection of the complete data set if

and only if the average variation value is lower than the mean value. Eq. (1) can be used to determine the average variation explicitly.

$$s = \sqrt{\frac{\sum(X_i - \bar{X})^2}{n-1}} \qquad (1)$$

The symbol S represents the usual variation, $\bar{X}$ represents the median amount of the data, and n represents the number of data points. The findings indicate that the median variation among the pre-test is 0.60774 and the post-test is 0.44809. This indicates that both the variances are lower than the mean value.

Hence, the mean of the pre-test and post-test may accurately portray the entire dataset. Eq. (2) provides a method to calculate the mean standard error ($s\bar{x}$) through dividing the standard deviation by the square root of the population length.

$$S\bar{x} = \frac{s}{\sqrt{n}} \qquad (2)$$

The variable s represents the standard deviation, whereas the variable n represents the number of data points. The mean standard error provides a measure of how accurately the mean data across each sample can approximate the overall means for every factor.

TABLE III.   PAIRED T-TEST RESULTS

Paired Sample Test								
Pair 1	Paired Changes					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Break Difference				
				Lower	Upper			
Pre-test - Post-test	-.22083	.24306	.06276	-.35543	-.08623	-3.519	14	.003

Table III displays the outcomes of a paired sample t-test. The median figure of Table III is the mean of the bilateral variances generated by the variance between the median values. Test outcomes indicate that the median measurement for the variance is -.22083. The stated average variance is the total standard variation calculated from the differences between pairs. The average variation of the variance can be computed using the previously given equation [39].

The test findings indicate an average of the difference of 0.24306. The median average error is a statistical measure that provides an estimation of the normal variation over the representative standard probability for a population that is infinitely large. It is possible to determine the median error of the average variation using the formula provided. We know that the median score has a standard error of .06276. The range of certainty for the mean difference has upper and lower bounds that represent the confidence interval's confidence.

In summary, the results from the paired samples t-test reveal that participants showed significant improvements in their SEL and ER skills after engaging with the VR intervention. The mean scores increased, indicating better performance, while changes in standard deviation suggest greater consistency among participants' responses post-intervention. The statistical significance ($p < 0.05$) confirms that these improvements are unlikely to be due to chance, and a moderate effect size indicates meaningful benefits from using VR for enhancing emotional and social competencies among adolescents. This interpretation provides a clear understanding of how statistical measures reflect the effectiveness of the VR intervention without unnecessary complexity or redundancy.

This demonstrates the utilization of mVR-REAL apps has a significant influence on user experience outcomes. mVR-REAL apps are transforming the way users engage with digital content. Through an exploration of user immersion, satisfaction, and learning, this study reveals the profound impact of mVR-REAL apps on enhancing user engagement and learning in a virtual environment. The findings suggest the element factor of UE on

ER are emotional and psychological. The construct will guide with the matrix on testing the mVR-REAL app.

TABLE IV.   DESCRPTIVE ANALYSIS

Tests	n	Descriptive Statistics	Paired T-Test		
		M (Std. D)	t	df	Sig. (2-tailed)
Pre-test	15	3.74 (0.60)	-3.519	14	0.003*
Post-test	15	3.96 (0.44)			

Table IV presents a descriptive statistic. Aside from the t-value, relevance can also be inferred from the p-value or significant value seen in Table IV. The decision-making process is based on the criterion that if the significance (Sig. (2-tailed)) is below 0.05, the null hypothesis (H0) which states that there is no relationship between two paired groups, is rejected, and the alternative hypothesis (Ha) which states that there is a relationship between the two paired groups, is accepted. The paired samples t-test yielded a significance level (Sig. (2-tailed)) of 0.003, leading to the rejection of the null hypothesis (H0) and acceptance of the alternative hypothesis (Ha). Therefore, the utilization of mVR-REAL apps has a significant influence on UE outcomes which signifying an element of emotion and psychological. This displays that mVR-REAL apps are effectively used in regulating emotions among participants. The findings suggest the element factor of UE on ER are emotions and psychological. The construct will guide with the matrix on testing the mVR-REAL app.

V.   DISCUSSION

The findings of this study underscore the significant potential of VR as an innovative tool for enhancing ER practices, aligning with existing literature that emphasizes the importance of immersive environments in promoting emotional well-being. Previous research has shown that VR can create a heightened sense of presence and engagement, which are critical for effective emotional interventions. This study builds on that foundation by demonstrating how specific design elements such

as aesthetics, audio, and personalization can further enhance the effectiveness of VR in supporting ER.

A. User Experience Element of Virtual Reality for Emotion Regulation

According to the findings, mVR-REAL apps positively impact the user experience. The findings propose two important UE element needed in developing a VR app to enhance ER namely emotional and psychological. In the development of a VR app aimed at enhancing emotion regulation, two crucial user experience elements are the consideration of emotional design and the incorporation of psychological principles. Both elements play significant roles in creating an immersive and effective experience for users seeking to regulate their emotions.

1) Emotional design

a) Aesthetic and visual elements: The visual aspects of a VR environment have a profound impact on users' emotions. The choice of colours, textures, and overall aesthetics can evoke specific emotional responses. For emotion regulation, calming and soothing visual elements, such as nature scenes or soft colour palettes, may be incorporated to create a positive and serene atmosphere.

b) Immersive audio: Sound and music are powerful tools for influencing emotions. Integrating immersive audio experiences that align with the desired emotional state can enhance the overall effectiveness of the app. This could involve calming ambient sounds, guided meditations, or music designed to induce relaxation.

c) Personalization: Allowing users to personalize their virtual environment can contribute to a sense of control and emotional comfort. Customizable elements, such as avatar appearance or the choice of surroundings, empower users to tailor the experience to their preferences, contributing to a more emotionally resonant interaction.

2) Psychological principles

a) Cognitive behavioural techniques: Incorporating principles from cognitive-behavioural therapy (CBT) into the VR app can provide users with practical tools for managing their emotions. This may involve interactive exercises, guided cognitive restructuring, and behaviour modification strategies that users can engage with in the VR environment. This information can be used to guide users through exercises aimed at regulating their emotional and physiological states, promoting self-awareness and control. The integration of CBT and mindfulness within VR interventions is particularly compelling due to the unique enhancements provided by the immersive nature of VR. Compared to traditional methods, VR offers several advantages that significantly bolster the effectiveness of these therapeutic techniques.

*b) Social skills***:** Implementing features that allow users to learn about their social skill to enhance the psychological impact of the app. Progress tracking, along with reflective exercises, can contribute to a sense of accomplishment and self-discovery, reinforcing positive emotional experiences.

*c) Guided mindfulness***:** Integrating mindfulness practices and relaxation techniques into the VR app such as an exercise can help users cultivate a focused and present state of mind. Guided sessions led by virtual mentors or interactive experiences that encourage mindfulness can contribute to emotional regulation by promoting a sense of calm and centeredness.

3) Cultural aspect

a) Content representation: Consideration should be given to the representation of diverse cultures of Malaysia within the mVR-REAL content. This includes incorporating scenarios, environments, and characters that are inclusive and representative of Asian cultural contexts. Users from different cultural backgrounds should feel a sense of inclusivity and relevance in the virtual experiences.

b) Language and communication: The app's language and communication should be mindful of cultural nuances. mVR-REAL involves using Malay language and ensuring that any written or spoken content is easily understandable and culturally appropriate for a Malaysian user base. Language choices should be respectful and considerate of cultural diversity. Therefore, mVR REAL chose Malay language in the whole app presentation because Malay language is close to heart of Malaysian. Emphasizing cultural representation and language in the context of VR applications is crucial for enhancing user engagement and ensuring that emotional and psychological benefits are universally accessible, particularly within the Malaysian context. Cultural relevance not only enriches the user experience but also fosters a deeper connection between the content and the users, leading to more meaningful interactions.

In summary, the findings of this study highlight the critical importance of integrating emotional, psychological, and cultural elements in the development VR applications for ER. By focusing on these aspects, developers can create immersive experiences that resonate deeply with users, enhancing engagement and therapeutic outcomes. Ultimately, mVR-REAL applications hold promise as effective tools for persons aiming to improve their emotional well-being and regulation by immersing themselves in engaging virtual environments. The findings suggest that the mVR-REAL app effectively integrates emotional, psychological, and cultural elements to enhance emotion regulation. Users experienced positive emotional effects, benefitted from cognitive-behavioural techniques, and appreciated the cultural sensitivity and inclusivity of the app, contributing to an overall positive user experience in the pursuit of improved emotional well-being. The mVR-REAL app that incorporates various elements of emotional design, psychological principles and cultural aspect has successfully impacted the user experience. This investigation has illuminated on the positive impact of various element features on user experience across a wide range of digital and physical environments involving VR apps. Furthermore, the findings from this study provide valuable insights for VR developers aiming to create applications that effectively support ER. By prioritizing emotional design and psychological principles during the early stages of development, developers can enhance user engagement and improve therapeutic outcomes.

Further research will be directed towards the concrete implementation of usability testing for the mVR-REAL project

that should focus on several key questions that emerge from the findings of this study such as how do different design elements affect user satisfaction and engagement in VR environments for ER? and what is the impact of culturally tailored content on the effectiveness of VR interventions for diverse populations?. Moreover, challenges related to time were also identified, necessitating further research on how does the duration of VR sessions influence the effectiveness of ER techniques?

In a nutshell, as the technology continues to evolve, it is imperative for developers and researchers to explore innovative ways to harness the potential of mVR-REAL apps, ultimately providing users with immersive and transformative digital experiences. The app holds the promise of reshaping how we learn, entertain, and engage with digital content in the mobile VR era. The potential long-term impact of mVR-REAL apps on the field of ER is substantial, with implications that extend beyond VR app development into broader digital health interventions. By leveraging immersive technology, these applications can transform how individuals manage their emotions, offering innovative solutions that are both engaging and effective. mVR-REAL apps can cultivate a deeper understanding of emotional states through immersive experiences that allow users to visualize and interact with their emotions in real-time. This heightened awareness can lead to improved emotional regulation skills over time, fostering resilience and adaptability in various life situations.

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