Dementia and Technology

Using Virtual Reality and Artificial Intelligence (VRMemory©) to Promote Multi-Sensory Reminiscence Experiences and Social Connectedness for People with Dementia and Caregivers

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Purpose The introduction of reminiscence therapy through virtual reality (VR) technology combines sight, touch, sound, and events from past experiences [1]. Our exploratory study seeks the input of PWD, caregivers, and program workers of dementia care services in enhancing VR reminiscence therapy prototype using Cognitive Stimulation Exergaming and Conversational AI (Artificial Intelligence) Avatar**.** The objective of our project is to evaluate the potential use of technology-enabled reminiscence therapy called VRMemory© [2] by integrating VR, exergaming and AI-powered tool to support PWD and caregivers in the community-based dementia care programs. **Method** This research focuses on the use of co-designing approaches with 4 PWD, 4 caregivers and 2 healthcare providers (n=10). It aimed to explore and understand the participants' perspectives on applying VR, exergaming and AI features as immersive approaches to facilitate reminiscence therapy for PWD. VRMemory© intervention is conducted with PWD and caregivers through usability testing for 30 to 45 minutes once a week for six weeks, including assessing the user interface, system functionality and user responses such as cognitive function, depressive symptoms, apathy and social connectedness. Our study employs Meta Quest 3 VR headsets, and the pilot usability stimulated cognitive engagement and physical interaction within the VR environment and promoted reminiscence therapy through memory recall and exergaming activities. After the interaction with VR reminiscence experiences, participants interacted with AI-enabled Digital Avatar. The AI component of reminiscence therapy has three modes: (1) Conversational Mode (PWD simply chat with AI avatar, and they will respond); (2) Open User Defined Storytelling Mode (AI avatar asks PWD about a story or experience, and provide prompts for reminiscence; and (3) Caregiver Story Mode (Caregiver inserts a story, and the AI will help PWD to remember significant/ meaningful events of the story from the past). This project employed mixed methods study using quasi-experimental pre-post quantitative design and qualitative descriptive study through post-intervention interviews. Outcome measures were collected using validated scales including Cornell Scale for Depression in Dementia; Neuropsychiatric Inventory Scale for Behavioral and Psychological Symptoms of Dementia; MoCA scale for memory recall; Social Connectedness Scale; Zarit Caregiver Burden for caregiver stress. For usability outcomes, we collected System Usability Scale (SUS); VHIL Presence Scale for VR presence; and NASA Taskload Index for cognitive load. **Results** Overall, severity of depressive symptoms in PWD decreased after the four sessions as measured by Cornell Scale for Depression in Dementia. Participants reported the sessions improved their cognitive load in relation to the use of VRMemory© over time as measured by NASA Task Load Index. Participants had favorable experiences using VR technology, with a total median score of 73.6, which would be deemed above average and usable as measured by SUS Scale. Participants spatial perception and awareness whilst inside the VR increased after completing the sessions. No statistical changes in the MoCA and NPI scales when comparing pre- and post-assessments. However, the sense of social connectedness for PWD and caregivers showed a substantial individual improvement (+7 points), from borderline high connectedness to a stronger sense of belonging. Qualitative findings from PWD revealed that engaging in cognitive stimulation games can be a form of rehabilitation to promote physical/mental well-being. They reported improved daytime wakefulness and focus, as well as feeling more relaxed and reduced anxiety. Caregivers described VRMemory© sessions as "something to look forward to" as they perceive conversational AI can provide a form of caregiver respite. **Discussion** Utilizing co-designing approaches enhances trust and collaboration between the study participants and researchers, which is vital for our study as we seek to introduce VR and AI in dementia care. This study is of relevance to clinicians to explore the educational training, resources and support to equip healthcare providers related to the use of VR and AI reminiscence tools to support healthcare delivery, with the aim of supporting technology-enabled dementia care**.** VRMemory© is found to have the greatest impact on promoting the social connectedness between PWD and their caregivers. The positive impact on social connectedness contributed to PWD and caregivers in experiencing a greater sense of belonging, which can play a critical role in overcoming their risks of loneliness and social isolation [3]. Future research will further explore how VR and AI-enabled reminiscence therapy can enhance intergenerational connection through integrating multi-sensory approaches.

References
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