

Use of Virtual Reality (VR) as a Clinical Tool for Management of Self-Perceived Anxiety in College Students

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College students have reported the transition to college and leaving home is a time of great stress and anxiety. The purpose of this study was to reduce the self-perceived anxiety of college students through the use of Virtual Reality (VR). The participants in this study consisted of 20 college students at a small, rural, private liberal arts college from varying majors. The participants were tested pre VR utilizing the Beck Anxiety Inventory to measure levels of perceived anxiety. The participants were introduced to interventions utilizing VR and then provided the Beck Anxiety Inventory post participation of the VR. The results indicated VR interventions had a significant effect in reducing self-perceived anxiety. The VR interventions were provided through the use of Oculus Rift VR and applications used were free to the user. The study highlights the importance of college students recognizing anxiety symptoms and ways to manage perceived anxiety through the use of VR as one avenue to reduce anxiety symptoms.

Keywords: anxiety, virtual reality, college students

LITERATURE REVIEW

College can be perceived as a time of high levels of stress due to the increasing new responsibilities related to transition to adulthood, role conflict in regard to personal relationships, and challenging academic expectations (Blanco et al., 2014; Chung et al., 2011). COVID-19 has also posed many challenges for college students as they have suffered a great sense of loss through high school and for those entering into college. Data from Penn State University's Center for Collegiate Mental Health (2019) indicated students seeking health and counseling on college campuses has increased by 40% between 2009 and 2015, with an additional rise in that percentage following the COVID-19 pandemic. Lipson et al. (2022) reported that mental health concerns of students are on the rise, with over 60% of college students diagnosed with at least one mental health condition. Colleges often offer health and counseling services, but it has been reported many of these types of resources are often underutilized by students (D'Amico et al., 2016). Brockelman and Scheyett (2015) stated that students in college are usually in young adulthood and may experience the emergence of mental health symptoms for the first time. Recent studies have shown that stress, depression, suicidal ideation, anxiety, and substance abuse are all factors associated with a decrease in academic productivity and retention of valuable information learned in classes (Blanco et al., 2014; D'Amico et al., 2016; De Luca et al., 2016).

With increasing mental health concerns for college students, professionals must find a way to help students cope with daily conflicts. To help students cope with these concerns, it is important to offer interventions that would be of interest to this generation. Users participate in virtual reality (VR) with a head-mounted device or headset (Pottle, 2019) and the use of a 3D computer-based environment that allows an individual to fully immerse and interact with the environment (Cipresso et al. 2018; Pottle 2019). Virtual reality allows users to fully immerse themselves in the psychological feeling of actually being in the environment (Heeter, 2000). These interactions include visual and auditory environments. In a study completed in South Korea, researchers found VR a novel tool in stress management (Kim et al., 2021). Clinical use of VR has been in place since the 1990s but has become more innovative and useful in the treatment of many medical conditions. Some of the benefits to using VR reported by Rizzo et al., (2019) include fear reduction in individuals with phobias, post-traumatic stress disorder, and depression. Rizzo et al., (2019) also reported VR can help in pain reduction, enhancing functional skills training, as well as effective use in rehabilitation for cognitive impairments. Clinical VR has been used to immerse users in simulations generated by a computer. Virtual reality has been used for exposing disorders such as anxiety or addiction, distraction as in reducing pain perception or pain reduction, motivation for cognitive conditions, and engagement as in to gain attention in clinical situations (Rizzo et al., 2019). Clinical VR within the healthcare industry is becoming more commonly used (Pottle, 2019).

One of the VR systems which is frequently used is the Oculus Rift (Cipresso et al., 2018) which has been used for virtual environments including nature scenes was found to have an increased level of relaxation for the participants (Anderson et al., 2017). In recent reviews of meditation programs, it was found that mindfulness meditation programs demonstrated effective interventions for anxiety (Tarrant et al., 2018). According to Freeman et al. (2017), VR has the potential to help people find relief from mental health problems for situations that are troublesome. The mental health conditions may include fear of animals or spiders such as arachnophobia, past trauma or post-traumatic stress disorder, fear of attack caused by delusions, or substance abuse disorders. In many situations when people feel anxious they report difficulty interacting in their worlds. Some people's difficulties are in finding ways to interact in their worlds, and recovery concerns thinking, reacting, and behaving differently (Freeman et al., 2017).

Camara and Hicks (2019) reported VR such as Oculus Rift has provided this type of technology for entertainment, as well as in education as a tool in mental health treatments. The available VR devices provide immersive experiences and are user friendly. Virtual reality has been used in previous studies to show mental health problems can be treated using this technology. In one such study by Camara and Hicks (2019), they attempted to evaluate the efficacy of VR in reducing the anxiety expressed by college students. In this study Camara and Hicks (2019) offered VR to one group and reading therapy to another group. Camara and Hicks (2019) found both VR and reading therapy were significant in reducing stated anxiety levels, but it was evident that of the two interventions, VR decreased anxiety more than the reading interventions. They concluded that VR was a positive tool and an affordable way to aid in anxiety reduction among the study participants (Camara & Hicks, 2019).

The Beck Anxiety Inventory (BAI) was chosen for this study since it can be completed by students who can report their perceptions of their own anxiety. The BAI consists of 21 items listed as common symptoms of anxiety. Participants are asked to read each item on the list and indicate how much they have been bothered by that symptom during the past month by marking an "X" in the block for each symptom. The scale options are rated from not at all for each symptom up to the symptoms bothering the person a lot. The total score is calculated by finding the sum of the 21 items. A score of 0-21 indicates low anxiety, a score of 22-35 indicates moderate anxiety, and a score of 36 and higher would indicate high levels of anxiety (Beck et al., 1988).

PROBLEM STATEMENT

According to the American Psychological Association (APA) (2019), there was an increase in the types of mental health disorders experienced by young adults over the past ten years. It was estimated in 2017 that 792 million people lived with a mental health disorder. This is slightly more than one in ten people

globally (10.7%) (Dattani et al., 2021). According to the APA (2019), in a survey completed by the Association for University and College Counseling Center Directors (AUCCCD), the top concern for college students appeared to be anxiety, then depression followed closely by relationship issues.

PURPOSE OF THE STUDY

The primary focus of this study was to reduce the self-perceived anxiety of college students by using VR as an intervention. Virtual reality intervention could be implemented as a method for self-regulation for college students. The intent of the study was to teach students to increase self-awareness skills that lead to using VR as symptom management strategies. With participation in the study, the intention was the students could learn that VR can be used for reducing anxiety and which applications would be available for download if the student planned to use VR outside of the interventions offered at the college by two occupational therapists.

PROCEDURES

Student referrals for this study utilizing VR as a treatment for anxiety were received in two ways. The students were referred as a recommendation from the Health and Counseling Center located at the college, or the students could self-refer. The Health and Counseling Center located at the small, rural college where this study was completed reported that in the academic year 2022 there was a 50% increase in students seen for counseling appointments from the fall to spring semesters. According to one of the the mental health counselors at the college, over 67% of students utilizing the center have a presenting problem and/or diagnosis attributed to high stress/anxiety such as adjustment disorders, anxiety-related disorders, and panic disorder and other comorbidities related to this such as substance use disorder or trauma (Kois, 2023).

When students arrived for the VR intervention at the campus VR lab, a cover sheet that gathered demographic information was completed by one of the investigators. Once the consent forms were read and signed, the BAI was administered before receiving any VR intervention. The BAI is not a diagnostic tool, but instead is used as a self-report measurement of anxiety. During the VR intervention the Oculus Rift applications that were offered free by the system were chosen by students for each session. A session consisted of two 30-minute sessions at a minimum (within a two-week period). The BAI was administered again following the students' second VR intervention session for a post-test score.

There were a variety of application choices for the student to select during their session (refer to Table 1 for a display and full description of each application). Each of the selections was driven by the needs of the particular student. The investigator provided a brief description of the purpose of the application they were selecting. If a student used the application, Open Brush for example, the investigators explained that this type of application could be compared to doodling or coloring for stress relief and has been found to improve focus. In a study by Turturro and Drake (2020), they found coloring and drawing can be effective in reducing anxiety. The application Google Earth led to discussions with the investigators from students who were homesick or who wanted to travel to places they had always wanted to go. Other students used this application to travel to places they have already visited and explained how much enjoyment they had there with family and/or friends. Students who chose the Go for a Walk application reported the music and unique sounds that were heard while traveling through dynamic surroundings could be compared to going for walks while listening to calming music. If a student chose (m)ORPH as an application, they could relate to listening to music for a calming experience. The benefits of listening to music while walking was confirmed when a study done at Arizona State University after the COVID-19 pandemic by Hernandez-Ruiz (2020) found, experiencing music briefly can help reduce anxiety in college students. Breathe Peace World, another application option chosen by students for the VR experience, enabled students to learn deep breathing techniques that can be used at any time when feeling anxious or in stressful situations. Another application, Sunset Bay, was selected by some students and allowed the students to learn deep breathing and meditation techniques. Students learned to use these strategies to decrease anxiety at any time

throughout their day. It has been discovered that mindful breathing can be useful in self-regulating when students feel anxious before an exam (Cho et al., 2016).

TABLE 1
APPLICATIONS USED FOR INTERVENTIONS

<u>Applications</u>	<u>Descriptions:</u>
Open Brush	<p>“Open Brush is the community created successor to Tilt Brush, a room-scale 3D-painting virtual-reality application available from Google, originally developed by Skillman & Hackett. Open Brush lets you paint in 3D space with VR. Unleash your creativity with three-dimensional brush strokes, choosing from a wide palette of brushes, including stars, light, and even fire. Your room is your canvas. Your palette is your imagination. The Possibilities Are Endless. Open Brush is free forever, and open source”.</p> <p>https://www.oculus.com/experiences/quest/3600360710032222/</p>
Google Earth	<p>“The world has so many beautiful and amazing places to visit. If we’re lucky, we’re able to travel and see a few of them. But even the most active travelers can only see a fraction. What if we could see them all? Ten years ago, Google Earth began as an effort to help people everywhere explore our planet. And now, with more than two billion downloads, many have. Today, we are introducing Google Earth VR as our next step to help the world see the world. With Google Earth VR, you can fly over a city, stand at the top of the highest peaks, walk along new streets, and even soar into space. Now, at 196.9 million square miles, we know the world is pretty big, so we’ve made it easy to find great places to visit. Google Earth VR comes with cinematic tours and hand-picked destinations that send you to the Amazon River, the Manhattan skyline, the Grand Canyon, the Swiss Alps, and more”.</p> <p>https://www.oculus.com/experiences/rift/1513995308673845/</p>
Go for a Walk	<p>“Go For a Walk is a musical VR experience emphasizing non-linearity, user interaction, and making chill beats! Unlike other musical games and experiences, Go For a Walk has no set beginning or end. Instead the musical environment evolves as you engage your surroundings, creating a dynamic arrangement through natural VR interaction. In other words, point at everything you see and listen to the nice sounds”!</p> <p>https://www.oculus.com/experiences/go/1795066593933270/</p>
Tripp	<p>“Are you ready to experience meditation like you never have before? Just put on your VR headset, download TRIPP, and select Free Demo to get started. TRIPP’s fully immersive meditation experiences make it easy to let go of outside distractions and racing thoughts as you escape into stunning landscapes and virtual worlds. Follow along with your guide’s soothing voice and the simple breathing exercises to keep your focus in the present moment and let the peace and calm wash over you”.</p> <p>https://www.oculus.com/experiences/quest/2173576192720129/</p>

Breathe Peace World	<p>“Awaken your ability to Breathe Peace inside a luminous Virtual Reality storybook world. Enter a shimmering grove of living, breathing trees where uniquely sparkling snowflakes undulate in a watercolor landscape. Meet Aya, your adorable wisdom teacher who always greets you with boundless love and appreciation. Aya will help awaken your innate ability to Breathe Peace through embodied learning. When you’re ready to return home, you’ll know exactly how to breathe peace with anyone in any situation, anywhere. Included in Breathe Peace in the World are Meet Aya & Breathe Peace. In Meet Aya, learn a simple practice to transform your inner world into a peaceful world and your lifetime into a peaceful lifetime. Enter Breathe Peace and explore more or simply enjoy breathing peace with the trees, the snowflakes or with Aya. Stay as long as you like”.</p> <p>https://www.oculus.com/experiences/rift/1526202524057260/</p>
Sunset Bay	<p>“A playful meditation app, great to relax. Simple and plain, beautifully designed. Discover 6 different worlds while floating towards the sea into the sunset. Activate giant objects in each world during the relaxing flight and rotate them as you like. Enjoy 6 minutes long flights through beautifully designed low poly worlds into sunsets. Activate an optional soothing voice and breathing sound to experience the world as a guided meditation”.</p> <p>https://www.oculus.com/experiences/rift/2677096172367847/</p>
(m)ORPH	<p>“(m)ORPH is an abstract, musical VR experience for Oculus Rift, Rift-S, and Quest 1 & 2. (m)ORPH is not a game, but let’s players interact with audio in real-time to create a dynamically evolving music environment. Sound is literally all around you, yielding an immersive 360-degree spatial audio mix that you get to control and customize. (m)ORPH features 15 ambient, experimental songs from innovative artists like Christopher Willits, Taylor Deupree, Symbion Project, Kodomo, Micah Frank, George Hurd, Yumi Iwaki, dvdv, Kodacrome, Matthew Mercer, Dispak, Bloodbeak, Khems, and Black House Triangle. The free VR app includes a free soundtrack called “(m)ORPH Artist Series” which will be available via bandcamp on Foil Records. Perfect for meditation or to escape the stresses of the world, the placid music and chill artistry will transport you to a new state of mind. Experience a whole new way of listening”!</p> <p>https://sidequestvr.com/app/1952/morph-music-vr-experience</p>
Blocks	<p>“Blocks lets you easily create 3D objects in virtual reality. Using six simple tools, you can bring your applications to life, create a volumetric masterpiece, or simply let your imagination run wild. Get inspired by others’ creations or publish your own to https://vr.google.com/objects to inspire the world around you. No matter your modeling experience, you’ll create beautiful 3D objects in no time”.</p> <p>https://www.oculus.com/experiences/rift/1320373124698683/</p>

METHODOLOGY

This study took place over the 2022-2023 academic year. Participants were 20 male and female students who were enrolled at a small, rural liberal arts college, were at least 18 years of age and had utilized the Health and Counseling Center for medical/behavioral assistance or made self-referrals. Advertisements were posted on campus on flyers, the college’s Wellness Portal, and through electronic newsletter announcements to recruit students who wanted to participate in this study. To fully participate in the program, the students were expected to have access to an internet connection and telephone or mobile communication for scheduling. Consent forms for participants were obtained prior to intervention and pre-testing. The population of program participants included both newly enrolled and existing students. The population of the study were students who were willing to participate in the pre and post BAI form and completed a minimum of two virtual reality sessions (within a two-week timeframe) on campus with either the primary investigator or co-investigator.

This study generated both quantitative and qualitative data following each session. This mixed method design allowed for the participants to complete the BAI for pre and post testing while the participants openly discussed the usage of the applications at the end of each individual session.

RESULTS

Participants’ demographics are presented in Table 2. Sixty-five percent of the participants were occupational therapy majors with a total of 85% of the participants identifying as female. A distribution of students from first year to senior year participated, with the highest level of participants being seniors at 40% overall. Students in the senior year are typically taking high level coursework as they prepare to complete their degree or go on to graduate school. The second largest group of participants were first year students (35%). As previously mentioned college is a time of transition into new living arrangements, new friends, and the development of new schedules without parental supervision, all of which may influence the higher levels of stress and anxiety a student may be managing. Of the participants, 95% of the students self-referred to participate in the virtual reality study to reduce stress and anxiety.

TABLE 2
PARTICIPANT DEMOGRAPHIC INFORMATION (N=20)

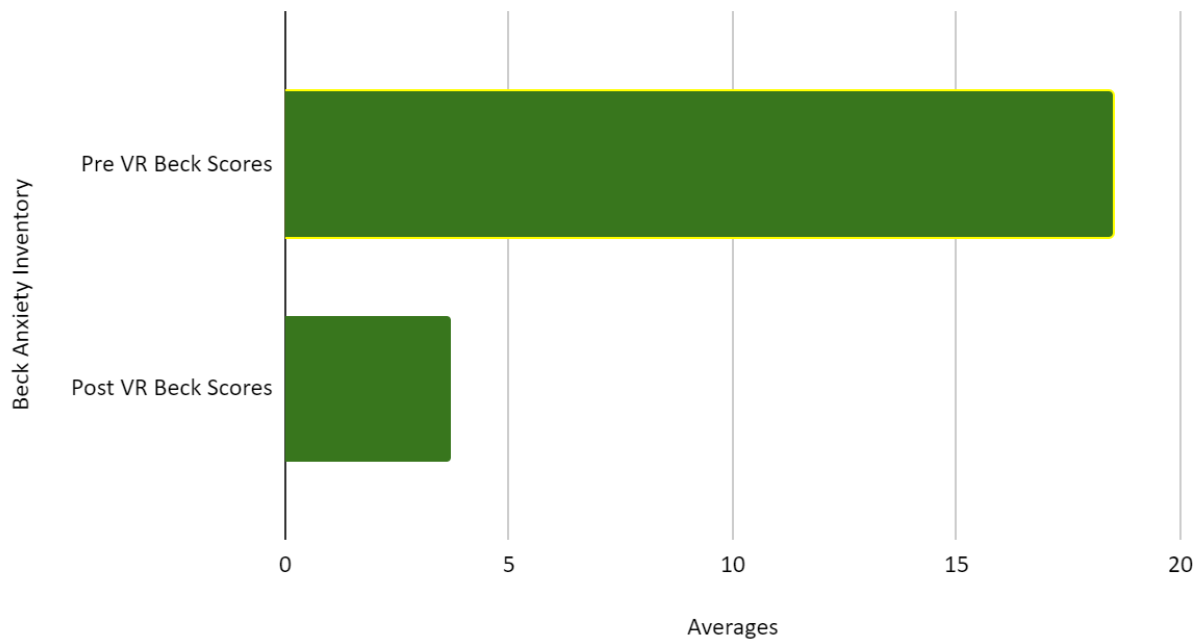
	Numbers/Percentages
Majors	
Biology	1 (5%)
Occupational Therapy	13 (65%)
Education	1 (5%)
Social Work	1 (5%)
Psychology	1 (5%)
Criminal Justice Business	1 (5%)
American Sign Language	1 (5%)
Gender	
Male	3 (15%)
Female	17 (85%)

	Numbers/Percentages
Year of Study	7 (35%)
Freshman	2 (10%)
Sophomore	3 (15%)
Junior	8 (40%)
Senior	
Referral Source	19 (95%)
Self	1 (5%)
Health & Counseling	

The aim of this study was to evaluate VR as an effective tool in reducing perceived anxiety for college students. The 20 participants in this study utilizing the BAI pre-test showed relatively high levels of anxiety ($M=16.9$, $SD=11.99$). After the interventions were completed and the BAI was utilized as a post-test, the reported levels of anxiety were significantly lower ($M=4.6$, $SD=3.79$). See Figure 1 change in perceived anxiety scores (pre/post) after VR interventions.

FIGURE 1
CHANGE IN PERCEIVED ANXIETY SCORES (PRE/POST) AFTER VR INTEVENTIONS

VR Project



Themes were generated from the qualitative data that was generated from students' comments after the VR interventions. Many of the students who participated in this study indicated they had a great time learning how to use VR for relaxation. Many indicated they felt much more relaxed after the VR sessions. There were a few students who said they did not know the Oculus VR headsets offered the free applications and others were excited to return to the VR lab to see more applications they could use on their own in the future.

LIMITATIONS AND FUTURE RESEARCH

While the study provided effective insight into using VR to reduce self-perceived anxiety, the overall number of participants was a small sample size. Extending the study over another academic year would allow for additional data collection with potential to cross correlate the students' academic school year and the level of stress/anxiety over another academic year. A focus group of interested individuals could provide feedback as to the intervention's effectiveness and students' willingness to continue this self-regulation process with other VR relaxation measures. Additional research could include increasing the minimum number of sessions required for participation as well. If the sample size were larger, there could be many more correlations made between students' academic year of study and levels of self-perceived anxiety. Another correlation that could be established if the sample size were larger could be times of occurrence of high levels of anxiety, which could include during midterm examinations, hands-on practical's, or final examinations. This study was important and could inform future research, since the prevalence of stress/anxiety is high among college students. Utilizing VR interventions to reduce anxiety is one way to teach students to self-regulate anxiety symptoms.

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