Offline onboarding as a potential contributor to adherence in virtual reality interventions for hospitalized older adults

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Abstract

Virtual reality (VR) may support coping with passivity and reduced autonomy in hospitalized older adults, yet unsuccessful first encounters may reinforce withdrawal rather than support involvement. We developed a structured offline onboarding protocol as a brief preparatory phase to reduce uncertainty, support understanding of interaction logic, and help make the first VR encounter a positive experience. As a conceptual, practice-informed position paper, this manuscript frames offline onboarding as a potential mediating component between intervention design, user readiness, and sustained involvement, to be examined in future research. By addressing cognitive, emotional, and interaction-related factors prior to immersion, offline onboarding may support accessibility and continued engagement with VR interventions in vulnerable populations.

1. Introduction

Older adults undergoing prolonged hospitalization are at increased risk of functional and psychological decline. Beyond medical factors, the hospital environment itself contributes to reduced activity levels, loss of independence, and limited opportunities for decision-making (Creditor, 1993; Covinsky et al., 2011). These conditions are associated with decreased perceived control and increased passivity, which may negatively affect motivation and engagement in both everyday activities and therapeutic processes. The concept of learned helplessness provides a useful framework for understanding how repeated experiences of non-contingency between action and outcome can lead to reduced initiative and withdrawal (Abramson et al., 1978). Restoring a sense of control has been shown to positively influence well-being and behaviour in older populations. Even small, structured opportunities for choice and agency can improve engagement and outcomes (Langer & Rodin, 1976; Bandura, 1977). VR interventions have emerged as promising tools in this regard, offering immersive environments in which users can actively explore and interact within otherwise constrained settings. In clinical contexts, VR has been associated with reductions in anxiety and improvements in mood, while also providing accessible and engaging experiences for older adults (Appel et al., 2020).

However, successful engagement with VR, especially among older and clinically vulnerable users, can be challenging. First encounters with immersive systems may involve uncertainty, anxiety, cognitive overload, or concerns related to physical discomfort (Huygelier et al., 2019; Saredakis et

al., 2020; Schaumburg et al., 2025). These difficulties are consistent with broader findings showing that perceived complexity, usability, and self-efficacy influence technology acceptance among older adults (Chen & Chan, 2014; Schroeder et al., 2023). Because early exposure can shape user attitudes toward VR, the quality of the initial experience becomes particularly important (Huygelier et al., 2019). While prior work has emphasized usability and accessibility, less attention has been given to processes that prepare users before initial engagement. Onboarding refers to methods that support users in becoming familiar with a system and its use (Renz et al., 2014; Strahm et al., 2018), and may include pre-session preparation, in-situ guidance, or system-integrated tutorials (Chauvergne et al., 2023). In VR, onboarding may be particularly demanding for first-time users due to the novelty of both the device and the interaction paradigm (Liu et al., 2018), requiring users to learn unfamiliar interaction concepts such as navigation, controller-based input, object manipulation, and movement within a virtual environment.

In this context, particularly in older clinical populations where maintaining engagement is essential, we developed a structured offline onboarding protocol. This brief pre-exposure phase introduces the virtual environment, clarifies interaction logic, and establishes safety and control, supporting the formation of a coherent mental model of the experience. This manuscript is a conceptual, practice-informed position paper rather than a review. Its aim is to conceptualize offline onboarding as a potential mediating component between intervention design, user readiness, and sustained involvement, and to outline its relevance for VR-based interventions targeting hospitalized older adults. By addressing cognitive, emotional, and interaction-related factors prior to immersion, offline onboarding may play a key role in supporting engagement, particularly in populations at risk of passivity and disengagement.

2. Conceptual background

2.1. Loss of control and engagement in hospital settings

Hospitalization in older age is frequently associated with reduced autonomy, environmental constraints, and decreased opportunities for self-directed action (Creditor, 1993; Covinsky et al., 2011). In such constrained and externally structured environments, older patients may have fewer opportunities to experience a clear connection between their own actions and meaningful outcomes, a mechanism closely related to learned helplessness (Abramson et al., 1978; Seligman, 1975). In rehabilitation contexts, learned helplessness has been used to explain reduced motivation and engagement among older patients when repeated losses, disability, or limited control foster the perception that personal efforts have little influence on outcomes (Abramson et al., 1978; Seligman, 1975; Teitelman, 1982). Low engagement may therefore reflect not merely resistance to novelty, but a clinical context in which perceived control, competence, and initiative are already compromised. Interventions that reintroduce clear action–outcome contingencies may help counteract these effects by creating structured opportunities for choice and self-directed action. It has long been established that even small opportunities for choice can enhance engagement and well-being in older adults (Langer & Rodin, 1976; Bandura, 1977). In parallel, self-efficacy theory suggests that perceived capability and outcome expectations influence whether individuals initiate coping behaviour, how much effort they invest, and how long they persist when facing obstacles (Bandura, 1977). Restoring a sense of agency may therefore require environments that are predictable, controllable, and offer meaningful interactions as opportunities for choice rather than mandatory tasks, allowing users to decide whether and how to engage (Huygelier et al., 2019). Virtual environments can be designed to provide active, controllable, and choice-based

experiences (Lundstedt et al., 2023), but access to these potential benefits is not automatic. For hospitalized older adults who may already experience passivity, reduced autonomy, and diminished perceived control, first-time VR use may create a paradox: while the intervention aims to support agency and self-efficacy, the unfamiliar technology may initially be experienced as an additional demand or competence threat. Offline onboarding should therefore be distinguished from the therapeutic mechanism of the VR intervention itself. Its role is not to directly reverse learned helplessness, but to prepare users for meaningful engagement with an intervention that may support agency, perceived control, and self-efficacy.

2.2. Virtual reality as a potential control-restoring intervention

VR offers the possibility to support psychological well-being by enabling active exploration and interaction for individuals with limited mobility or access to natural environments. Evidence suggests that immersive VR experiences may positively influence emotional health in later life (Appel et al., 2020). However, its effectiveness depends on the user's ability to meaningfully engage with the system. Initial encounters with VR may involve uncertainty, unfamiliar interaction logic, and concerns related to safety or performance. These early interactions can be understood as a critical phase during which expectations, cognitive load, and emotional responses are shaped and may influence subsequent engagement (Bharti et al., 2024; Huygelier et al., 2019; Saredakis et al., 2020). The control-restoring potential of VR can also be interpreted through Self-Determination Theory, particularly the needs for autonomy and competence, which are central to motivation, engagement, and well-being (Ryan & Deci, 2000). The relevance of these mechanisms for health-related interventions has been supported across a wide range of clinical and behavioural contexts (Ntoumanis et al., 2021). From this perspective, VR may be clinically relevant not only because it provides distraction, stimulation, or access to otherwise unavailable environments, but because it can offer opportunities to choose, act, explore, and experience the consequences of one's own actions within a constrained clinical context. However, this therapeutic potential depends on whether users are sufficiently prepared to engage with the system in the first place.

2.3. The role of preparatory processes in intervention effectiveness

In healthcare, preparatory interventions such as pre-procedural information and expectation management have been shown to improve patient outcomes by reducing anxiety and enhancing coping (Johnston & Vogele, 1993; Suls & Wan, 1989). These processes support expectation formation and perceived control, while patients' expectations and illness perceptions also influence treatment outcomes and engagement (Broadbent et al., 2009). Despite this, preparatory phases are rarely described in the VR literature. This observation also emerged in our scoping review (N = 349) of immersive VR interventions in older adults, where onboarding processes were largely absent despite extensive focus on interaction design (Chovanec et al., 2025). High exclusion rates reported among older and disabled users further highlight the importance of supporting early interaction (Galindo Esparza et al., 2025). In this context, we conceptualize offline onboarding as a structured preparatory phase that supports initial engagement and bridges intervention design and user experience.

2.4. Development approach and experiential basis

The offline onboarding protocol was developed through a practice-informed conceptual process rather than as a formal empirical study. The need for such a preparatory phase first became apparent during the first of three preparatory workshops preceding the development of Zenctuary VR+, which involved older hospitalized adults. Compared with younger users, these participants

required more extensive explanation before entering VR, and it became clear that once the headset was already in place, explaining controller-based interactions and the logic of the virtual environment was considerably more difficult. In addition, one participant experienced fear of heights while watching a passive 3D video, despite not having been prepared for this possibility in advance. These experiences highlighted that preparation before immersion should address not only technical instructions, but also expectations, safety, emotional readiness, and perceived control. Following these observations, we examined relevant literature on VR onboarding, cognitive load, preparatory interventions, learned helplessness, perceived control, and disease- or context-specific factors related to hospitalized older adults. These experiential observations were not collected as formal research data and were not subjected to qualitative analysis; rather, they informed structured team reflections that were translated into a brief semi-structured onboarding sequence.

2.5. Design principles of onboarding

Drawing on the conceptual considerations and experiential observations outlined above, four core design principles guided our onboarding process: First, onboarding should reduce uncertainty and anxiety by providing clear and reassuring information about the upcoming experience (Johnston & Vogele, 1993; Suls & Wan, 1989). Second, it should support the formation of a coherent mental model of the virtual environment and its interaction logic, enabling users to understand how actions translate into outcomes (Liu et al., 2018; Chauvergne et al., 2023). Third, onboarding should emphasize perceived control by explicitly communicating user agency, including the ability to interrupt or modify the experience at any time (Langer & Rodin, 1976; Bandura, 1977; Abramson et al., 1978). Fourth, onboarding should limit cognitive demands by presenting only essential information, avoiding overload during initial exposure to VR (Liu et al., 2018; Sweller, 1988; Schaumburg et al., 2025).

2.6. Structure of the onboarding protocol

The offline onboarding is implemented as a short (approximately 5–10 minute), semi-structured procedure conducted prior to the first VR session. It is delivered by a researcher or clinician and follows a standardized sequence of steps, while allowing minor adaptations based on participant needs. The protocol was developed for the Zenctuary VR+ application, a nature-based intervention for older adults in clinical settings. The onboarding consists of four main components. First, the virtual environment is introduced using 2D visual materials and a brief verbal explanation that emphasizes safety and the absence of performance expectations. Second, basic navigation principles are explained, focusing on simple and predictable interactions. Third, interactive elements are presented in a limited and structured manner to support understanding without overload. Fourth, safety instructions are provided, including the option to interrupt or stop the experience at any time. The process begins with a brief assessment of prior VR experience, allowing the facilitator to identify potential misconceptions or previous negative experiences. As prior exposure does not necessarily translate into transferable understanding, onboarding remains relevant even for experienced users. The process concludes with an opportunity for participants to ask questions before entering the VR environment.

3. Discussion

This paper conceptualizes offline onboarding as a structured preparatory phase that may support engagement with VR interventions among hospitalized older adults. We position onboarding as a mediating component between intervention design, user readiness, and sustained involvement,

particularly in populations with reduced autonomy and increased vulnerability to disengagement. From a clinical perspective, hospital environments may reinforce passivity and reduced agency, while VR interventions may offer active, choice-based, and controllable experiences. However, this potential is unlikely to be accessible if the first encounter with VR is experienced as confusing, anxiety-provoking, or overly demanding. A key implication of this framework is the distinction between the therapeutic potential of the VR intervention and the enabling role of onboarding. Offline onboarding prepares users to engage with an intervention that may support perceived control, competence, and agency. By establishing predictability, safety, and a basic understanding of interaction logic before immersion, onboarding may reduce the risk that unfamiliar technology becomes an additional barrier to engagement. The proposed approach has limitations as it was developed for a specific application and target population, and its relationship with longer-term engagement, adherence, and drop-out rates remains to be empirically tested. Future research should examine offline onboarding as a potential mediating factor influencing user readiness, engagement, and intervention outcomes in clinical VR settings. Despite these limitations, offline onboarding represents a low-resource and clinically relevant component that may improve the accessibility and effectiveness of VR-based interventions for older adults.

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