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IMPROVING QUALITY OF LIFE THROUGH VIRTUAL REALITY: EMOTIONAL REGULATION IN ADULTS WITH INTELLECTUAL DISABILITIES USING THE LIMINAL VR PLATFORM

Mihaela Camelia MOTORCA (GHERGHEL), PhD., Cnd.,
Interdisciplinary Doctoral School, Social Work," Aurel Vlaicu" University of Arad,
cami@camimotorca.com

Mihaela GAVRILĂ-ARDELEAN, University Professor, Ph.D.,
Interdisciplinary Doctoral School, Social Work, European Institute „Serge Moscovici" Faculty of Educational Sciences, Psychology and Social Assistance" Aurel Vlaicu" University of Arad
miha.gavrila@yahoo.com

Abstract: *This research paper aims to explore the integration of the virtual reality (VR) along with the emotional journaling in order to improve emotional regulation and also to reduce the self-harming behaviors in a participant with severe intellectual disabilities (American Psychiatric Association, 2013). The intervention included three sessions using the Cosmic Flow Scenario on the Liminal VR (ArborXR, n.d.) platform together with daily emotional journaling based on Paul Ekman's universal emotions (Ekman, n.d.). The results highlighted major improvements in emotional self-regulation, reflected in an increased Emotional Balance Coefficient from 0.75 to 2.5 and the termination of self-harming behaviors. The observations underscore the potential of VR interventions in social work, emphasising their scalability for broader application, in spite of the challenges such as costs and accessibility. Future research is needed to investigate long-term impacts and group-based implementations (Yalon-Chamovitz & Weiss, 2008).*

Key words: *social work, virtual reality, Liminal VR, self-aggression, quality of life, mentally disabled adult.*

Introduction

Virtual reality (VR) has rapidly evolved from an entertainment environment to a valuable instrument for therapeutic and educational interventions, proving a significant potential in approaching various psychological and behavioral issues (Chalkiadakis et al., 2024). In mental health care, VR has been widely utilized for treating anxiety disorders, PTSD and phobias through controlled exposure and

immersive environments. (Perandré & Haydu, 2018). These applications are based on VR's unique ability to simulate real-life scenarios in a safe, personalized and controlled setting, allowing individuals to confront their emotional challenges at their own pace (Hamzah et al., 2024).

Although VR has demonstrated success in psychotherapy, its usage in social work remains underexplored (Cheung et al., 2022). Social work focuses on holistic approach and behavioral interventions intended for vulnerable populations, including individuals with intellectual disabilities. These beneficiaries commonly experience emotional dysregulation, by displaying maladaptive behaviors such as self-harm, aggression, or social withdrawal. Institutionalized settings amplify these challenges, offering limited opportunities for emotional expression and self-regulation (Littlewood, Dagnan, & Rodgers, 2018).

This study aims to bridge the gap by sifting through the way VR combined with simple tools like emotional journaling, can support emotional regulation and enhance the quality of life for adults with intellectual disabilities (de Oliveira Malaquias & Malaquias, 2016). By focusing on both immediate emotional shifts and long-term behavioral improvements, this paper proposes to extend the application of VR beyond traditional therapy contexts into social work practice (Vita, Morra, & Rega, 2021).

Emotional journaling, especially when suited to the cognitive abilities of individuals with intellectual disabilities, offers a simple way to track emotional states. Utilizing emoji-based representations of Paul Ekman's universal emotions, (Ekman, n.d.) this tool provides accessibility and fosters self-awareness. The combination of journaling with VR allows a comprehensive approach, harnessing both the immediate and cumulative effects of the intervention.

Objectives of the Study

1. Reducing Self-Harming Behaviors: Self-harm behaviors such as self-mutilation, often serve as maladaptive coping mechanisms for emotional dysregulation (McClure, Halpern, Wolper, & Donahue, 2009). This study aims to evaluate how VR interventions, in particular, the Cosmic Flow scenario from Liminal VR, can reduce the frequency and severity of these behaviors by offering an alternative means of emotional relief and regulation.
2. Enhancing Emotional Self-Regulation: Emotional regulation is an essential ability for managing stress and negative emotions, such as fear, anger, and sadness (McClure, Halpern, Wolper, & Donahue, 2009). The immersive and calming environment of VR allows participants to experience and practice emotional regulation techniques, potentially fostering long-term improvements in managing challenging emotions.

3. Integrating VR with Emotional Journaling: Although VR offers an immediate emotional reset during sessions, journaling captures the daily emotional fluctuations between sessions. This study is questioning how combining VR with accessible instruments such as emoji-based journaling enhances emotional awareness, allowing participants to identify patterns and triggers for their emotional states.

4. Improving Quality of Life: Emotional dysregulation and self-harming behaviors negatively affect the overall quality of life, reducing social participation and well-being. By promoting emotional stability, this paper proposes to measure enhancements in psychological health, interpersonal relationships and participation in social activities.

Methodology

Participants : The study involved one adult beneficiary with mental disabilities residing in a social care center under the jurisdiction of DGASPC Arad. Participant (CL), is a 33-year-old adult with severe intellectual disability and autism spectrum disorder, exhibited significant challenges in emotional regulation, including frequent self-injurious behaviors. Despite these challenges, CL demonstrated the ability to participate in structured interventions. Informed consent was obtained from the participant's legal guardian.

Instruments:

1. Virtual Reality (VR) Technology

• Platform: Liminal VR, accessed through Meta Quest devices.

• Scenario: Cosmic Flow, designed to induce relaxation through immersive imagery and calming auditory stimuli. This scenario was chosen for its proven ability to reduce stress and promote a state of emotional balance.

• VR Metrics: Built-in psychometric assessments provided by the Liminal VR platform were used to measure the participant’s emotional states before and after each session.

2. Emotional Journal

• A simplified daily emotional diary was used, adapted to the participant’s cognitive abilities.

• Format: Emotions were represented using Paul Ekman’s universal emotions (anger, disgust, fear, surprise, contempt, joy, sadness), accompanied by large emoji images for ease of understanding. The participant marked their emotional states using these emojis.

• Purpose: To capture participant self-reported emotional experiences between VR sessions and assess changes in emotional self-regulation over time.

Intervention design : Three weekly VR sessions were conducted using the Cosmic Flow scenario on the Liminal VR platform (Liminal VR, n.d.). Each session was supplemented with daily emotion journaling

using an emoji-based format tailored to the participant's cognitive abilities. The Emotional Balance Coefficient (EBC) was used as a metric for evaluating emotional tendencies. While Fredrickson's broaden-and-build theory highlights the importance of a 3:1 positive-to-negative emotion ratio for flourishing, the EBC used in this study is a tailored metric to capture shifts in emotional balance specific to the intervention's context. A coefficient above 1.0 indicates an emotional balance favorable to positive emotions.

Institutional Review Board: This research complied with the ethical standards indicated in the Declaration of Helsinki (1964) and its amendments, as well as the guidelines of the Ethics Committee of The General Directorate of Social Assistance and Child Protection of Arad, which approved the research protocol. The informed consent was obtained from the legal guardian of the participant, ensuring a clear understanding of this research's objectives, methodology, and potential benefits or risks.

Data Availability Statement: The data supporting the conclusions of this research include sensitive information and are therefore not publicly available. Anonymized data are available on request from the corresponding author, subject to approval by the Ethics Committee of The General Directorate of Social Assistance and Child Protection of Arad.

Conflicts of Interest: The authors declare no conflict of interest in regards to the publication of this study.

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Results

The results presented in the table provide clear information about the effectiveness of the virtual reality (VR) intervention and emotional journaling in promoting emotional regulation and reducing the participant's maladaptive behaviors.

[Insert Table 1 here]

Positive vs. negative emotions

• Week 1: The participant experienced three positive emotions (e.g., joy, surprise) and four negative emotions (e.g., anger, sadness, fear). The higher frequency of negative emotions in this week indicates an initial emotional dysregulation, consistent with the two self-harm incidents observed. The Emotional Balance Coefficient (EBC) of 0.75 confirms that negative emotions predominated, signaling emotional instability.

• Week 2: The participant showed significant improvement, with five positive emotions compared to two negative emotions. This change increased the EBC to 2.5, reflecting the predominance of positive emotions and marking the participant's most balanced emotional state during the intervention. It is important to note that self-harming behaviors completely ceased during this period.
• Week 3: Although positive emotions decreased to three and negative emotions increased to four, the participant maintained the absence of self-harming incidents. The EBC returned to 0.75, similar to Week 1, suggesting some emotional fluctuations. However, the lack of maladaptive behaviors indicates improved emotional regulation compared to baseline.
Emotional Balance Coefficient (EBC): The EBC provides a quantitative measure of emotional regulation by comparing the frequency of positive and negative emotions:
• The significant increase in EBC in Week 2 demonstrates the effectiveness of the intervention in shifting the participant's emotional states toward positivity.
• Although the EBC decreased in Week 3, the participant's emotional resilience was sufficient to sustain behavioral improvements, as indicated by the continued absence of self-harming incidents.

[Insert Figure 1 here]
[Insert Figure 2 here]
[Insert Figure 3 here]
[Insert Figure 4 here]

Key Findings

1. Positive Changes in Emotions: The intervention consistently increased positive emotions, with the most pronounced improvements observed in Week 2.
2. Reduction in Maladaptive Behaviors: The elimination of self-harming behaviors highlights the combined effectiveness of VR and journaling in supporting emotional regulation.
3. Sustained Impact: Despite emotional fluctuations in Week 3, the participant maintained improved behaviors, indicating the intervention's potential for long-term benefits.

Liminal VR Evaluation Results: The data from the Liminal VR evaluation instruments provide clear evidence of the intervention's ability to reduce negative emotions, encourage positive emotional states, and support emotional regulation over the long term.
[Insert Table 2 here]
Interpretation of the Mean Likert Scores

The mean Likert scores obtained from the VR intervention sessions provide insights into the emotional changes experienced by the participant. Here is the interpretation of the results:

Session 1:

• Pre-VR Emotion: Fear (3/5)
• Post-VR Emotion: Excitement (5/5)
• Mean Likert Score: 4.0
• Interpretation: The participant began the first session with a moderate level of fear, likely reflecting initial anxiety about the unfamiliar VR environment. However, the intervention led to a significant emotional change, with the participant reporting excitement afterward. The mean score of 4.0 reflects this marked improvement in emotional state.

Session 2:

• Pre-VR Emotion: Calm (4/5)
• Post-VR Emotion: Calm (5/5)
• Mean Likert Score: 4.5
• Interpretation: The second session shows that the participant started in a positive emotional state (calm) and maintained it, with an increase to the maximum Likert score post-intervention. The mean score of 4.5 indicates consistent emotional regulation and highlights the calming effect of the VR scenario.

Session 3:

• Pre-VR Emotion: Calm (3/5)
• Post-VR Emotion: Enthusiasm (5/5)
• Mean Likert Score: 4.0
• Interpretation: The participant started this session with a moderate level of calm, slightly lower than in the previous session, possibly due to external stressors. However, the intervention was able to improve the participant's mood, resulting in a shift towards enthusiasm. The mean score of 4.0 demonstrates the effectiveness of the session in stimulating positive emotional changes.

[Insert Figure 5 here]
[Insert Figure 6 here]

Overall Perspectives

1. Consistent Positive Results:

• Across all sessions, the VR intervention effectively improved the participant's emotional state, moving from neutral or negative emotions (e.g., fear, moderate calm) to positive emotions (e.g., excitement, calm).

2. Sustained Emotional Regulation:

• The second session highlights the ability of VR to maintain and enhance an already positive emotional state, reflecting the participant's familiarity with the intervention.

3. VR Effectiveness:

• The mean Likert scores across sessions (4.0–4.5) indicate a consistent pattern of emotional improvement, highlighting the potential of VR as a therapeutic tool for emotion regulation in individuals with intellectual disabilities.

Limitations of Mean Scores:

• Loss of Context: Although mean scores provide a useful summary, they may obscure individual variations between pre- and post-VR emotional states.

• Small Sample Size: Results are based on a single participant, limiting generalizability.

These findings demonstrate the value of VR interventions in improving emotional regulation, although further research with a larger sample is needed to confirm these results.

Broader implications

• Therapeutic integration: These findings demonstrate the feasibility of using VR as a therapeutic tool in social work, particularly for people who experience difficulties with conventional interventions.

• Rapid emotional changes: VR's ability to rapidly induce positive emotional changes and support emotional regulation suggests that it could complement traditional therapeutic approaches by providing an immersive and interactive pathway for emotional support.

Discussion

The results align with Fredrickson's (2001) Broaden-and-Build Theory, which emphasizes the role of positive emotions in building resilience. Similar to findings from studies on anxiety and VR (Perandré & Haydu, 2018) this case demonstrates the potential of VR to support long-term emotional stability (Vita, Morra, & Rega, 2021)

Implications for Social Work Practice

1. Scalability: VR-based interventions can be scaled up to group settings, providing care centers with cost-effective tools for emotional regulation.
2. Accessibility: Simplified tools, such as emoji-based journaling, ensure inclusion of people with cognitive disabilities.
3. Policy Integration: Incorporating VR training into caregiver education programs can amplify its impact.

Limitations

1. Small sample size: This single case study limits the generalizability of the results.
2. Resource dependency: VR interventions require initial investments in equipment and training.
3. Ethical concerns: Safeguards are needed to protect participants with cognitive disabilities when using VR.

Future research directions

1. Diverse populations: Testing VR interventions across different demographics and disabilities.
2. Longitudinal impact: Assessing long-term effects over multiple years.
3. Cost-benefit analyses: Assessing the scalability of VR tools within social care budgets.

Conclusions

This study demonstrates that VR interventions, when combined with personalized tools such as emotional journaling, significantly improve emotional regulation and eliminate maladaptive behaviors in adults with intellectual disabilities. The emotional balance coefficient provides a robust metric for monitoring progress, and the results highlight the potential for VR to be scalable. Future research should address accessibility barriers and long-term effectiveness to expand its applicability in social care.

Appendix

Tables

Week	Positive Emotions	Negative Emotions	Emotional Balance Coefficient	Self-Harming Incidents
Week 1	3	4	0.75	2
Week 2	5	2	2.5	0
Week 3	3	4	0.75	0

Table 1: Summary of Emotional Trends, Emotional Balance Coefficient, and Self-Harming Incidents Over Three Weeks

Session	Pre-VR Emotion (Likert)	Post-VR Emotion (Likert)	Mean Likert Score
1	Scared (3/5)	Excited (5/5)	4.0
2	Calm (4/5)	Calm (5/5)	4.5
3	Calm (3/5)	Excited (5/5)	4.0

Table 2: Liminal VR median pre and post VR intervention

Figures

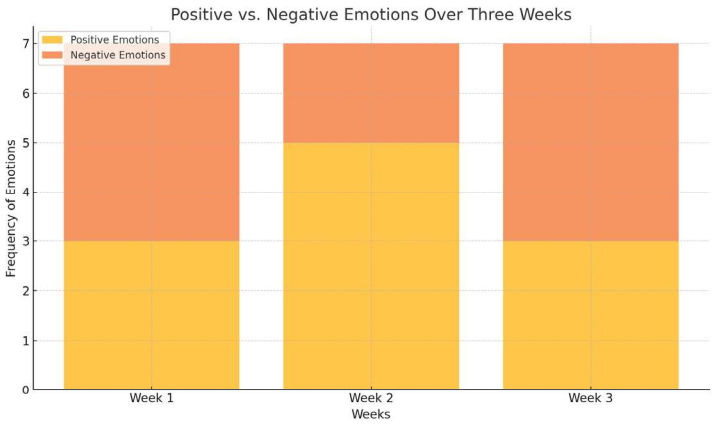

Figure 1: Proportional Distribution of Positive and Negative Emotions Over Three Weeks

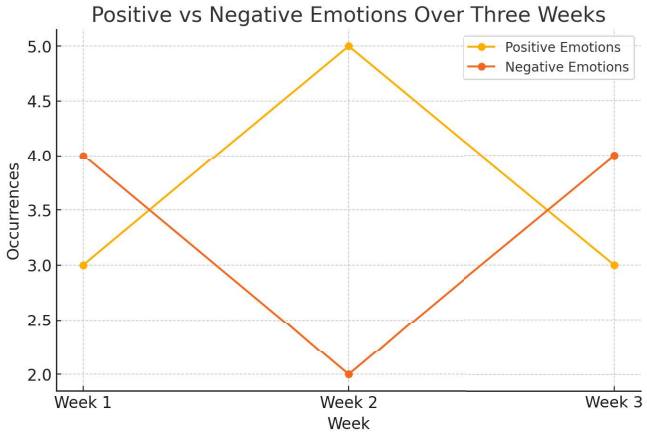

Figure 2: Trends in Positive and Negative Emotions Over Time

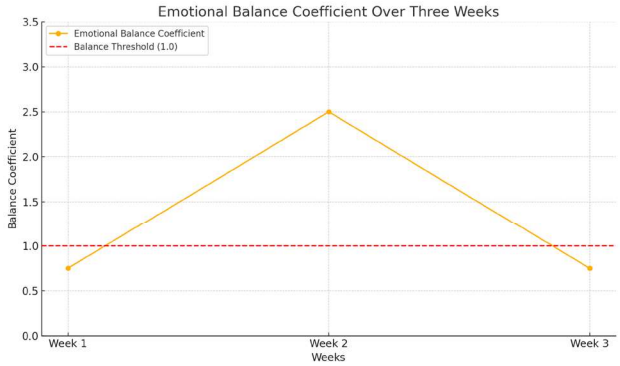

Figure 3. Emotional Balance Coefficient Over Three Weeks

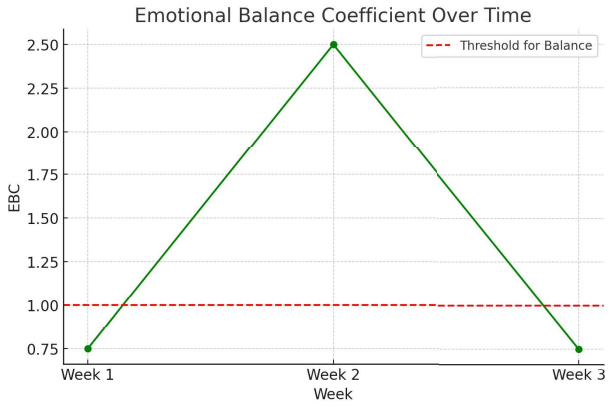

Figure 4. Emotional Balance Coefficient Over Time

Figure 5. Mean Likert Scores

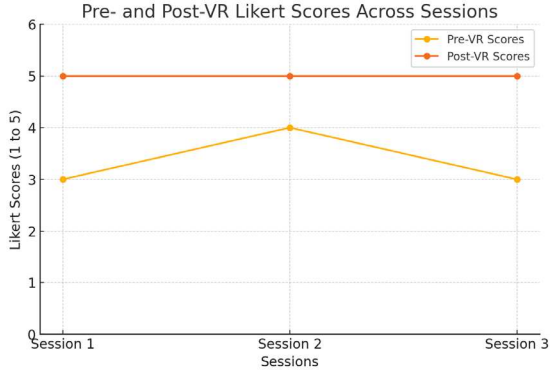

Figure 6. Pre and Post VR Likert Scores

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