



Effectiveness of Home_Positivity: A VR Program for Promoting Positive Mental Health. A Pilot Feasibility Study

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Abstract

Virtual reality (VR) has been recently used for the treatment of mental health conditions. While research shows symptom reduction, further investigation is required to ascertain the impact of VR on well-being indicators. This pilot study aims to assess the effectiveness of a new VR software, H.O.M.E (How to Observe and Modify Emotion)_Positivity, in promoting positive mental health, which implies addressing both psychological distress and well-being. A sample of 16 healthy college students participated in a six-session intervention involving individual interviews and VR experiences using H.O.M.E delivered at the university of Bologna. They were assessed before and after intervention and at 3-month follow-up with indicators of negative symptoms (i.e., Depression Anxiety Stress Scales (DASS) and the Negative affect scale of (PANAS) and of well-being (i.e., Mental Health Continuum (MHC) and the Positive Affect (PA) subscale of the PANAS. Moreover, they were asked to report their satisfaction and comments on the experience of the VR software. Following the intervention, participants reported significantly lower scores at DASS and higher scores at MHC and PA. In contrast, NA subscale score did not change significantly after the intervention or at three months follow-up. The results provide support to the use of H.O.M.E_Positivity for the promotion of positive mental health. Participants reported a reduction of psychological distress and improvement in well-being, and they were all highly satisfied and engaged while using the VR software. These findings indicate the potential value of this intervention, particularly in an increasingly digital society.

Keywords Positive mental health · Well-being · Virtual reality · Positive emotions · College counselling

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1 Introduction

Virtual reality (VR) refers to a simulated experience similar to or completely different from the real world. It is typically generated by computer technology and allows users to interact with a three-dimensional environment, through specialized equipment such as headsets and gloves. VR allows the generation of artificial experiences in real-time, delivering a sense of immersion to users and enabling them to interact within these simulated worlds as if they were genuine physical environments. In mental health settings, VR has emerged as an innovative tool to provide effective psychotherapies, especially in treating phobias and anxiety disorders (e.g. Botella et al., 2017; Riva, 2005; Valmaggia et al., 2016). During the last decades, several software and interventions with VR therapies have been developed and tested, demonstrating their capacity to elicit a greater degree of participant engagement and interest (Li Pira et al., 2023). Thus, VR therapies can be employed to deliver more intense and effective interventions compared to the traditional ones (e.g. Bouchard et al., 2017 & Bouchard, 2005). However, there is considerable heterogeneity in the type of software and hardware used and a significant proportion of these tools focused typically on specific symptomatology (i.e., fear of flying, fear of animals, public speaking, etc.), with very few VR programs targeted at enhancing well-being (Li Pira et al., 2023). For instance, in the context of anxiety (Kampmann et al., 2016) and phobias (Lindner et al., 2020), VR is employed as a tool to facilitate traditional exposure therapy. Empirical evidence suggests that this approach is effective in alleviating the symptoms associated with anxiety disorders (Rowland et al., 2021). Nevertheless, the available evidence concerning the enhancement of well-being is not definitive. Similarly, there are various VR interventions to address depressive symptomatology: some targeted specific positive domains such as self-compassion and the cultivation of positive experiences, demonstrating the potential to diminish the severity of depressive symptoms (Falconer et al., 2016; Habak et al., 2020).

The current understanding of mental well-being, which is rooted in the principles of positive psychology, comprises two interconnected aspects: (i) the presence/absence of symptoms or psychopathological conditions and (ii) the presence/absence of well-being (Keyes, 2002; Ruini, 2017). This framework posits that psychopathology and well-being exist on a dual continuum, with mental illness and languishing on one axis, and flourishing mental health on the other axis (Keyes, 2002). Moderate mental health represents the most frequent condition as documented by various epidemiological studies (Keyes, 2003). According to this complete perspective on mental health, the promotion of well-being and optimal human functioning should receive the same emphasis as the treatment of symptoms and psychopathology. Consequently, modern interventions in mental health should be equipped to address both aspects. (Sin & Lyubomirsky, 2009)

With the recent development of digitalization, modern technologies (such as computer, software, apps, virtual reality devices, etc.) can be considered innovative and promising methods to enhance the overall quality of individual experiences. The fundamental theoretical foundation of this approach has been labeled as “positive technologies” (Riva, 2005).

1.1 The Software H.O.M.E

On the wake of the positive technology approach (Riva et al., 2012), a new VR software was developed at the University of Bologna, under the acronym of H.O.M.E (How to Observe and Modify Emotion). It consists of a four-room virtual house equipped with various objects and stimuli, which enables user interaction. This interaction allows the user to associate an object present in the house with an emotional label that represents the user's frequent reaction when dealing with that specific object (i.e., food, drinks, computer, books, paintings, mirrors, etc.). The rationale behind this selection is twofold. Firstly, the use of a house setting allows the clinician to extend the applicability of the software to a wide range of daily situations, providing a flexible tool that can be continuously integrated and modified with additional stimuli, based on the users' needs. This flexibility enables the customization of experiences, making the VR environment adaptable to various emotional and situational triggers relevant to each user's personal life. Secondly, the ability to interact with objects within the virtual environment allows the clinician to observe the participant's emotional reactions in real-time, and in a realistic context (for an illustration of interaction with the software, see Fig. 1). This contrasts with traditional counselling methods, where reactions are often reported retrospectively, limiting the immediacy and context of patients' responses. By utilizing VR, therapists can gain insights into a patient's state during immersive experiences, leading to more effective interventions and tailored therapeutic approaches. This synchronic interaction can enhance the understanding of clients' emotional responses, fostering better therapeutic relationships and treatment outcomes (Gaggioli et al., 2014). This feature is particularly valuable for working on emotion regulation and psychoeducation (Gardini et al., 2023). As participants engage with different virtual scenarios, clinicians can guide them through strategies for recognizing, managing, and adjusting dysfunctional emotional



Fig. 1 Example of interaction with an object in the H.O.M.E. virtual environments. **a)** emotional labeling of an object **b)** selection of resources from the box

responses. This real-time feedback supports the development of emotional awareness and self-regulation skills, allowing participants to learn and practice these techniques in a safe, controlled setting. Through such interactions, the software serves as a practical tool for psychoeducation, helping users to understand the nature of their emotions and offering insights into how different coping strategies can be applied in daily life (Ruini et al., 2024). By incorporating VR in traditional sessions, clinicians can create a dynamic and engaging therapeutic environment that not only provides immediate feedback, but it also facilitates the transfer of emotional regulation skills to real-world situations.

The advantage of using this type of virtual environment is that it can be administered transdiagnostically across several psychiatric conditions, overcoming the limitation of a disorder-specific approach (Freeman et al., 2017; Ioannou et al., 2020; Colombo et al., 2021). Gardini and colleagues (Gardini et al., 2023) published a recent research protocol where they describe the use of H.O.M.E software to reduce unhealthy lifestyles and behaviors, offering a structured framework for its implementation and evaluation.

With the present research we aim at expanding the application of H.O.M.E. software to the promotion of well-being (i.e., HOME_Positivity). In fact, each room in the virtual house has been equipped with a box containing items representing multiple psychological resources (e.g. gratitude, environmental mastery, self-efficacy, positive interpersonal relationships, etc.). The theoretical foundations of the resource box are based on the principles of hedonic and eudaimonic well-being (Seligman, 2011) and the concept of positive technologies (Riva, 2005). The virtual resource box allows the selection of items aimed at discovering and cultivating various domains of well-being. The virtual environment is used to induce positive and pleasurable experiences; to foster engagement and self-realization; and to support connection and interpersonal relationships (Botella et al., 2012). The resources contained in the virtual environment are gradually discovered by the users, who can select and engage in exercises with the clinician, aimed at training that specific dimension of well-being in a virtual scenario. Through the use of H.O.M.E_Positivity, the final objective is not only to alleviate negative symptoms experienced by the participants but also to enhance and bolster their positive mental health and the resources they possess, or they wish to develop.

1.2 The Present Study

Given the novelty of H.O.M.E_Positivity, its feasibility still needs to be verified, as well as its beneficial effect in promoting positive mental health (i.e., addressing distress and promoting well-being).

Using a single arm longitudinal design study, the present study aims to verify the feasibility of our digital intervention and to assess whether our intervention is able to decrease negative symptoms as well as to promote well-being and positive mental health. The targeted population consists of young college students, presenting moderate to severe psychological distress. Moreover, this target population is also likely familiar with the use of digital technologies (Davies et al., 2014).

1.3 Hypothesis

We hypothesized that the intervention will be feasible and accessible to the participants. Moreover, given the existing data regarding the efficacy of digital interventions, we hypothesize a decrease in depression, stress, and anxiety symptoms along with an increase in well-being in the participants who will take part in our intervention, and that improvements will be maintained at three-month follow-up.

2 Methods

2.1 Sample and Recruitment

Participants were recruited in a medium size university campus in Northern Italy through digital channels, newsletters, and social networks. The VR intervention was also presented during academic classes, and students were invited to enroll on a voluntarily basis. Before enrollment in the project, all participants were screened online through the Qualtrics digital platform, using a screening procedure that was designed with the purpose of selecting participants devoid of severe psychiatric conditions and presenting impairments in well-being dimensions according to specific psychometric instruments (MHC\DASS\PANAS) (see section below). All participants were requested to sign an informed consent form before participation. The research project was approved by the ethical board of the University of Bologna.

Inclusion criteria: Participants had to meet at least one of the following criteria to be included in the project: (1) presence of moderate to severe psychological distress (DASS score ranging from 31- to 60); (2) presence of impairments in well-being; (participant belonging to the moderate mental health category of MHC); (3) absence of clinical condition which would compromise the use of a virtual reality device (i.e., neurological disorders, or motion-sickness conditions).

The exclusion criteria were: (1) the presence of high psychological distress (DASS score over 60); (2) the presence of a psychiatric diagnosis of bipolar disorder, schizophrenia, psychotic disorder, personality disorder (as reported by participants during the online screening); (3) presence of neurological disorder, (4) refusal to sign the informed consent or (5) presence of difficulties in comprehension and production of the Italian language.

Participants who met eligibility criteria were contacted by phone or email and invited to take part in the study. A final sample of 16 college students (*mean age* = 23.2; *SD* = 2.9; 14 women) participated in the study. None of them reported current or past psychiatric disorders.

2.2 Instruments

An online form was created for the collection of socio-demographic, anamnestic, and clinical data related to mental health. The screening and assessment have been carried out using the following psychometric questionnaires:

Depression Anxiety Stress Scale (DASS-21) (Henry & Crawford, 2005): consists of 21 items (7 items per subscale: depression, anxiety, and stress). Participants were asked to score every item on a Likert scale from 0 (did not apply to me at all) to 3 (applied to me very much). According to previous clinical investigation a total score of higher of 60 can be used as a cut off for high psychological distress (Melaku et al., 2021). The Chronbach' α of the DASS-21 (total score) is 0.926 in this sample.

Mental Health Continuum short-form (MHC) (Keyes et al., 2008a): consists of 14 items that measure the frequency of 3 domains of well-being: 3 items for emotional well-being (EWB); 6 items for psychological well-being (PWB); and 5 items for social well-being (SWB); according to a Likert scale ranging from 0 'never' to 5 'every day'. A total well-being score was calculated with a Cronbach' α value of 0.924 in this sample. The MHC can provide a categorical diagnosis of languishing, flourishing and moderate mental health. To be flourishing, individuals must report that they experience "everyday" or "almost everyday" at least seven of the symptoms, where one of the symptoms is from the hedonic cluster (i.e., happy, interested in life or satisfied). To be languishing, individuals must report that they "never" or "once or twice" experienced at least seven of the symptoms, where one of the symptoms is from the hedonic cluster. Individuals who do not fit the criteria for flourishing or languishing are categorized as moderately mentally healthy (Keyes, 2006; Keyes et al., 2008b).

Positive and Negative affect scale (PANAS) (Watson et al., 1988): measures two distinct and independent dimensions: positive affect (PA, 10 items), and negative affect (NA, 10 items) for a total of 20 items. The PA subscale reflects the degree to which a person feels enthusiastic, active, and determined. The NA subscale refers to unpleasant emotional states such as anger, guilt, and fear. Respondents had to evaluate the frequency of positive or negative emotions using a 5-point Likert scale. The Cronbach' α for this sample is 0.865 for PA and 0.838 for NA.

In order to collect qualitative data on the feasibility and acceptability of the new software, at the end of the intervention participants were interviewed with few questions regarding their personal experience with the software and regarding additional comments/suggestions for improving it. (e.g. How did you find the overall experience? What did you like and what would you improve in the software?)

2.3 Materials

Hardware: The software was displayed via an HTC Vive Pro (display resolution of 1440×1600 pixels per eye and 90 Hz refresh rate) head-mounted display (HTC Corporation, 2021), running on a Dell Alienware (Windows 10 Pro 64 bit, intel i7-9750 H 2.6 GHz CPU, NVIDIA RTX 2070 GPU, 16 GB RAM).

2.4 Procedure

The intervention was delivered at the University of Bologna Virtual Reality Lab, by a junior researcher, who was trained and supervised by one of the senior authors of the manuscript (C.R.). The training was focused on traditional counselling skills, integrated with positive psychology methodologies for promoting hedonic and eudai-

monic well-being (Ruini, 2017). Supervision was provided in case of specific problems/difficulties during the delivery of the individual sessions.

The VR intervention comprised six individual sessions lasting approximately 50 min each. For each session, the initial 30 min were dedicated to conducting an individual psychological interview, while the remaining 20 min were allocated to the HOME VR training. The interview aimed to explore and discuss with the clinician the specific theme brought by each participant and its evolution during the course of the intervention. Thus, this initial phase of the session was conceived as a tailored preparation for the VR phase. For example, a participant could have reported difficulties in concentrating while trying to study or difficulties in waking up on time for attending classes. Accordingly, we would recreate the same situations within the virtual environments (e.g. studio, bedroom) and monitor the progress made throughout the intervention in each session of the intervention.

Within the virtual environment, the topics that emerged during the interview were thoroughly discussed and elaborated, with participants being encouraged to utilize objects and various virtual spaces to articulate their emotions and even re-enact the experiences they shared.

The first three sessions were primarily focused on conveying the purpose of the treatment and providing an explanation of how the software operates, as well as exploring the issues raised by the participants in the virtual environment to foster a deeper understanding of their emotional state (psychoeducation with the use of the VR software).

The last three sessions were dedicated to introducing the participant to the virtual resource box, which was present in each room of the house within the virtual environment. The participant was encouraged to enhance the application of the selected resources, to elucidate why they were chosen, and to outline their plans for utilizing these strategies in real-life scenarios. During these last sessions, the interview was also used to assess the progress of each participant's daily exercises aimed at enhancing their strength and resources. This comprehensive approach ensured that the sessions had a tangible impact on participants' growth and well-being beyond the virtual world.

2.5 Analysis

In this experimental design, we conducted a single-arm study where all participants received the individual VR treatment. We measured negative symptoms and positive mental health at three-time points: before the treatment (T0), immediately after the treatment (T1), and three months post-treatment (T2).

For the analysis of normally distributed data, we used repeated measures MANOVA with time (T0, T1, T2) as a within-subject factor. To further investigate specific effects within each dependent variable (Positive Affect (PA) and Mental Health Continuum (MHC)), we performed one-way ANOVA for each variable and pairwise comparisons adjusted using the Bonferroni method.

For the non-normally distributed data, specifically the Depression Anxiety Stress Scales (DASS) and the Negative Affect (NA) subscale, we applied the Friedmann non-parametric test to compare the mean scores before and after the intervention.

Table 1 Pairwise comparison between PA and MHC. The mean difference is significant at 0.05 level.*

Measure (I)	TIME (J)	TIME	Mean Difference (I-J)	Std. Error	Sig. ^b	95% Confidence Interval for Difference ^b	
						Lower Bound	Upper Bound
PA	T0	T1	-2.333	2.337	1.000	-8.686	4.019
		T2	-6.467*	1.740	0.007	-11.195	-1.738
	T1	T0	2.333	2.337	1.000	-4.019	8.686
		T2	-4.133	1.927	0.150	-9.370	1.104
	T2	T0	6.467*	1.740	0.007	1.738	11.195
		T1	4.133	1.927	0.150	-1.104	9.370
MHC	T0	T1	-3.333	2.220	0.467	-9.368	2.701
		T2	-7.000*	2.453	0.038	-13.668	-0.332
	T1	T0	3.333	2.220	0.467	-2.701	9.368
		T2	-3.667	1.748	0.164	-8.416	1.083
	T2	T0	7.000*	2.453	0.038	0.332	13.668

Table 2 Wilcoxon test between each time point of DASS total scores. The mean difference is significant at 0.05 level.*

Comparison	Statistic	<i>p</i> -value	Effect Size (<i>r</i> value)	Magnitude
T0_DASS vs. T1_DASS	179	0.056	0.341	Medium
T0_DASS vs. T2_DASS	208	0.008	0.538	Large
T1_DASS vs. T2_DASS	145.5	0.34	0.114	Small

This approach allowed us to comprehensively analyze both normally and non-normally distributed data to understand the impact of VR treatment on various psychological measures.

The raw data for this project are available in a public repository on the Open Science Framework (OSF) through the following link: <https://osf.io/fdq7s/>.

3 Results

The analysis was implemented to assess the effect of time on the variables PA and MHC. The multivariate results revealed a significant effect of time on the combined dependent variables, as indicated by Wilks' Lambda ($\lambda=0.477$, $F=2.802$, $p=0.012$, $\eta^2=0.310$). These findings suggest that the intervention had a moderate to large effect on the measured variables.

Further examination through univariate analysis allowed for a more detailed understanding of the effects of time on each variable. Pairwise comparisons between different time points (T0, T1, and T2) were conducted to elucidate specific differences (see Tables 1 and 2). There was a significant increase between T0 and T2 (mean difference=6.467, $p=0.007$) in PA, and MHC (mean difference=7.000, $p=0.038$); suggesting that the intervention effectively improved the participant's well-being. The effect sizes, measured by Cohen's *d*, were $d=0.96$ for PA and $d=0.74$ for MHC, indicating a large effect for PA and a medium effect for MHC, respectively.

The Friedman test results showed significant differences in the distributions of DASS scores across different time points ($p=0.002$) with a moderate effect size (Kendall's $W=0.37$). Subsequent pairwise comparisons using the Wilcoxon signed-rank test for DASS scores across different time points revealed significant differences between T2 and T0, with a large effect size ($r=0.538$, $p=0.008$), and a marginal significant difference between T1 and T0, with a moderate effect size ($r=0.341$, $p=0.056$). However, no significant difference was observed between T2 and T1.

Finally, the Friedman test results for the NA scores indicated no significant differences in distributions across different time points ($p=0.063$). See Fig. 2 for a summary of the results.

In order to collect data on the feasibility and acceptability of the new software, the most relevant comments provided by participants are summarized and reported in Table 3. We categorized them in 5 main areas.

4 Discussion

The results of the pilot study give support to the beneficial effect of a digital intervention for promoting positive mental health in university students. Following a brief psychological intervention delivered with the use of a new software of VR, we obtained a reduction in psychological distress (measured with the DASS questionnaire) and an increase in participant's well-being (measured with MHC and PANAS).

These results suggest that the positive effects of VR interventions in reducing psychological distress previously documented in the literature (e.g. Falconer et al., 2016; Habak et al., 2020), can be generalized to our new software. This finding is particularly promising, as these symptoms are often associated with various mental health challenges and can significantly impair an individual's daily functioning, interper-

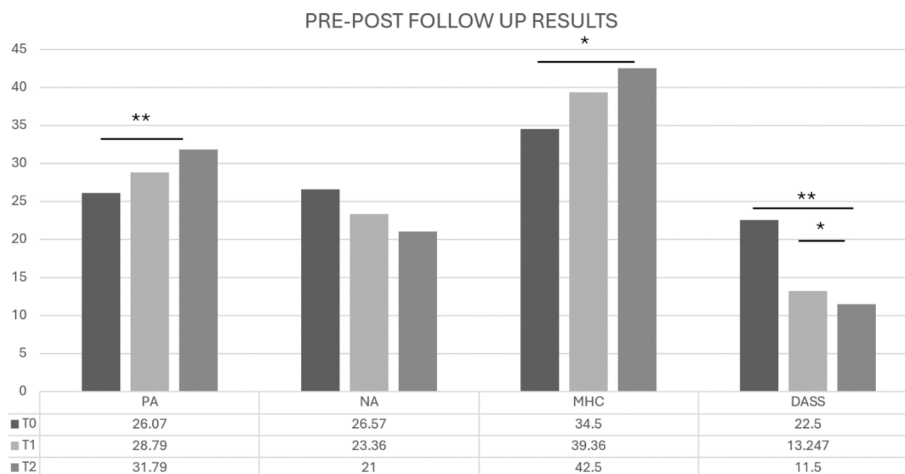


Fig. 2 Bar plot of the scores of the different dependent variables: Positive Affect (PA), Negative Affect (NA), Mental Health Continuum (MHC), and Depression, Anxiety, and Stress (DASS) at three time points (T0 “baseline”, T1 “post-intervention”, T2 “follow-up”). * $p<0.05$, ** $p<0.01$

Table 3 Categories of comments provided by participants

Area	Comments
Easier Expression of Emotions	Wearing the headset somehow made it easier to open up. It felt like a safe space where I could express myself without judgment. The virtual environment helped me detach from the real world and delve into my emotions more freely.
Engaging and Immersive Experience	I was skeptical at first, but the technology surprised me. It was way more engaging and immersive than I could have imagined. The virtual reality was so similar to the situation I was describing that it helped me remember and express my thoughts and feelings. I would have liked an avatar to make things even more realistic.
Excitement about Resource Box	The resource box was my favorite thing! Having tangible tools in the virtual world helped me understand and practice my personal strengths. It was like a treasure trove of self-discovery, and I left each session with practical skills to apply in my daily life.
Useful Intervention but Desired More Sessions	The intervention was helpful, no doubt. But I felt like there was so much more we could explore. I wanted more sessions to dive deeper into certain aspects.
Enhanced imagination through VR	I thought imagination was powerful, but this technology took things to a whole new level. It wasn't just in my mind; it was all around me. It made the whole process feel real. I found myself fully engaged, and it pushed me to confront things I might have avoided otherwise. Something I would have liked though, is the possibility to save the changes made in the environment at each session.

sonal relationships and overall quality of life. For example, previous research by Lindner and colleagues (Lindner et al., 2020), highlighted the effectiveness of Virtual Reality Exposure Therapy (VRET) in treating specific phobia. Additionally, a recent review of the literature (Li Pira et al., 2023) emphasize that VR was found to be effective in improving negative symptoms but not necessarily positive mental health. Conversely, our pilot study also demonstrated an improvement in well-being and positive mental health among the participants. Specifically, there was a significant improvement in the total score of the Mental Health Continuum (MHC) and positive affect (PA), indicating an enhancement in the participants' overall emotional and psychological well-being. Even though our participants were devoid of severe psychiatric conditions, these outcomes suggest that the intervention may not only yield a reduction of negative symptoms, but it may also promote the cultivation of positive emotions and psychological resources. To date the appport of digital technologies in promoting well-being and positive mental health is still debated (Babbage et al., 2022; Li Pira et al., 2023; Thangavel et al., 2022) and the results of this pilot study, although preliminary, support the possibilities to use this kind of tool to promote resilience and positive mental health. This promising result could be due to the specific use of VR. Firstly, re-experiencing daily episodes with the use of the VR software may result in better memory recall and acceptance of negative life experiences

(Colombo et al., 2024) as well as possible beneficial effect on memory bias (Visser et al., 2020). Secondly, VR could be considered a useful tool for building a therapeutic alliance between participants and the therapist because it introduces a gamification component within the sessions, and it allows a better agreement on treatment goals and activities to be performed in between sessions. Even though research on therapeutic alliance in digital psychotherapeutic interventions is still debated, VR was found to improve participants' engagement and self-realization (Botella et al., 2012). Finally, another benefit of our VR software was provided by the resource box which contains the visual representations of hedonic and eudaimonic well-being dimensions (i.e., positive interpersonal relationships, forgiveness, self-esteem and self-acceptance, relaxation, gratitude, etc.). These dimensions could be considered difficult to understand because of their abstract nature (Fattore et al., 2019). However, in our VE they can be visualized inside the resource box and can be freely explored by participants and then discussed with the clinician during the session. After the virtual training, the participants are specifically invited to use the selected well-being dimensions in real world contexts. The experience of well-being in participants' real life may have determined the maintenance of the beneficial effects of the digital intervention also during the follow up.

On the other hand, the unexpected finding of no significant difference in negative affect (NA) after the intervention or during the follow-up period, despite the decrease in DASS scores post-intervention, raises interesting questions about the mechanisms underlying the intervention's effects. While it is possible that the intervention indirectly influenced negative affect through other pathways not captured by the measures used in this study, further investigation is warranted to better understand these dynamics.

Regarding the feasibility and acceptability of the new VR software, users' feedback revealed several key benefits and areas for improvement (see Table 3). Torous and colleagues (2021) emphasized that VR can provide users with a sense of safety, making it easier for them to express their emotions without fear of judgment, which is crucial for effective therapeutic interventions. Our results align with these findings and highlight VR's potential to facilitate deeper self-disclosure compared to traditional methods. In the framework of positive technologies, Riva (2005) documented that the use of interactive elements within VR scenario could enhance users' engagement and learning. According to participants' comments, this fact emerged also for our new HOME software, particularly referring to the resource box (see Table 3).

In fact, the resource box placed in each virtual environment was particularly well-received by participants, offering them practical tools for self-discovery, skill development and application in real life contexts. These results confirm the possibility to foster mental wellbeing through the use of positive technology (Riva, 2005). The results are encouraging given the lack of empirical data on the topic (Li Pira et al., 2023).

While technology was found to be more engaging than imagination alone, the inability to save environmental changes between sessions was noted as a limitation. Allowing users to save progress from one session to another could enhance continuity and the overall effectiveness of the intervention. Thus, further refinements to the new software could be needed in the future.

Finally, the feedback indicating a need for more sessions suggests that while VR interventions are impactful, their duration may need to be extended to fully realize their benefits. The present literature on the topic is very heterogeneous with VR-based therapies ranging from one-session treatment to twenty sessions of VR and duration of the intervention ranging from 5 min to 120 min. (Rowland et al., 2022). Similarly, the debate on the optimal duration of positive psychology interventions is still open, with studies underlying the necessity to address various components of well-being (and therefore needing more sessions) and other studies emphasizing the hedonic treadmill phenomena, which calls for shorter interventions to prevent well-being adaptation (Rusk et al., 2018; Sheldon & Lyubomirsky, 2012). Overall, while VR offers significant advantages, further research is needed to understand if it can be used to deliver shorter interventions and if so, what would the best duration be according to participant clinical status and readiness to self-awareness.

Therefore, it is crucial for future studies to explore the mechanisms behind VR and positive interventions, considering factors such as the type of technology used (e.g., VR vs. non-VR), the resources selected, and the treatment dose effects. (e.g., the number of sessions required to achieve significant improvement).

5 Limitations and Strengths

Limitations of the study included a small sample size, which affect the generalizability of the findings to broader populations and the statistical power of our results. Indeed, observations from 16 participants do not allow to draw inferences regarding the robustness of the intervention outcomes.

Additionally, a single-arm design without a control group makes it challenging to attribute changes solely to the intervention, as other factors could have contributed to the observed outcomes, such as screening and assessment performed during exam period or other stressful academic moments. Moreover, the improvement in well-being dimensions could have resulted as a consequence of an effective treatment alliance fostered by the VR. Unfortunately, we have not assessed therapeutic alliance in the present study. Future studies are needed to further explore this possibility.

It should also be noted that the relatively short duration of the intervention may not have been sufficient to produce significant changes in certain outcomes, such as negative affect, which may require longer-term interventions for noticeable improvements.

Another notable point is the potential enhancement of user experience through personalization. The desire for the presence of avatars suggests that incorporating such elements could further improve user engagement. Future developments should consider including an avatar in the environment, in line with Freeman and colleagues (2017), who reported that even the mere presence of a human avatar, without interaction, can enhance the sense of immersion experienced by users.

Despite these limitations, the study provides promising insights into the potential of this new VR intervention for improving psychological well-being and positive mental health, while highlighting areas for further research and refinement.

6 Conclusions

In conclusion, while this pilot study provides promising evidence of the intervention's effectiveness in improving psychological well-being and positive mental health, it also highlights areas for refinement and further investigation. Future research could explore the long-term effects of the intervention, as well as the specific mechanisms through which it operates. Additionally, considering individual differences in response to the intervention and potential moderators or mediators of its effects could enhance our understanding of its efficacy and inform tailored interventions for different populations.

Given the brief duration of the intervention and the utilization of newly developed trans-diagnostic software, these results are promising and underscore the value of HOME Positivity software to be easily integrated in traditional counselling. This integration is in line with the swift transition of our society toward increased digitalization, also when delivering mental health interventions.

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Data Availability Data are available at <https://osf.io/fdq7s/>.

Declarations

Conflict of Interest None declared.

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