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**Social VR: A Promising Platform for Enhancing Mental Wellness
among College Students**

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**Social VR: A Promising Platform for Enhancing Mental Wellness
among College Students**

by

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Dedication

This is dedicated to my parents, Hui Su and Danli You, whose unwavering support, understanding, and unconditional love have been the foundation of my academic and personal success.

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Abstract

Social VR: A Promising Platform for Enhancing Mental Wellness among College Students

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In recent decades, there has been an alarming increase in the number of university and college students struggling with intensifying psychological distress, which has become a mental health crisis on campuses. To address this issue, this study proposes social virtual reality (VR) as a potential platform to promote social interaction and improve mental well-being for college students. In this study, 68 students explored a variety of social VR platforms in a classroom setting. Results showed that a virtual space, audio, avatar, communication types, and activities were key contributing features that facilitated social interaction among college students in social VR and have the potential to enhance mental wellness, and the anonymous nature, communicative cues, and designated private areas provided by social VR platforms were effective in facilitating self-disclosure, indicating social VR's potential in delivering mental health services such as individual and group counseling and therapy. This study provides evidence that social VR can enhance social interaction and communication while serving as a platform for professional mental health care, a venue that has yet to be explored in previous studies.

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Introduction

In recent years, there has been a growing concern over the mental health of college and university students, given the increasing number of students reporting mental health issues. According to the American College Health Association, the percentage of college students being treated for at least one mental disorder has risen from 18% in 2005 to 43% in 2022, with depression and anxiety being the most commonly reported issues (American College Health Association, 2022). What's more, 77% of students reported moderate or high levels of distress, and 51.7% reported feelings of loneliness (American College Health Association, 2022).

To address this rising demand for psychological care, educational institutions have increased their investment in campus mental health services (Legislative Analyst's Office, 2021). Despite these efforts, many campus communities still struggle to meet the increasing demand (Xiao et al., 2017). With limited resources and the ongoing rise in mental health concerns among college and university students, it has become necessary to find supplementary tools and platforms that provide effective mental health care.

The emergence of digital technology has had a significant impact on all aspects of people's lives, including the way individuals connect with each other. With the internet removing the burden of physical distance, online communities allow users to connect with their existing friends and make new connections with like-minded individuals, expanding the scope and reach of their social support networks (Smith-Merry et al., 2019). These online communities also offer a level of anonymity and reduced social pressure, facilitating individuals' sharing of experiences and emotions, fostering a sense of belonging and social support, and promoting mental health and psychological well-being (Lattie et al., 2019).

Among emerging technologies, virtual reality (VR) is unique in its ability to create immersive experiences through head and body movement tracking, making it effective in engaging users and conducive to fostering social interaction (Maloney et al., 2020c). Since the commercialization of headsets in the 2010s, the number of VR users has been steadily increasing, and it is estimated that the US alone will have 70.2 million users by 2023, with the global market expected to reach \$20.9 billion by 2025 (Gilbert, 2022). Social VR platforms, which focus on facilitating synchronous social interaction among users (van Brackel et al., 2023), have experienced a surge in usage due to the increasing demand for social contact, which was catalyzed by the enforced quarantine during the COVID-19 pandemic (Kelley, 2021; Sykownik et al., 2021). One of the social VR platforms, Rec Room, experienced three times the number of active users during the 2021 holiday season compared to the same period in 2020 (Lang, 2022). Although social VR platforms have been studied for communication and interaction (Ahn et al., 2021; Kirchner & Forsberg, 2021; Maloney & Freeman, 2020a; McVeigh-Schultz, 2018), few studies have evaluated their potential in providing mental health care and enhancing mental well-being.

This paper aims to address these limitations by 1) identifying specific features of social VR platforms that enhance college students' social experience and 2) examining social VR's potential as a platform for mental health care. To achieve these goals, the author analyzed data from a collaborative research project explored how students learn and interact in social VR platforms. Specifically, the author examined students' responses to an open-end question: *"How did social VR help you build social connections with people you interacted with?"* The findings highlight: 1) virtual space, audio, avatar, communication types, and activities were key features that facilitated social interaction among college students in social VR and could potentially enhance mental wellness, and

2) the anonymous nature, communicative cues, and designated private areas provided by social VR platforms facilitated self-disclosure, suggesting that social VR has the potential to deliver mental health services such as individual and group counseling and therapy.

This paper contributes to the existing literature in three ways: 1) expanding the understanding of social interaction and communication in social VR platforms, which is an emerging type of VR application that has not yet been extensively studied; 2) enriching the knowledge of social VR platforms' impact on college students' social experience by identifying specific features that foster social interaction; and 3) examining the potential of social VR to provide mental health services.

Literature Review

Social Relationships to Mental Well-being

Social relationships play a critical role in human survival and are closely linked to achieving and maintaining good health and well-being (Haslam et al., 2015). Extensive research has established that positive and supportive social connections can enhance mental health and well-being, while the absence of social connections can have adverse effects on individual's physical and mental health across all age groups (Asante & Karikari, 2022; Clark et al., 2018; McLouglin et al., 2018; Nabi et al., 2013; Newman & Zainal, 2020).

Social support and social connectedness are the two major concepts relevant to social relationships, and are frequently identified as mechanisms for enhancing health and well-being (Haslam et al., 2015). By definition, social support refers to one's perception or experience of being cared for, esteemed, valued, and loved by others, as well as being a part of a social network where mutual assistance and obligations are present (Wills,

1991). It can be further categorized into different forms, such as informational support (e.g., resources and coping strategies), instrumental support (e.g., tangible assistance and specific aids), and emotional support (e.g., warmth and reassurance) (Taylor, 2011). Beyond these specific forms, social support, as the definition suggests, also encompasses the perception that such support is available and can be received when needed (Wills, 1991). Research has shown that perceived social support can trigger feelings of support, reduce levels of anxiety and depression, and enhance mental wellness (Nabi et al., 2013; Taylor, 2011; van Brakel et al., 2023).

Social connectedness, on the other hand, reflects the sense of belonging and attachment to a social network, and is characterized by the “subjective awareness of being in close relationship with the social world” (Lee & Robbins, 1995, p.338). While social support involves the provision of assistance and emotional comfort from others, social connectedness is more focused on the sense of being part of a larger social network. The two concepts are interrelated, as social connectedness can be fostered through the continuous provision of social support. Research has shown that social connectedness is associated with higher levels of resilience and more positive mental health outcomes (McLouglin et al., 2018). Therefore, building and maintaining social connections can promote both social support and social connectedness, leading to positive effects on mental health and well-being.

Communication Channels for Social Connection Building

The way people build social connections has evolved significantly with the rise of internet-based technologies. While in-person interaction used to be the primary means of building social support and connectedness, a growing number of individuals now rely on computer-mediated communication to interact and connect with others. By engaging in

online forums, gaming, and social media platforms, people can access large communities of individuals with diverse backgrounds and experiences that may not be available in their offline network, enabling them to build social connections that might be lacking in their daily lives (Smith-Merry et al., 2019; Walther & Boyd, 2002). Furthermore, online applications provide real-time messaging, making it easier for the maintenance of distant relationships. The anonymous nature of online communication also promotes a sense of freedom and reduces social inhibition, encouraging individuals to express themselves more honestly and openly, as well as a sense of privacy and protection, providing a safe space for the discussion of sensitive or personal topics (Baccon et al., 2019; Fox & McEwan, 2017; van Brakel et al., 2023).

Despite the many benefits of online communication channels, computer-mediated communication is still perceived as limiting when compared to face-to-face interaction due to the lack of social cues. In-person communication allows individuals to pick up on nonverbal cues, such as facial expressions and body language, which are lost in audio or text-based communication. Videoconferencing platforms, though providing nonverbal cues, require people to maintain close-up eye gaze for extended periods, making communication less natural and more tiring than in-person interaction (Bailenson, 2021). Numerous studies conducted during the COVID-19 pandemic, when in-person interaction was restricted due to social distancing, have reported on these setbacks of computer-mediated communication. For example, one study investigated the relationship between different modes of computer-mediated communication and well-being during the pandemic and revealed that text-based communication had a negative association with well-being, while face-to-face interaction had a positive association despite the health threats (Newson et al., 2021). Although this study did not find an association between well-being and video-based communication, another study suggested that extended use of

videoconferencing could lead to issues such as excessive close-up eye gaze, cognitive overload of processing nonverbal cues, increased self-awareness and performance pressure, and lack of physical mobility, resulting in feelings of exhaustion and stress, commonly known as “Zoom fatigue” (Bailenson, 2021). These studies indicate that face-to-face interaction is crucial for maintaining good mental health, yet typical digital technologies cannot fully replicate such experience, and may even cause negative consequences when used excessively.

Social VR to Enhance Social Connection

Unlike the aforementioned online communication channels, social VR provides a unique communication platform that closely mimics the experience of in-person interaction, offering a natural and effective way to build social connections. Utilizing VR technology, social VR platforms are housed within 3D computer-generated environments (Spanlang et al., 2014). They are primarily accessed through head-mounted displays, which provide users with a first-person view of the virtual space, as well as sensory feedback through various channels, including visual, haptic, auditory, and even olfactory cues, to simulate a range of sensations and experiences (Bailey & Bailenson, 2015; Markowitz & Bailenson, 2019). Through head and body movement tracking, users’ digital representations, also known as “avatars”, mimic their real-time movements and actions in the virtual world, allowing for social interactions that closely resemble those in the real world (Bailey & Bailenson, 2015). As such, social VR platforms can overcome the limitations of other computer-mediated communication channels, facilitating social interaction that is as beneficial to mental health as in-person interaction.

A growing body of research has provided evidence in support of this statement. For example, a quantitative survey conducted among 1231 social VR users found that the heightened sense of presence, facilitated by social VR platforms, leads to increased

perceived social support, which in turn, positively affects the perceptions of overall social support and subjective well-being (van Brackel et al., 2023). Similarly, a qualitative study that involved eight interviews and two months of participatory observations on LGBTQ users highlighted several key benefits of social VR: 1) social VR facilitated natural and immersive social interaction that closely resembled face-to-face communication; 2) social VR engaged users in multi-modal communication, fostering more open and inclusive interaction within the LGBTQ community; and 3) social VR constitutes a safe space for LGBTQ users to build close relationships, which would be beneficial for their social lives beyond the virtual world (Acena & Freeman, 2021).

In light of these findings, scholars have delved into specific features of social VR applications that promote social interaction. Based on an analysis of 44 commercial and prototypical VR applications, Handley and colleagues (2022) developed a taxonomy of design choices that classified features into three distinct categories. The "self" category covers all aspects of avatar embodiment, including avatar representation, customization, manipulation, and locomotion. The "interaction with others" category is focused on communication modalities, such as verbal and nonverbal communication, user blocking and muting, as well as activities that facilitate social interaction. The "environment" category includes design choices concerning the virtual space's construction, manipulation, and openness.

Several studies have utilized this generalized taxonomy to investigate the impact of design choices on user interaction and experience in social VR (Freeman et al., 2020; Maloney & Freeman, 2020a; Maloney et al., 2020b; Maloney et al., 2020c; Sykownik et al., 2021; Zamanifard & Freeman, 2019). One study focused on couples' experiences of using social VR to maintain their long-distance relationships and found that avatars played a crucial role in enhancing intimate interaction between couples, as embodied

physical contacts made them feel together despite being physically apart (Zamanifard & Freeman, 2019). In another study, nonverbal communication was identified as an essential facilitator of interaction in social VR, perceived as more effective and flexible in conveying social meanings than other communication channels. The study also noted that the variety of communication modalities, both verbal and nonverbal, contributed to an enhanced sense of connectedness (Maloney et al., 2020c).

Existing literature has explored the efficacy of social VR in enhancing social interaction among individuals in various relationships and settings, such as long-distance relationships (Maloney & Freeman, 2020a; Zamanifard & Freeman, 2019), colleagues (Kirchner & Forsberg, 2021), and in-group members (Acena & Freeman, 2021). However, little research has focused on college students' experiences of building connections in social VR. One study involved 12 master's students exploring social, educational, or entertainment VR applications across six weeks, and found that interaction in social VR enhanced the sense of connectedness and provided a better learning experience (McGivney et al., 2022). However, the small sample size limited the generalizability of the findings, and it was unclear which specific feature(s) of the VR applications attributed more importance to social interaction. The other study, conducted among 81 college students in a class setting, showed that avatar appearance had an effect on students' sense of presence and perception in social VR, and their group dynamic and sense of connectedness increased over time. This study shed light on the role that avatars played in students' experience in social VR, yet its quantitative perspective lacked details about how students connected and interacted with each other in social VR and the role that their avatars played in the process.

Given the high level of technological comfort among college students, and their struggles with increasing mental health issues (Lattie et al., 2019), they are most likely to benefit from social VR. Therefore, this study aims to enrich the understanding of college students' experience in social VR, identify feature(s) of social VR platforms that promote interaction, and assess the potential of social VR to improve students' mental well-being.

Method

Participants

The current study drew data from a sample of 68 undergraduate and graduate students who 1) were enrolled in a course with VR experiences and 2) had consented to share their data. Students explored a variety of virtual worlds during the course (see Table 1 for virtual world descriptions) and completed surveys after each session about their social and learning experience in the virtual space. While the survey asked about both the positive and negative aspects of social VR in building social connections in two separate questions, this study focused on the positive reflections due to the large amount of data. In total, the 68 participating students generated a total of 224 data entries.

Thirty-two of the 68 participants provided demographic information. Gender was distributed evenly, with 16 males, 15 females, and one student who preferred not to self-identify. Participants are 25 years old on average ($SD = 7.97$), with the youngest being 20 and the oldest being 54 years old. According to the data, 13 participants identified as Asian or Asian-American, 12 as White, 4 as multiracial, and one as African, African-American or Black, Hispanic or Latinx, or Middle Eastern. In terms of prior VR experience, 21% ($n = 14$) had never used VR before the course, 26% ($n = 18$) had used VR before, and 53% ($n = 36$) did not report this information.

Materials

Description of the course

This study was part of a large-scale collaborative research project aimed at examining how students learn and interact in social virtual worlds. The project was led by faculty members teaching VR-related courses at four institutions across the United States. The courses varied in their specific focus and structure, but all included virtual experiences as a key component, giving students direct experience with the technology and enabling them to put their learned concepts into practice.

During each session, students participated in virtual world visits chosen by the course instructor (see Table 1 for virtual world descriptions) and completed tasks assigned by the instructor. These tasks covered a range of independent exploration and group learning activities, including forming project teams, conducting group meetings, virtual field trips, guest lectures, or presenting research posters. A videoconference was kept open throughout the virtual world sessions, with teaching assistants available to resolve technical issues.

Device Usage

In the social virtual worlds, students employed a range of digital technologies to connect and interact with others, including desktop/laptop, VR headset, smartphone/tablet, and others (see Table 2). Desktops/laptops were used at least once by 84% of the participants ($n = 57$), while 60% used VR headsets at least once ($n = 41$). The most frequently used VR headsets included the Oculus Quest, Oculus Go, Oculus Rift, and HTC Vive. During multiple sessions, 51% of the students ($n = 35$) utilized different devices, with 47% ($n = 32$) alternating between desktops/laptops and VR headsets. The total sessions completed by students varied based on different courses' requirements, ranging from one to six sessions ($M = 3, SD = 1.59$).

Analysis

As per the original collaborative project's agreement, the author was granted access to the survey data and given permission to analyze it for the purpose of the master thesis. As the sole rater, the author closely followed Braun and Clark's guidelines (2006) to conduct thematic analysis. Initially, the author read through the students' responses with the research questions in mind to gain familiarity with the data. In the second round of reading, the author highlighted important pieces of data and noted down emerging ideas, which served as the basis for the initial list of codes. The author then grouped the notes and preliminary codes into meaningful categories and created a codebook that defined, labeled, and established criteria for each code. In the third round of reading, the author used the codebook to systematically code each response. During this process, the author identified new codes and refined code definitions as necessary. Once the codebook was finalized, the author completed coding all the responses. Finally, the author analyzed the codes to identify overarching themes and patterns, which were used to develop a rich description of students' social experiences in social VR.

Results

During the courses, students had the opportunity to explore different virtual worlds, each with unique features and settings. This exposure allowed them to gain valuable insights into design choices that foster social interaction within virtual environments. Additionally, students' reflections on their virtual reality experiences indicated that social virtual worlds have the potential to improve mental well-being. In this section, the findings will be presented in two parts: the first part will discuss the design choices that participants found beneficial for developing social connections, while

the second part will report aspects that could make social virtual worlds an ideal platform for enhancing mental wellness and providing mental support.

Social Interaction Made Easy: Key Features in Social VR Platforms

The immersive, engaging, and inclusive environment affords user interaction

As the main area where users immerse and interact with others, the virtual space plays a significant role in the crafting of user experience and building of social connections. According to P49, *“the virtual world was very much designed to facilitate conversation, and created various spaces and opportunities for people to interact in different active and passive environments.”* Others echoed this view. They praised the virtual environment for providing the space for them to explore and interact with others, creating a shared experience and promoting the feeling of social connection:

“The virtual rooms felt very immersive and the way you were able to walk through them and interact was absorbing.” (P18)

“The lab environment for which the speaker gave us a tour was very engaging and afforded different users to interact and connect. We could stroll from different parts of the environment and interact with each other efficiently.” (P35)

“The virtual world was helpful via the interesting environments that were able to be explored with the people around you.” (P64)

As participants mentioned, the virtual environment felt very *“immersive”*, *“engaging”*, and *“interesting”*, it attracted users to *“walk through”* the environment with others, and this was why they felt the virtual space helped facilitate social interaction.

Participants went beyond evaluating the virtual environment as a whole and reflected on specific aspects that contributed to an enjoyable and engaging virtual experience. One aspect that received appreciation was the virtual environment’s ability to cater to various needs and interests. For instance, users entered the virtual worlds with

diverse group sizes and engaged in various types of conversations. The virtual space was constructed with these differences in mind, allowing users to choose the environment that best suited their needs and resulting in an optimal social experience:

“It really helps [build social connection] since we can move to different rooms and each of them have different usages. For example, if we have few people, we can go to the classroom or conference room, while we have more people, we can go to the stadium.” (P53)

Regarding the nature of discussions, participants found it valuable to have a spacious and unrestricted area. This provided them with a personal and confidential environment for communicating with others, while also instilling a sense of safety and preventing privacy issues:

“I did like how the world is very vast and wide open, allowing users to have private space if need be.” (P39)

“I noticed no real threats to privacy, as individuals had to be friends with others in order to enter their rooms in the virtual world.” (P40)

While some participants formed a feeling of “welcoming” and intimacy with others through private conversations, others preferred to engage in more public interactions. For example, P25 derived pleasure from being stationed at the virtual world’s spawn point, where new participants would first appear when entering the virtual world, and chatting with each of them: *“The virtual world was key in facilitating social interactions, the way the space was set up it made it easy to talk with people. I was located in the spawn points so when people would appear I could talk with them, it was very nice to be the first point of contact when they entered and just have a brief chat.”*

Virtual worlds have also developed dedicated areas for underrepresented communities to gather and connect with each other. These spaces were also intended for individuals outside of these communities to learn more about them. One such example is the Crystal Ballroom exhibit. P63 visited this exhibit during one of the sessions. As P63 described, *“It had a little welcome structure that gave you information about it. I learned that this was built for someone named Keao, who is blind. In this informational message, they explain they wanted a ballroom because it was the first place they visited in [the virtual world] and they love to dance. They also explained some of the features like the chimes and talk about how they wanted a space that was inclusive for people to hang out in since there is a mixture of people with many interests in the blind community.”*

In addition to the inclusive design that accommodated all kinds of needs, participants recognized the diverse offering of themes and room settings as key factors that influenced their virtual experience and social interactions. For example, P7 indicated that the diverse designs and themes *“helped build social connection”* by making him feel a sense of presence and engagement within the virtual space: *“the set environments may have helped in building social connections: seating, soccer fields, beaches. I found it enjoyable and oddly immersive.”* On the other hand, P63 thought that the different room settings were created with social interaction in mind: *“I think the different room settings were a great feature to guide the social interactions to happen in a certain way.”*

Others held this view as well and provided specific examples based on their close-up observations of how interactive objects encouraged user engagement and initiated interactions with both the environment and other users:

“Users could interact with objects in the environment. Users picked up firecrackers, lit them up by getting close to the bonfire and played with them. This activity got many people engaged and interacting with each other.” (P11)

I found it very interesting that each space included its own unique features based on the environment the user chose. The camping space included snakes that would slither around the feet of the participants. These could become even more interactive, such as the interactive screen in the boardroom area that could have pictures cast. These both helped create social connections with other participants in our group. (P40)

According to the participants, the diverse themes and interactive objects that were unique to each setting were greatly appreciated and were seen as an important factor in creating an immersive experience and promoting social interaction. In addition, they expressed a desire for even more interactive elements. This sentiment was expressed by P51, who said: *“I liked how I was able to interact with certain objects, chairs, boats, etc and wish there were a bit more interactive elements (but it was still nice nonetheless).”*

As demonstrated in participants’ own account, having a wide selection of themes featuring unique interactive objects attracted individuals to fully engage and immerse themselves in virtual environments that suit their interests and preferences, thereby enhancing their overall experience. Furthermore, this diversity fostered the formation of distinct social interactions and even influenced the nature of interactions within the virtual space.

Dynamic audio feedback supports effective communication

Participants in this study believed that the use of audio feedback was an essential feature that improved their communication with others. One participant, P11, specifically appreciated the ambient noise present in each environment, which added to the realism of the virtual experience. P11 stated, *“The application gave importance to audio feedback. There was an ambient noise unique to each environment. Further, I could hear whispers of people talking if they were away from me and just like in real life I could go closer and become a part of the conversation.”*

In support of his argument, P11 presented concrete examples to illustrate how the environment utilized distinct audio features to meet varying communication needs: *“I found it extremely interesting and useful that the environment applied both spatial voice and flat voice depending on the requirements of the meeting. In conference rooms, flat voice was used which means everyone in the room could hear the speaker. On the other hand, if users moved into private areas or were outside the rooms spatial sound was used which promoted private conversations.”* P11 found this approach to be both intriguing and beneficial, as it optimized the effectiveness of communication in different settings.

P63 echoed this view and further emphasized the positive impact of dynamic audio feedback on enhancing social connections in the virtual worlds. As P63 noted, *“[the virtual world] was helpful in that we could talk to the whole class or more privately to the people around us.”* Moreover, P63 found that the spatial voice, which automatically adjusts the volume based on the user’s proximity to others, *“makes it feel more personal”*, creating a sense of closeness and connection.

Being able to customize and control the avatar enhances user interaction

The avatar, which is the representation of users in the virtual world, was considered a critical element in fostering social connections in the virtual environment, setting it apart from other communication mediums. For instance, P39 noted: *“I think it helped me build social connections cause there was an added dimension of the avatar when compared to a Zoom call. In a Zoom call, you can only see a screen but in [the virtual world], you have the avatar to control which gives the interactions more depth.”* According to P39, the avatar offered a unique dimension to interactions, enhancing the social engagement experience beyond what is possible on video conferencing platforms.

Echoing P39's opinion, other participants remarked on specific aspects of the avatar that promoted social interactions. One of these aspects is the ability to be customized based on user preferences, as noted by P63: *"Having avatars that are customizable to resemble you makes you feel more present."* P63 suggested that the personalized avatars heightened users' sense of presence, leading to a more immersive experience. P11 also appreciated the ability to modify the avatar's appearance, stating that *"everyone's avatars looked interesting and unique"* after customization. P11 found this diverse range of visual representations enticing and suggested that the avatar's customizability encouraged social bonding in the virtual environment.

According to participants, another crucial aspect of the avatar is its ability to mirror users' movements and actions. P49 described how the avatar's hand gestures and body motions were effective in indicating active listening and conducive to social connections: *"[The avatar] was built for conversation, ..., you could act out a series of hand gestures with a button click, and there were rendered hand gestures and body motions that showed that you were listening to others speak. It was very conducive for social connections."* P21 appreciated the avatar's ability to resemble users' real-life head and hand movements, making the interactions feel more natural and realistic: *"It was quite interactive and I liked that our avatars would indicate who is talking. For those wearing the headsets, it was interesting to see the real-life head and hand movement."*

Furthermore, participants found that having control over their avatars enhanced their virtual experience and made it easier to interact with others. As P36 put it: *"The ability to do casual actions like dance made the experience a lot more informal and easier to connect with people."* Similarly, P41 highlighted how the ability to control their avatar and perform real-world actions helped them build connections: *"I could use my avatar to interact with other people's avatars using much of the same principles as the*

physical world. For example, I could run, jump, sit, shift gaze, dance, and interact with objects such as projectors, tables, soccer balls, and even drive a boat.”

In summary, the avatar’s customizability, ability to mirror users’ head and body movements, and to perform actions as in the real world elicited a strong sense of presence, immersed users in the virtual world, and facilitated interactions and social connections among users.

Communication modalities and social activities help build connections

Guided by the principle of enhancing social interaction, virtual worlds have integrated multiple communication modalities to create a seamless and effective social experience. For example, P49 highlighted the value of face cams and microphones in building social connections as they enabled users to show expressions and observe the reactions of others. According to P49, *“utilizing face cams and microphones in addition to avatars in a virtual space mimics a real in-person experience”*, making it possible for individuals to interact with each other in a more authentic and natural way.

Besides face cams, avatars played a crucial role in providing non-verbal cues in virtual worlds, such as head and body movements, and physical expressions. P14 specifically appreciated the use of head nodding by avatars, considering it to be *“a very underrated non-verbal communication cue”*. According to P14, the combination of verbal and non-verbal communication modalities in the virtual world made it *“a lot easier to connect and communicate with people”*. Additionally, P11 noted that the tracking of hand movements *“significantly improved communication”*, while P29 concluded that synchronous head and hand movements of avatars created *“a sense to talk in reality”* that fostered a great feeling of communication.

In addition to verbal and non-verbal communication, the availability of various emojis also made the communication experience more enjoyable and interactive:

“There were a variety of emojis such as hand raise, clap, blush, sad, happy, etc. to choose from to communicate.” (P11)

Alongside offering communication options that cater to users’ communication needs, virtual worlds have also facilitated numerous social events to promote interaction and engagement among users. P45 expressed appreciation towards these events, stating *“I liked aspects of it, like that there are live events and concerts, which makes it feel like a real place people can go to for socialization.”* Likewise, P66 praised the feature of watching videos together. According to P66, this feature was *“good for small group interactions”* and *“provides users with a shared sense of immersion”* that enhanced community building. These social events and features helped create a sense of togetherness and community in the virtual world experience.

Beyond Connection: the Added Benefits of Social VR

Social VR offers a cozy and secure setting for disclosure

While the survey question focused on the ways in which social VR platforms enhanced social interaction, some participants also discussed their effects on self-disclosure. For example, participant P64 noted that *“the virtual world made it easy to talk to people in my class because we were all hidden behind avatars and online.”* P64's experience suggests that the use of avatars could potentially encourage greater self-disclosure in virtual environments.

Since self-disclosure typically necessitates a private setting, the virtual worlds included designated areas for private conversations, as described in the first section. These features were highly valued by participants, who noted that they *“took privacy into account”* and helped foster personal connections. As P33 described, *“there were privacy zones where only people in the zone could hear each other talk. The doors to some rooms*

were also lockable.” P19 even suggested that such rooms “could be used for student consultations.”

Social activities bring relaxation and help overcome social anxiety

As presented in the first section, social VR platforms organized various events and activities to bring users together and connect with each other. Not only did these activities foster connections among users, but they also “bring relaxation”. One example is the 3D painting activity described by P25. As she noted, “the experience was pretty good because we had a goal to work towards rather than just chatting on a virtual space ... working together to achieve something works much better in developing a sense of relaxation than cold conversation does.”

Another participant, P43, recounted an experience where virtual reality enabled him to engage in activities that he may not have felt comfortable doing in real life. As P43 described, “at first I just stood in the Haptics room watching people doing Gangnam Style and I felt awkward. But then I realized I am not the one dancing and was just going to make my character do it, and somehow in real life making my avatar dance made me feel more at ease.” This example demonstrated that the sense of anonymity and distance provided by the avatar in the virtual world can help individuals overcome social anxiety and enjoy social experiences that they may not have in the real world. As P65 noted, “virtual worlds were a good method of creating social connections, especially for those who have trouble doing so in the real world.” These findings suggest that social VR platforms can provide users with a unique social experience, which may help improve their mental wellness.

Discussion

The findings of the study suggest that social VR platforms have the potential to enhance social interaction and improve the mental well-being of college students in a class setting. Among the design choices listed in the taxonomy by Handley et al. (2022), virtual space construction, avatar representation, and communication types and activities were identified as key contributing features to students' social experiences in social VR. In addition, audio feedback, which was not included in the taxonomy, was also recognized as a key facilitator of social interaction in the virtual space.

Moreover, there is evidence to support the findings from Freeman and Acena (2021) and van Brackel et al. (2023) that using social VR may improve users' social skills. Students reported that social activities brought relaxation and helped overcome social anxiety, encouraging them to do things that they found hard to do in the real world (e.g., dancing with a crowd). Such experiences may facilitate individuals' social interactions in the physical world and enhance mental wellness.

Additionally, the study found that social VR platforms provided a safe and comfortable environment for students to disclose personal information. This discovery suggests that social VR platforms are capable of facilitating both casual and formal disclosure, making them ideal platforms for the delivery of mental health services, such as individual and group counseling.

Social VR Enhances Social Interaction

This study confirms the findings of previous research that virtual environments facilitate social connections. One notable aspect that received appreciation was the diverse offering of themes, rooms, and spaces in the virtual environment, which catered to different group sizes and interests, enabling users to engage in various conversations.

Furthermore, interactive objects complemented the themes, enhancing immersion and user engagement. These results align with previous studies that highlighted the role of virtual spaces' design in improving user experience and engagement (Jonas et al., 2019; Maloney et al., 2021; McVeigh-Schultz et al., 2019). This study also reveals that social VR platforms have developed dedicated areas for underrepresented communities to connect and interact, creating inclusive spaces that foster a sense of belonging. This finding is consistent with Acena and Freeman's (2021) research, which highlighted that social VR offered a safe space for marginalized communities.

Sound is a crucial component in creating an immersive virtual environment. However, previous studies evaluating design choices in social VR (Handley et al., 2022; Jonas et al., 2019; McVeigh-Schultz et al., 2018; McVeigh-Schultz et al., 2019) may have overlooked its importance. In contrast, participants in this study frequently cited sound as a key facilitator of social interaction. They praised the ambient noise for making the environment feel more realistic, which supports Bulu's (2012) statement that sound, along with texture, light, motion, and other details, can bring realism to the virtual world and thus create a more immersive experience. Furthermore, this study highlights the value of using a combination of spatial and flat sound to accommodate different communication needs. The flat sound, which projects the voice at an equal volume within a restricted area, was helpful during lectures and presentations in classroom settings. While the spatial sound, which adjusts the volume based on user proximity, promoted personal interaction, fostering a more intimate experience and a sense of closeness.

Students found the avatar to be a critical element in fostering social interaction in the virtual environment, providing an added dimension that sets it apart from other communication mediums. Specifically, the avatar's customizability, combined with the ability to mirror users' head and body movements, was found effective in enhancing the

sense of presence and fostering social interaction. These findings align with those of Han et al. (2022), who observed that personalized avatars, particularly those resembling users' appearance, were preferred by students as they allowed for a distinct self-presentation, thereby improving their experience and group dynamic in social VR.

There was also evidence to suggest that communication modalities, along with meaningful social activities, can enhance the authenticity and naturalness of social interaction in virtual worlds. Namely, face cameras and microphones facilitated the exchange of verbal cues and non-verbal expressions, which are important for social interaction (Handley et al., 2022; Jonas et al., 2019; Maloney et al., 2020c; McGivney et al., 2022). Face cameras, in particular, complemented avatars by conveying minute non-verbal cues that were not reflected on avatars. This finding supports the research of McGivney et al. (2022) that having video chat open while using VR created a shared experience, making students feel more connected to their classmates. Emojis were also found to make communication more enjoyable and interactive. Moreover, this study aligns with previous research that social events enhance community building and create a sense of togetherness (Maloney & Freeman, 2020a; Zamanifard & Freeman, 2019). As noted by Maloney and Freeman (2020a), "these point to social VR's potential to afford a wide range of social connectivity and forms of interpersonal relationships" (p. 518).

Social VR Encourages Self-Disclosure and Supports Mental Health Care

The finding that the level of anonymity provided by avatars can facilitate communication among students is consistent with Maloney et al.'s (2018) research, which suggests that people are more likely to share personal information when being anonymous. Furthermore, users were more comfortable disclosing their emotions and life experiences than other identifying information such as age, gender, and location. Baccon

et al. (2019) also reported that VR platforms tend to elicit more frequent cognitive and emotional self-disclosure than other computer-mediated communication channels, and they attributed this to the richer set of communicative cues available in VR, which makes VR an effective platform in eliciting self-disclosure, suggesting that VR has the potential to be as effective as in-person communication in eliciting self-disclosure.

This study adds to the discussion by emphasizing the importance of having private areas for self-disclosure in social VR, a factor that has received little attention in existing research. According to students, the designated privacy zones with lockable doors and enclosed audio feedback provided a safe and realistic environment for them to discuss personal and private topics with their close network. This finding suggests the potential of social VR to serve as a platform for the delivery of professional mental health care services, such as individual and group counseling, which require an enclosed and safe space.

Virtual reality has been gaining attention as a potential tool for delivering therapy and counseling services, particularly in light of the COVID-19 pandemic, which has led to an increased need for remote mental health services. While previous studies have demonstrated the effectiveness of VR in treating psychological disorders (Freeman et al., 2017; Hoffman, 2004; Maples-Keller et al., 2017; Paul et al., 2022) and providing counseling services (Lin et al., 2021; Sarpourian et al., 2022; Wray & Emery, 2022), these studies were typically conducted on self-developed platforms rather than publicly available social VR applications.

Despite the lack of literature, social VR platforms have shown promise as a means of providing mental health support. According to Kelley (2021), 17.8% of social VR users have used these platforms to cope with COVID-19 anxiety and social anxiety. Our

study also found that participation in certain social activities in social VR helped students overcome social anxiety and feel more relaxed.

Overall, these findings suggest that social VR platforms can serve as a potential supplementary tool for mental health care, as they offer a secure and comfortable environment for self-disclosure and can facilitate the delivery of professional mental health services. In particular, the avatars, designated private areas, and additional communication modalities remove barriers and address concerns around revealing personal insecurities, making them ideal for personal disclosure and formal consultations. Moreover, the accessibility of social VR makes it a convenient and cost-effective platform for delivering mental health services, especially for providers who lack the resources to create their own VR systems. As social VR continues to evolve, more research is needed to better understand how the platforms can be leveraged to support mental health care.

Limitations

Potential Biases in Participant Selection

Although the study was conducted across large educational institutions in the United States, the sample may not be representative of the general college student population. This is because students were asked to opt in to participate in the study, which could have biased the sample towards those who were more engaged and enthusiastic, and away from those who were more concerned about privacy and anonymity. Additionally, it is possible that students who enrolled in VR-focused courses had a pre-existing interest in the topic, which could have influenced their willingness to explore different options. To address these limitations, future studies could consider surveying students in non VR-focused courses to obtain a more representative sample of university and college students in general.

Potential Hindrances of Social VR

As mentioned in the “Method” section, the original survey included numerous questions about students’ social and learning experience in virtual environments. While this paper only focused on how social VR helped facilitate social interaction, the opposite question “*how social VR got in the way of building connections*” was also asked but was not reported in this paper due to its focus. Nevertheless, it’s crucial to acknowledge that social VR, that is primarily accessed through VR headsets and shares common characteristics as other social virtual worlds, has drawbacks that previous research has discussed. For example, technical issues such as immersion-breaking glitches and discomfort have been reported (Lege & Bonner, 2020). Some students may also be skeptical or reluctant to use VR, which may require additional efforts to promote this technology (McGivney et al., 2022). Furthermore, there is an increasing concern about the harassment of women and marginalized users in social VR (Maloney et al., 2020c). Considering these potential hindrances, the next study will incorporate the negative aspects of virtual experience in social VR to evaluate how they may affect the use of social VR platforms in mental health care.

Conclusion

The study investigated the effectiveness of social VR platforms in promoting social interaction among college students, identified key facilitators, and examined the platforms’ potential to serve as a platform for mental health care services. The evidence gathered through this study demonstrates that the virtual space, sound, and avatars immersed students in the virtual environment, communication modalities facilitated an effective exchange of information, and social events created a sense of togetherness.

These features were integrated to promote social interaction, which has been shown to enhance perceived social support and connectedness, and improve the mental well-being.

In addition to enhancing social interaction, social VR has the potential to support the delivery of mental health services. The study found that the anonymous nature, communicative cues, and designated private areas provided by social VR platforms create a safe and comfortable environment for students to disclose personal information, opening up opportunities for formal consultations. The accessibility of social VR also makes it an attractive platform for mental health professionals to reach students who are reluctant to seek traditional forms of therapy or lack access to mental health services.

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Tables

Table 1

Description of social virtual worlds selected for the courses

| | Description |
|---------------------|--|
| AltspaceVR | A social VR platform that features numerous user-generated spaces called ‘worlds’ as well as a wide variety of live virtual events. Users can socialize, collaborate, and entertain with each other in groups of varying sizes. The platform can be accessed via VR headsets or as a 2D application for desktops/laptops. |
| Gather.town | A social gathering and communication platform that combines video chat with gaming features to enhance interaction among groups for work, education, and socializing purposes. Users can create their own avatar, build their virtual office to suit their needs, and explore other virtual spaces. The platform is accessible through desktops/laptops. |
| Mozilla Hubs | An open source VR platform that offers a diverse selection of meeting spaces and the ability for users to design custom environments using a web interface. Unlike other platforms, Mozilla Hubs does not collect user data, relying mainly on internal testing and user feedback obtained through community events and forums for insights on the user experience. The platform can be accessed through all types of devices. |
| Rumii | A social VR space packed with features to accommodate a wide range of communication and collaboration needs. The platform offers a set of tools specifically designed for conferencing in education and business, making it a versatile solution for a number of work scenarios. The application is available on desktops/laptops, VR headsets, and smartphones/tablets. |
| Second Life | An online multimedia platform considered to be the first example of the metaverse. The world, known as the grid, allows users to explore, interact with others, participate in social activities, create and trade virtual assets using the platform’s virtual currency. The application is accessible via VR headsets and desktops/laptops. |
| Virbela | A virtual world that constructs custom environments for businesses and educational institutions to increase social and emotional connection in group settings, including remote work, remote learning, and virtual events. The platform is compatible with both VR headsets and desktops/laptops. |
| vTime XR | A VR and AR social network that enables groups of up to four individuals to communicate in a private chat room. Users can customize an avatar and choose a 3D environment for the chat. The application is accessible via VR headsets and smartphones/tablets. |

Table 2*Summary of devices used for accessing social virtual worlds*

| | Number of sessions used (N = 224) | Number of participants (N = 68) |
|--------------------------|--|--|
| Desktop/laptop | 148 | 57 |
| VR headset | 69 | 41 |
| Smartphone/tablet | 6 | 5 |
| Other | 1 | 1 |
| Total | 224 | 68 |

Source: You, X. Y. S., MacIntyre, B., Ahn, S. J. G., Won, A. S., & Bailey, J. O. (2023). Building social connections in online classes: The use of social virtual worlds in remote learning. Manuscript submitted for publication.

Figures

Figure 1

Students at an in-class dance party in the virtual world Virbela



Source: You, X. Y. S., MacIntyre, B., Ahn, S. J. G., Won, A. S., & Bailey, J. O. (2023). Building social connections in online classes: The use of social virtual worlds in remote learning. Manuscript submitted for publication.

Figure 2

Students doing group activities in virtual worlds



(a) Modzilla Hubs



(b) vTime

Source: You, X. Y. S., MacIntyre, B., Ahn, S. J. G., Won, A. S., & Bailey, J. O. (2023). Building social connections in online classes: The use of social virtual worlds in remote learning. Manuscript submitted for publication.