applied sciences

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Psychoeducation on Stress and Anxiety Using Virtual Reality: A Mixed-Methods Study

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Abstract: Virtual reality can help individuals to manage stress and anxiety. In addition to its efficacy in reducing stress and anxiety through relaxation, virtual reality can be helpful for psychoeducation. However, to date, few studies have explored this topic. Therefore, this mixed-methods sequential explanatory study, aimed to investigate the usability, sense of presence, emotional response, and effect on learning of MIND-VR, a psychoeducational virtual experience created to offer information on stress and anxiety. Twenty healthcare workers (60% female; mean age 43 ± 10) tried MIND-VR. Psychometric outcomes served as quantitative variables, while participant interviews provided qualitative data. Results showed that the virtual reality psychoeducational experience: (a) was highly usable and satisfying; (b) increased positive emotions (i.e., happiness and surprise) and decreased negative emotions (i.e., fear, sadness) and state anxiety; (c) elicited a strong sense of presence, especially spatial presence; and (d) was practical, simple, motivating, and engaging for learning information about stress and anxiety. These findings offer promising insights into that virtual reality may be an effective tool to provide psychoeducation.

Keywords: virtual reality; psychoeducation; stress and anxiety management; anxiety; stress; healthcare workers; COVID-19

Citation: Pallavicini, F.; Orena, E.; Achille, F.; Cassa, M.; Vuolato, C.; Stefanini, S.; Caragnano, C.; Pepe, A.; Veronese, G.; Ranieri, P.; et al. Psychoeducation on Stress and Anxiety Using Virtual Reality: A Mixed-Methods Study. *Appl. Sci.* **2022**, *12*, 9110. https://doi.org/10.3390/app12189110

Academic Editor: Dimitris Mourtzis

Received: 5 August 2022
Accepted: 7 September 2022
Published: 10 September 2022

1. Introduction

Since the COVID-19 pandemic broke out in 2020, data from different countries around the world have shown high levels of stress and anxiety among the general population [1–3], with a prevalence of, respectively, 57.4% and 50.9% [3]. Healthcare personnel, especially those working in emergency medicine, intensive care units (ICUs), infectious diseases, and pulmonary medicine, have been particularly affected by the harmful effects of the COVID-19 crisis on mental health [4–6]. Stress and anxiety have markedly increased among doctors and nurses [6–8]. Given that excessive stress and anxiety, in addition to having long-term harmful health consequences [9,10], can impair healthcare workers' performance [11,12], it appears critical finding innovative and effective training programs for teaching how to manage them [13,14].

Virtual reality (VR) represents one of the most appealing technologies for developing programs for managing stress and anxiety [15–17]. Although there are multiple definitions of VR [18], this term is usually adopted to describe a set of technology, including head-mounted displays (HMDs), computers, and mobile devices, providing access to a real or imaginary digital environment [19]. What strongly distinguishes VR from other technologies is the level of immersion, that is usually defined as a "quantifiable characteristic

that includes the extent to which it is possible to step into the virtual world through interfaces" [20]. VR systems can offer different levels of immersion within a three-dimensional (3D) environment [18,21]: from desktop VR, which provides a simple presentation on a two-dimensional (2D) display screen, up to immersive VR, which adopts HMDs. Nowadays, on the market is available an extreme variety of HMDs, including low-budget mobile (e.g., Google Cardboard) and standalone (e.g., Meta Quest 2) systems, that have made VR an affordable and accessible consumer technology [22]. A second relevant feature of VR concerns interactivity which can be described as the degree to which a user can modify the virtual environment in real-time [23]. In VR, individuals interact with the virtual world using their bodies [24]. These features offer unique chances, combining engagement with intense emotions, thus providing a sense of presence, defined as "the subjective experience of being in one place or environment, even when physically located in another" [25].

Several studies, reviews, and meta-analyses conducted over the last decades showed that VR can help individuals to learn valuable resources to manage better stress and anxiety [26]. In addition to its efficacy in reducing levels of stress and anxiety by immersing individuals in relaxing virtual worlds [27–29], a relevant feature is linked to the usefulness of VR for psychoeducation [30–32]. This seems important since mental health literacy, defined as knowledge and beliefs about mental disorders, which aid their recognition, management, or prevention [33], is an essential facilitator of formal help-seeking behavior [34,35], and it is the first step intervention for the management of stress and anxiety [36,37]. However, to date, there is limited knowledge on this topic (e.g., [30,38–40]). Therefore, we developed and tested in a sample of healthcare workers MIND-VR, a VR-based psychoeducational experience on stress and anxiety [31].

1.1. Managing Stress and Anxiety Using Virtual Reality

In addition to pharmacological treatment [41,42], several psychological support programs are successfully used to help manage stress and anxiety. Most of these are based on the principles of cognitive-behavioral therapy (CBT) [43], which, as stated by the American Psychological Association (APA), is a psychological treatment with solid scientific evidence that underlines the strict relationship between behavior, cognition, and emotions. CBT-based programs for stress and anxiety management generally use several techniques simultaneously [44] and focus on two areas: relaxation (e.g., progressive muscle relaxation, biofeedback) and psychoeducation [45]. Such interventions effectively reduce stress and anxiety [46–48] and have been proven remarkably flexible in terms of format [49]. Along with the traditional therapist format, evidence reported that technologies, including VR [15], are also a viable delivery form [50,51].

VR is beneficial for relaxation, eliciting positive emotions, and diminishing levels of stress and anxiety [26,52]. In particular, relaxing virtual environments, especially naturalistic ones [27–29], can help people learn relaxation techniques, including progressive muscle relaxation [53], biofeedback [54,55] and mindfulness [56,57].

As reported by recent studies, VR-based programs resulted helpful for reducing stress and anxiety during the COVID-19 pandemic [58–63]. For example, COVID Feel Good, a self-administered at-home daily VR-based intervention, reduced stress and increased social connectedness during the COVID-19 lockdown in healthy individuals [59]. Immersive VR exposure therapy (VRET) showing different virtual scenarios related to COVID-19 (e.g., watching pandemic news) helped in diminishing anxiety in a 57-year-old male treated in ICU due to COVID-19 [58] and among patients with fear of COVID-19 [61]. Immersive VR-based programs reduced stress and anxiety even among healthcare personnel. In particular, 360° videos of calming natural environments (i.e., VRelax and Tranquil Cinematic-VR) decreased stress and enhance positive emotions among ICU nurses [64] and frontline healthcare practitioners [65].

Although these results are promising, at the moment, studies conducted on the use of VR for stress and anxiety management have a significant limitation. Namely, they are exclusively focused on using this technology for relaxation. However, VR, in addition to

being useful for reducing stress and anxiety levels through immersion in relaxing virtual environments, can also be adopted for psychoeducation [30–32].

1.2. Virtual Reality for Psychoeducation

Psychoeducation refers to interventions aimed at providing information about a mental disorder clearly and articulately [66,67]. The goal is to educate individuals about their condition and how to cope. Psychoeducation is a fundamental part of CBT [43] and can also be a stand-alone intervention [68,69]. Usually, it is carried out through face-to-face meetings or audiovisual aids (e.g., booklets or videos) [37].

VR can be beneficial for delivering psychoeducation [70–72]. Indeed, compared with traditional teaching methods (e.g., lecture, slideshow, or textbook), this technology allows people to "be at the center of the lesson." Due to VR's unique features in terms of immersion, presence, and engagement, the learning material can be gained deeply [73].

This technology can help stimulate individuals in all the so-called "soft skills" (e.g., creativity and problem-solving) [74] and in teaching specific subjects such as marine science [75], geology [76], and medical topics such as neuroanatomy and clinical anatomy (e.g., ref. [77]). Furthermore, VR is considered an effective and innovative tool for promoting scientific and medical knowledge among the general population. For example, recently, this technology was used to increase public understanding and knowledge of the COVID-19 pandemic [78,79].

Although VR represents one of the key technologies to change the way education is delivered, to date, few studies have tested the use of VR within psychoeducation programs [30,32,80]. For example, a psychoeducational experience (i.e., VRight) increased depressive symptoms awareness in individuals suffering from depression [30]. Psychoeducational material on Post-Traumatic Stress Disorder (PTSD) was created also as part of the STress Resilience In Virtual Environments (STRIVE) project, which aimed to made a set of multi-episode interactive narrative experiences for delivering PTSD exposure therapy for military personnel [40]. Furthermore, within Second Life, an online multimedia platform launched in 2003 and accessible from PCs that allows people to interact in an online virtual world using avatars, psychoeducational content on social anxiety (i.e., Drexel Island) [38], and for stress management (i.e., Learning Island) has been successfully tested [39].

1.3. Aim of the Study

Within the context described above, this study aimed to examine the usability, emotional response, sense of presence, and effect on learning of MIND-VR, a VR-based psychoeducational experience created to offer information on stress and anxiety [31].

2. Materials and Methods

2.1. Study Design and Setting

This study followed a mixed-methods sequential explanatory design [81,82]. Psychometric outcomes will serve as quantitative variables, while participants interviews will provide qualitative data. Participants were recruited among two Medical Sites (MS) in Lombardy: the IRCCS Neurological Institute Carlo Besta (Milan, Italy) and the Fondazione Europea Ricerca Biomedica (FERB) (Gazzaniga, Italy). Data were collected between April and September 2021.

2.2. Participants

A total of 20 consecutively enrolled doctors and nurses were recruited from the two hospital wards. Healthcare workers were informed about the possibility of participating in the study through oral communication and a formal email from the institutional study referent.

Inclusion criteria adopted in the study were: (1) being currently employed as a healthcare worker (i.e., doctors, nurses); (2) maximum age of 65; (3) no significant visual impairment (all with normal visual acuity or corrected to normal). A trained psychologist

conducted an interview to explain the study's purpose and procedures and verify the participant's eligibility. Before participating, individuals received written information about the study and the safety and hygiene procedures to prevent COVID-19 infection. All participants voluntarily agreed to participate in the study and were required to give written consent to be included. The study received ethical approval from the Ethical Committee of the University of Milano-Bicocca (Prot. 0061757/20) and was conducted in accordance with the Declaration of Helsinki [83].

2.3. Virtual Reality-Based Psychoeducational Experience on Stress and Anxiety

MIND-VR is an immersive VR psychoeducational experience on stress and anxiety designed by some of the authors of this study. The funds necessary for its technical development ($5000) were raised through a crowdfunding campaign [31]. MIND-VR works on the Oculus Quest 2, and it can be downloaded for free, both in Italian and English, on the project website (https://mind-vr.com/free-download/ (accessed on 15 July 2022)).

This VR-based psychoeducational experience was intended to be easy-to-use, pleasant, and educational [31]. In its design and development, we applied principles and practices of User-Centered Design (UCD) for VR experience [84]. Because MIND-VR was created for people who are not necessarily VR experts, great attention was given to creating a simple and intuitive interaction model (e.g., teletransportation for navigating the VR environment). Furthermore, following the conceptual framework defined as "emotional design" [85], we developed MIND-VR with extreme consideration of the graphic and sound quality of the experience.

Based on previous literature underlying the relaxing effect of naturalistic virtual environments [29,86], we chose a small tropical island as the setting. We avoided inserting elements on the island that could be excessively distracting for individuals compared to the psychoeducational content (Figure 1). On the virtual island there are three paths that describe different aspects related to stress and anxiety: (1) definitions (first path); (2) causes and symptoms (second path); (3) main treatments (third path) (Figure 2). The completion of each route takes about 15 min.

Figure 1. The MIND-VR virtual island.

2.4. Hardware

MIND-VR was tried using the Oculus Quest 2, a standalone VR system that includes an HMD and two controllers. It has a single LCD panel and an 1832 × 1920-pixel resolution per eye, with a 90 Hz refresh rate.

Figure 2. Along the three paths of MIND-VR, users are given information on stress and anxiety via text and audio.

2.5. Measures

At the beginning of the experimental session, participants were asked to complete the following questionnaires:

1. *Demographic*: individuals indicated their gender (male or female), age, years of education, profession (doctor, nurse), hospital, work department, and professional seniority.
2. *Ad hoc questionnaire on the use of technological solutions and VR*: a 4-item questionnaire on a 7-point Likert scale (1 = "not at all", 5 = "very much") on the level of use in general of technologies, the level of acceptance of technologies, the level of knowledge of VR, and the level of interest in using VR. Individuals were also asked if they have ever tried VR before (yes or no).
3. *Ad hoc questionnaire on the background knowledge of stress and anxiety*: a scale evaluating the use of psychological support programs and the knowledge of stress and anxiety (see [31] for details).

Furthermore, at the end of the experimental session, individuals were asked to complete the following questionnaires that served to study the usability, sense of presence, and effect on learning of MIND-VR:

- *System Usability Score (SUS)* [87]: a 10-item questionnaire on a 5-point Likert scale (1 = "strongly agree", 5 = "strongly disagree") about the ease of use or possible difficulty or critical issues experienced by individuals while using the VR system. A measure is provided on usability, namely "the extent to which a product can be used, by specified users, to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use" [88–90]. The reported reliabilities of the SUS are between 0.79 and 0.97 (e.g., ref. [91]).
- *Net Promoter Score (NPS)* [92]: a satisfaction measurement on a scale from 0 ("not at all") to 100 ("very much"), assessed to rate the likelihood that users would recommend the product MIND-VR to a family member or friend. The NPS adds depth to a product analysis through a quantitative measure of engagement [92].
- *Slater-Usoh-Steed Presence Questionnaire (SUS-II)* [93]: a self-report scale on the perceived sense of presence. The SUS-II consists of 6 items on a 7-point Likert scale and offers a single total score. Its internal consistency is 0.75 [94].
- *Igroup Presence Questionnaire (IPQ)* [95]: it consists of 14 items on a 7-point Likert scale. This questionnaire has three subscales: Spatial Presence (IPQ-SP) (i.e., the sense of being physically present in the virtual environment); Involvement (IPQ-INV),

measuring the attention devoted to the virtual environment and the involvement experienced; Experienced Realism (IPQ-REAL), assessing the subjective experience of realism in the virtual environment. The additional general item (IPQ-G) measure the broad "sense of being there". The IPQ has a Cronbach α coefficient of 0.87 [94,96].

- *Ad hoc questionnaire on learning using VR:* a questionnaire to assess self-rating of effort, understanding, motivation, and interest for the subject explained in the virtual experience. This questionnaire was developed and adapted using the methods adopted in a previous study [73]. It includes 8 items on a 7-point Likert scale (Table 1).

Table 1. The ad hoc questionnaire on learning using VR.

Rate on a 7-Point Likert Scale (1 = "not at all", 7 = "very much")
The content was mentally challenging
I perceived the theme of the content to be complex
I understood the information provided well
I enjoyed learning in this mode
In the future, I would like to learn in this mode
I am interested in learning more about this topic
I perceived the content as stimulating
I felt motivated to learn the information

In addition, to measure changes in the emotional states of users, participants filled in the following measures before and after the use of MIND-VR:

- *Visual Analogue Scale for Emotion (VAS-E)* [97,98]: participants indicate on a scale from 0 to 100 their current experienced level of six primary emotions: Anger (VAS-AN), Happiness (VAS-HP), Disgust (VAS-DS); Fear (VAS-FE), Sadness (VAS-SD) and Surprise (VAS-SP). Several studies have confirmed its reliability [99]. Several studies have confirmed its reliability and validity (e.g., ref. [99]).
- *State-Trait Anxiety Inventory—Y1 (STAI-Y1)* [100]: a validated psychological measure of state anxiety, defined as a temporary emotional condition characterized by apprehension, tension, and fear about a particular situation. This scale consists of 20 self-report items on a 4-point Likert scale (from "not at all" to "very much"), assessing symptoms of state and contingent anxiety. It has high internal consistency, with a Cronbach α coefficient ranging from 0.86 to 0.95 [101].

Finally, participants were interviewed for about 15 min using the methods described in a previous paper [31].

2.6. Procedures

Participants signed the informed consent and completed the baseline questionnaire (i.e., demographic, ad hoc questionnaire on the use of technological solutions and VR, ad hoc questionnaire on the background knowledge of stress and anxiety, STAI-Y1, and VAS-E). Then, the research psychologist gave an explanation of the safety and hygiene procedures to prevent COVID-19. Participants received the Oculus Quest 2 and a short training on using the VR system. Subsequently, they used MIND-VR for about 15 min, exploring the first path of the island (i.e., "Introduction to stress and anxiety"). At the end of the virtual experience, participants completed the post-experiment questionnaires (i.e., SUS, SUS-II, IPQ, NPS, ad hoc questionnaire on learning in VR, STAI-Y1, and VAS-E). Finally, they were interviewed for about 15 min. The session lasted approximately 40 min in total.

2.7. Data Analysis

Regarding questionnaires, first, we made common procedures of data cleaning (i.e., missing value analyses and outlier analysis). We set Mahalanobi's distance to $p < 0.001$. No outliers or missing values emerged. Standardized residuals, skewness, and kurtosis values were all <1, showing a normal distribution of the residuals [102]. Then, descriptive

methods were used to report sample demographics and the usability, sense of presence, and effect of learning of MIND-VR (i.e., SUS, SDM, NPS, SUS-II, IPQ, ad hoc questionnaire on learning in VR). Finally, paired-samples t-tests were conducted to examine the difference in state anxiety and emotions before and after the virtual experience (i.e., STAI-Y1, VAS-E). Data analyses were carried out through SPSS software (version 24).

Qualitative data analysis was conducted using a conventional qualitative content analysis [103]. Differently from summative content analysis, which focuses on counts and quantification of data [104], this methodological approach aims to identify repeated patterns of meaning across a data set [103]. Recordings from the interviews made at the end of the experimental session were transcribed. Two researchers (FA and EO) independently reviewed the interview transcripts carefully several times and coded the key concepts, identifying emerging themes and categories [105]. Since using multiple analysts to develop codes enhances the findings' credibility [104], the researchers discussed preliminary findings together. A codebook was created and modified until the final set of codes was obtained and reached the data saturation point when there was no emergence of other new themes. Codes were applied to the transcripts and converted into categories to represent the main themes arising from the data [106]. Disagreements on codes were resolved by discussion between the two researchers. Saturation was reached when no new codes emerged. Subsequently, to minimize potential bias, the principal investigator (FP) completed an independent audit of the transcripts to verify the credibility of the coding.

3. Results

3.1. Sample Characteristics

The study sample was composed of 20 participants (12 female, 60%), with a mean age of 43 years old (SD = 10). In total, 11 individuals (55%) were doctors, and 9 (45%) were nurses; 10 participants (50%) worked at the IRCCS Neurological Institute Carlo Besta and 10 (50%) at the Fondazione Europea Ricerca Biomedica (FERB). The sample reported high scores in the use (M = 5.6, SD = 1.2) and acceptance (M = 5.4, SD = 1.4) of technologies. Fourteen participants (70%) had never tried VR. The level of knowledge of this technology was low (M = 1.9, SD = 1.4), while general interest in its use was medium (M = 2.9, SD = 1.8). Seventeen participants (85%) reported that they had never used programs for psychological support and/or management of stress and anxiety. The sample reported good knowledge of the symptoms and causes of stress and anxiety, while lower knowledge of techniques to manage these conditions emerged (Table 2).

Table 2. Background knowledge of stress and anxiety in the sample (N = 20).

Variables	Mean (SD)	N (%)	Range
Have you ever used psychological support programs?			
Yes		3 (15%)	
No		17 (85%)	
Have you ever used stress and anxiety management programs?			
Yes		3 (15%)	
No		17 (85%)	
Knowledge of the difference between stress and anxiety	4.1 (1.3)		1–7
Knowledge of the causes of stress and anxiety	4.1 (1.2)		1–7
Knowledge of the symptoms of stress and anxiety	4.1 (1.4)		1–7
Knowledge of the main techniques to manage stress and anxiety	3.5 (1.5)		1–7
Importance of stress and anxiety management training	5.8 (1.4)		1–7
Have you ever searched the internet for information about stress and anxiety?	3.1 (1.8)		1–7
Have you ever attended meetings on stress and anxiety?	2.2 (1.8)		1–7
Have you ever read books on stress and anxiety?	2.5 (1.8)		1–7

3.2. Usability

The mean scores at the SUS (M = 79.3, SD = 16.5) and at the NPS were high M = 87, SD = 15.5), indicating a high usability of MIND-VR and a high satisfaction in using the virtual experience. Moreover, participants reported low mean scores at the SDM (M = 26.5, SD = 18.9), showing that the virtual experience was perceived easy-to-use.

3.3. Emotional Responses

Paired *t*-test conducted on VAS-E scores revealed significative differences between before and after the use of MIND-VR in the mean scores at VAS-HP ($p < 0.05$), VAS-SP ($p < 0.05$), VAS-FE ($p < 0.05$), VAS-SD ($p < 0.05$), indicating that the psychoeducational virtual experience was useful for enhancing happiness and surprise and decreasing fear and sadness. Moreover, results at the STAI-Y1 showed a statistically significant difference ($p < 0.05$) before and after the use of MIND-VR, suggesting that the virtual content helped decrease state anxiety (Table 3).

Table 3. Paired *t*-tests on VAS-E and STAI-Y1 in the sample (N = 20). * $p < 0.05$.

Variables		M	SD	t (df)	*p*
VAS-HP	Pre Post	61 68.5	15.5 19.2	−2.59 (19)	0.018 *
VAS-SP	Pre Post	34 45.7	14.6 27.4	−2.28 (19)	0.034 *
VAS-AN	Pre Post	15.7 11	14.8 14.4	1.82 (19)	0.084
VAS-DS	Pre Post	6.5 5.5	10.4 8.8	0.809 (19)	0.428
VAS-FE	Pre Post	16.7 9.7	16.8 13.4	2.57 (19)	0.019 *
VAS-SD	Pre Post	17.7 10.7	21.1 17.1	2.33 (19)	0.031 *
STAI-Y1	Pre Post	36.5 32.5	8.3 8.1	2.65 (19)	0.016 *

3.4. Sense of Presence

Participants showed high mean scores at SUS-II (M = 4.1, SD = 1.1) and IPQ-G (M = 5.1, SD = 1.7), indicating a high "sense of being" within the virtual experience. Mean scores at the IPQ-SP were also high (M = 4.2, SD = 1.2), suggesting a high spatial presence experienced by participants using MIND-VR. The mean scores obtained at the IPQ-INV (M = 3.3, SD = 1.1), and IPQ-REAL (M = 3.3, SD = 1.1) related to involvement in the virtual content and its realism, were average.

3.5. Effect on Learning

Participants showed high mean scores in understanding, motivation, and interest for the subject explained in the virtual experience. In contrast, mean effort scores were low, supporting the idea that MIND-VR was perceived to be clear, simple, motivating, pleasant, and engaging for learning information about stress and anxiety (Table 4).

3.6. Qualitative Data

Three themes emerged from the data: (1) MIND-VR was easy to use and without side effects; (2) MIND-VR was enjoyable and relaxing; (3) MIND-VR was useful, motivating, and engaging for learning. Table 5 provides an overview of themes and codes, as well as supporting participants' quotes.

Table 4. The ad hoc questionnaire on learning using VR (N = 20).

Variables	Mean (SD)	Range
The content was mentally challenging	2.6 (1.3)	1–7
I perceived the theme of the content to be complex	2.5 (1.6)	1–7
I understood the information provided well	5.6 (1.4)	1–7
I enjoyed learning in this mode	6.1 (1.2)	1–7
In the future, I would like to learn in this mode	5.5 (1.6)	1–7
I am interested in learning more about this topic	6 (1.1)	1–7
I perceived the content as stimulating	5.7 (1.4)	1–7
I felt motivated to learn the information	5.5 (1.3)	1–7

Table 5. Overview of themes and codes, as well as supporting participants' quotes (N = 20).

Theme and Code	Supporting Participants Quotes
Theme 1. MIND-VR was easy to use and without side effects	
Ease of use	I found virtual reality and the experience easy to use, very intuitive, and simple
	I had never been in a virtual world, it was a good experience, I'd like to use it again
Side effects	I didn't find anything annoying
	It didn't bother me at all
Theme 2. MIND-VR was enjoyable and relaxing	
Relaxing graphics and setting	The image and the environment relaxed me
	The visual part of the virtual experience is stunning and prompts relaxation
	The environment designed to be relaxing is very useful
	I really liked the island, the water, the waves
	The landscape and the movement in the space helped to focus
Pleasant audio	I really appreciated the tone of voice, it was soothing
Theme 3. MIND-VR was helpful for learning information on stress and anxiety	
Usefulness of information received	I found very useful what was being explained in the experience, the information contained about stress and anxiety
	Learning in this mode I think is less notional and more intuitive learning
	It was good the explanation about stress and anxiety in this mode
	Through this experience I learned more about what stress and anxiety is
Simplicity of content	I found the information on stress and anxiety very clear, with straightforward information that was easy to understand
	The explanations were concise and easy to understand
Interest in learning using VR	I would like to try this content again receive other information on stress and anxiety

4. Discussion

4.1. Principal Results

Almost all the healthcare workers who participated in this study had never tried VR before and had low knowledge of this technology. Moreover, participants reported a high curiosity about using VR, underlying how, despite the low familiarity, there is curiosity about this technology among doctors and nurses. Thanks to its "novelty effect", VR can offer a valuable and attractive new instrument for psychological support. Most healthcare personnel involved in this study have never attended psychological support or stress and anxiety management programs. However, doctors and nurses reported a medium knowledge of stress and anxiety and the high importance of receiving programs to manage these conditions. This discrepancy could be because healthcare practitioners tend to suffer in silence, trying to avoid the perceived stigma associated with experiencing "stress" and "mental illness", as well as fear of getting their medical license withdrawn [13,107]. The

stigma associated with mental health issues can compromise individuals' willingness to seek help or disclose a mental health problem [13,108]. In this context, the use of VR and other technologies- as well as, for example, commercial off-the-shelf (COTS) video games [109,110]—could "normalize" and make more appealing psychological support programs, decreasing the associated stigma and increasing the request for help.

Regarding MIND-VR, first of all, analyses on questionnaires (i.e., SUS, NPS, SDM) showed that healthcare workers considered this psychoeducational virtual experience highly usable and satisfying. Moreover, participants declared during the interviews that using MIND-VR was easy, and any of them reported side effects (i.e., nausea, vertigo). These results appear important since usability was considered one of the key qualities of the VR psychoeducational experience during its conception and development. Indeed, breakdowns or other interaction issues can reduce VR's ability to induce both emotions [111–113] and a satisfying sense of presence [112,114], with potential detrimental effect on learning outcomes [49,115].

Secondly, MIND-VR was considered by healthcare workers to be pleasant and relaxing. Specifically, the results of the analyses on the self-report scales (i.e., STAI-Y1, VAS-E) showed after the use of the virtual psychoeducational experience a significant increase in the intensity of positive emotions (i.e., happiness and surprise) and a decrease of state anxiety and negative emotions (i.e., fear and sadness). The interviews also revealed participants' particular appreciation/relaxation toward the visual and sound aspects of MIND-VR. The fact that MIND-VR was able to promote relaxation and positive emotions in users appear to be an essential feature of this virtual experience. Indeed, through its use even for a short period of time, it is possible to induce a state of relaxation in the individual, with immediate positive psychological effects. In addition, as underlined by the broaden-and-build model [116], experiencing positive emotions can enhance the interaction with others or the engagement in creative challenges [117,118]. Furthermore, a positive emotional state has a favorable impact on learning processes, promoting the acquisition of the information provided [119,120].

Thirdly, the sense of presence measured after the use of MIND-VR through the questionnaires (i.e., SUS-II and IPQ) was found to be high, especially regarding spatial presence. This fact appears important because VR offers advantages over traditional, non-immersive, education only when the experience is enjoyable, engaging, and able to elicit a sense of presence [49,115]. Thanks to VR, people have the possibility, unlike in the traditional non-immersive education instruments (e.g., books and PowerPoint presentations), "to be in the lesson". The sense of presence positively influences the students' interest and motivation to interact with the simulation [121,122], positively affecting the learning outcome [123]. However, in order not to negatively affect the learning process, it is good that individuals are not overwhelmed by the virtual environment [124,125]. For this reason, it seems important that involvement, as measured by the IPQ-INV, was found to be not high but with average scores in this study.

Finally, MIND-VR was perceived by the healthcare workers to be clear, motivating, and engaging for learning information about stress and anxiety. Participants reported in the ad hoc questionnaire on learning using VR high mean scores in understanding, motivation, and interest for the subject explained in the virtual experience. In contrast, mean effort scores resulted low. Furthermore, from the analyses of the data collected through interviews, VR was described as practical, motivating and engaging for learning. These results suggest that MIND-VR is a potentially valuable tool for improving knowledge and awareness about stress and anxiety. By exploring the virtual environment, individuals may feel in a safe and nonjudging setting, increasing insight into their mental conditions [30]. Improvement in symptoms awareness has significant consequences for clinical outcomes in terms of treatment-seeking, treatment adherence, and achieving recovery [126,127]. The results of this study support what has also been observed in previous studies about the potential of VR for psychoeducation, both on stress and anxiety [39,40] and on other types of mental disorders, such as depression [30]. In past research, however, passive virtual experiences

had been tested. In particular, psychoeducation was offered through explanation by an avatar or by using text or video information within a virtual environment (e.g., in the form of a virtual therapist's office and projector screen). In this study, even with the limitations imposed by the minimal budget for development (i.e., EUR 5000), we instead created an experience that was more complex, dynamic, and therefore likely to be effective. In the future, once the necessary budget is raised, we plan to integrate within MIND-VR some mini-games to make the experience even more engaging and motivating.

4.2. Limitations and Strengths

Our findings have some limitations. First, the small sample size may have limited the study's power and reduced the findings' reliability. Second, even if previous studies reported a good test–retest reliability of single-item scales [128,129], future studies should use longer questionnaires or other instruments to measure ease of interaction (e.g., the walkthrough method developed by Sutcliffe & Kaur [130]). Moreover, the use of instruments that do not use only Likert scales is also recommended [131]. We did not include a control group in the study to test for possible differences between VR and other modalities for psychoeducation. We conducted a second study on this topic and we are currently analyzing the results. Finally, in this study, we did not assess physiological measures related to emotional responses (e.g., heart rate variability) and/or state anxiety (e.g., cortisol level).

Despite these limitations, this study has several strengths. First of all, it is one of the first few published studies to assess the usefulness of the UCD approach for developing a VR-based psychoeducational experience. Secondly, to increase the accuracy of the findings, we used both qualitative and quantitative data. Third, we selected an appropriate sample for usability testing.

4.3. Implications for Clinical Practice

The findings of this study have some practical implications for clinical practice. Firstly, the VR psychoeducational experience tested in this study could be included for psychoeducation within CBT-based stress and anxiety management programs among healthcare workers. Currently, we are running a Randomized Controlled Trial (RCT) study on a sample of doctors and nurses to investigate the use of MIND-VR within home-based training programs for stress and anxiety management [132]. Secondly, the methodology used for MIND-VR can also be adopted for creating other VR psychoeducational experiences, offering guiding elements in designing and evaluating such virtual contents.

4.4. Recommendations for Future Research

More studies are needed to expand the limited literature in the area of VR-based psychoeducation. VR could be used as a psychoeducational tool to implement future interventions on stress, anxiety, and other conditions. More rigorous studies (such as RCT) with a larger sample size should be carried out to test the efficacy of the virtual psychoeducational experience. Next, it might be worth investigating the learning outcomes and the effect on stress and anxiety levels at follow-up assessments to determine the longer-term effects of VR-based psychoeducation.

5. Conclusions

In summary, the present study shows that the VR-based psychoeducational experience: (a) was highly usable and satisfying; (b) increased positive emotions (i.e., happiness and surprise) and decreased negative emotions (i.e., fear, sadness) and state anxiety; (c) elicited a strong sense of presence, especially spatial presence; and (d) was practical, simple, motivating, and engaging for learning information about stress and anxiety. This empirical evidence offers promising insights that VR can help in providing psychoeducation on stress and anxiety.

Author Contributions: F.P. conceived the work and wrote the first draft of the manuscript; F.P., E.O., F.A., S.S., M.C. (Maddalena Cassa), and C.V. supervised the study in its clinical aspect; F.P., E.O., F.A., S.S., M.C. (Maddalena Cassa), C.V., C.C., A.P., G.V., P.R., S.F., C.A.D., M.C. (Massimo Clerici) and F.M. developed the first draft manuscript into the final version suitable for publication. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki and approved by the Institutional Review Board of the University of Milano-Bicocca.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The datasets of the study are available on request from the authors.

Acknowledgments: The authors would like to thank Univale Onlus and the more than fifty supporters who, through the fundraising campaign, have allowed the realization of MIND-VR.

Conflicts of Interest: The authors declare no conflict of interest.

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