Development of a Patient-Embodied Experience, How and Why?

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Keywords: VR, Therapeutic Language and Communication, Ethnographic Phenomenology, Health Care Education, Patient-Embodied Experience, Proteus-Effect.

Abstract: **Introduction:** The rise of immersive technologies, particularly virtual reality (VR), has significantly impacted medical education. In patient-embodied VR, through VR headsets, learners can embody patient's perspective, offering a secure and immersive learning encounter. This communication outlines a framework for crafting patient-embodied experiences, drawing from our VR endeavours aimed at enhancing therapeutic communication skills in medical education. **Methods:** Our framework includes a development process with consideration of user experience, technical implementation, content creation and validation. Central to content creation is the collaborative construction of a patient journey, involving the involved parties via storyboards and scripts distinguishing direct and indirect actions. **Results:** For our patient-embodied experience, the cooperative development of the patient journey, script and storyboard included an initial version created by the main researcher after study of landmark articles on therapeutic communication and fieldwork. Validation was achieved through two group sessions with healthcare providers who consented to participate. **Conclusions and practice implications:** The findings and insights presented can contribute to the growing knowledge in the field of educational VR development. They demonstrate the feasibility and potential of leveraging immersive technologies to create engaging and impactful virtual experiences. Hitherto, further validation may evaluate how they influence believes and attitudes of healthcare providers towards therapeutic communication.

1 INTRODUCTION

Medical education has been incorporating elements of experiential learning for several decades, and the specific use of immersive technologies has gained more prominence in recent years. In particular, learning with virtual reality (VR), or immersive virtual environments (IVEs) aligns with the Constructivist Theory, which suggests that learners actively construct their knowledge and understanding of the world by building upon their existing mental frameworks. In an immersive learning environment, learners are given the opportunity to explore, discover, and make meaning from their experiences (Whitman, 1993)

In virtual reality (VR), immersive learning incorporates various sensory modalities to enhance *multisensory engagement* enabling embodiment. Embodiment is the possibility in VR to visually substitute a person's real body by a life-sized virtual one, seen from the person's own first-person perspective. In other words, when we place a VR headset on, our virtual bodies momentarily substitute our real bodies, a phenomenon known as the *Proteus effect* (Fox et al., 2013). Multisensory and motor systems interconnect during cognitive processing. During VR, embodiment can increase users' engagement and provide emotional fidelity invoking a sense of *presence* creating realistic emotional and neurocognitive responses (Bem, 1972; Navarro et al., 2022).

When using VR as educational tool, learners have the ability to experience a full 360-degree view, providing them with unrestricted access and freedom to explore their surroundings. This contrasts to traditional video experiences, where the audience's perspective is limited to a fixed viewpoint as depicted

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in Figure 1. The distinctive aspect of VR lies in its participatory nature. In VR, writers, directors, and producers, referred to as builders, do not have the ability to dictate how learners engage with the story. Instead, they can only invite participation, allowing learners to choose where to direct their attention and which aspects of the story to focus on (O'Sullivan et al., 2018). This stands in contrast to conventional storytelling, where a storyteller transmits the narrative to listeners. Traditional videos typically provide viewers a fixed perspective. The screen acts as a window into the world of the video, and viewers can only observe the events and scenes from the specific viewpoint chosen by the director as shown in Figure 1.

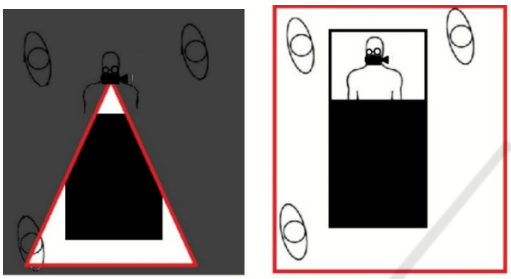

Figure 1: Red outlines show the extent of what a camera can film in 90 vs 360 degrees of freedom. Left: 90 degrees of freedom of traditional film, Right: 360 degrees of freedom of VR.

In healthcare, a growing emphasis on patient-centered care, and consumerism in medicine has exemplified the importance of effective physician-patient communication (Santana et al., 2018) and the use of IVEs as an educational tool in this context ("The Effects of Viewing an Uplifting 360-Degree Video on Emotional Well-Being Among Elderly Adults and College Students Under Immersive Virtual Reality and Smartphone Conditions," 2020; Tang et al., 2022). We will refer to patient-embodied VR as the specific VR application where a learner who puts on the VR headset virtually becomes the patient. Given that this immersive transformation has the capacity to affect self-perception, attitudes, convictions, and conduct in both implicit and explicit ways (Bian et al., 2015; Fox et al., 2013; Navarro et al., 2022), our hypothesis posits that it holds substantial promise as an exceedingly effective and innovative pedagogical approach in education on communication skills.

An example of the use of patient-embodied VR can be found in our work published recently (Hoek et al., 2023a, 2023b). We developed two patient-embodied experiences to create a possibility for healthcare providers to feel what it is like to become a patient. In these VR experiences, the learner experiences the sequential stages of a patient undergoing elective general anesthesia and surgery, with nuanced shifts in language and interactions. We will describe how we have developed these experiences, and what important lessons we have learned that can be used by researchers aiming to develop-embodied VR experiences.

2 METHODS

This prospective exploratory research was carried out at the Leiden University Medical Center (LUMC, Leiden, the Netherlands), a large tertiary academic teaching hospital. The protocol was approved by the Institutional Science Committee and obtained a waiver from the Institutional Review Board (NWMO-LUMC).

Informed consent was obtained prior to inclusion, participation was voluntary and privacy rights were in alignment with the Declaration of Helsinki and GDPR guidelines. Data was collected and recorded between February 2019 to December 2020. Participants received no financial compensation.

2.1 Participants and Procedures

Healthcare providers working in the OR were invited to participate in the development of the patient-embodied VR experiences. They were recruited between January 2019 and May 2019. The procedure encompassed content creation, content validation, and filming and editing of the VR experiences as shown in Figure 2.

2.2 Content Creation

To create the storyboard and script of the patient journey, a theoretical framework needed to consider the study of landmark articles in the concerned domain. In our case, Landmark patient-centered studies were used to include important aspects of lived patient experiences in preoperative settings (Ben-Amitay et al., 2006; Butt, 2021; Derksen et al., 2013; Kain et al., 2004; Kain et al., 2006; Lang et al., 2005; Maranets & Kain, 1999; Smith & Mishra, 2010; Swayden et al., 2012).

Secondly, fieldwork of the researcher (KH) included informal interviews with healthcare providers and patients, along with observations to gather data was used to create an initial script for the patient journeys as shown in Figure 2.

2.3 Content Validation

Group sessions are an adapted tool to validate the storyboard and script (Stewart et al., 2007). In our study, a first group session was held to discuss and adapt the scripts.

Group input such as photographs, focused and selective observation notes, reflective notes and commentaries were used to write a second version of the patient journeys. A second group session implied a final validation where the scripts were discussed and adapted until consensus was reached; that is until the final script was consented by all group members (Briggs et al., 2005) as shown in Figure 2.

The specific linguistic features were further validated by an independent hypnotherapist based on validated and relevant research (Boselli et al., 2018; Lang, 2019; Lang & Berbaum, 1997; Lang et al., 2005; Swayden et al., 2012; Watzlawick, 1978; Zech et al., 2014).

2.4 Filming and Editing

Asking healthcare providers to play their own role has several advantages as its economical, and the actors may identify themselves very easily with their own professional role. We asked the developers to play their own professional role, e.g. a surgeon would play the surgeon. An anaesthetic nurse volunteered to play the patient, as she had been a surgical patient several times before.

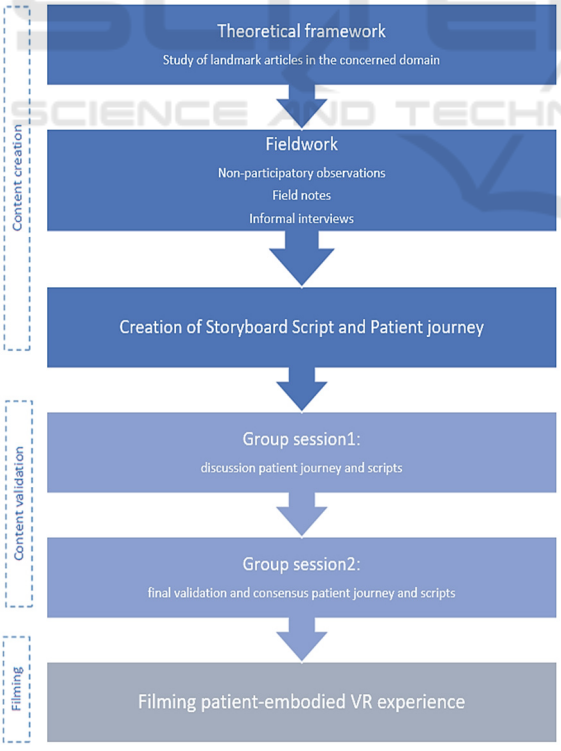

Figure 2 structure of the study participation.

3 RESULTS

3.1 Case Study Description

Nine healthcare providers participated in the development of the patient-embodied VR experiences. Six were OR nurses , one was a surgeon and two were anaesthesiologist-hypnotherapists. One hypnotherapist who was not affiliated with our hospital did not participate in the filming of the experiences. The majority was female (82%). Demographics are shown in Table 1.

Table 1: Demographic characteristics of the VR development team and study participants.

Clinical role	
Anaesthesiologist-hypnotherapist	2
CRNA (Nurse anaesthetist)	2
Preoperative holding area nurse	3
Operating room nurse	1
Surgeon	1
Years of practice	
<1year	1
1-5years	3
5-10years	1
>10years	4
Sex	2/7
Male/Female	

3.2 Development of the Patient-Embodied VR Experiences

Between February 2019 and December 2019 two scripts and storyboards were created: the positive and negative patient-embodied VR experience.

Guidelines of several digital platforms were used (Newton, 2016; O'Sullivan et al., 2018). Filming was performed using a *GoPro®* camera, editing was performed using *Movavi®* enabling the experiences to be available on most common VR headsets. Also, an online Youtube version was uploaded making it possible to view the experience online.

The final durations of the experiences were 12 minutes and 19 seconds for the negative experience, and 10 minutes and 36 seconds for the positive experience.

The story-world needed to be as consistent with reality as possible, using objects, personas, and actions to stimulate the sense of immersive *presence*.

3.2.1 Storyboard and Script

We developed a storyboard with the main scenes as shown in Figure 3 including all direct interactions with the patient.

Figure 3: Storyboard patient-embodied VR experience.

We developed a script with 'shadow actions' visible if the learner would look around. An overview of the main differences in setting, direct interactions and shadow actions can be found in Table 2.

Table 2: Overview of main difference in setting, interactions and shadow actions.

	Negative experience	Positive experience
Setting		
Preoperative holding area	No (distraction) activities for other patients No preventive measures for delirium prevention	Other patients use a tablet or read a magazine Curtains opened, visible clock, noises of monitoring minimalized
Operation room	Radio on	Noises minimalized
	Alarms and sounds of continuous monitoring on. Surgical equipment partially displayed	No visible surgical equipment
Direct interactions		
Contact with preoperative holding area	-Patient is ignored when she requests to go to the toilet -Nurse does not ask any personal questions while she places the IV cannula	-Nurse sits next to the patient -Nurse uses hypnotic distraction methods during the placement of the IV cannula -Nurse responds to the concerns of the patient.
Contact with anaesthesio-logist	Contact with anaesthesiologist with little rapport.	Anaesthesiologist asks personal questions before the patient is taken into the OR
Shadow interactions		
Preoperative holding area	OR nurse passes as the patient is brought to the preoperative holding area, he tells his colleague there is a bleeding in the OR, and he needs to hurry	OR nurse passes as the patient is brought to the preoperative holding area. He holds something in his arms, but is discrete.

3.2.2 Setting

In the positive experience, another patient present is able to read a magazine as shown in Figure 4. This is a distraction method that may increase comfort while the patients await their surgery (Pati & Nanda, 2011).

Figure 4: Positive experience: another patient reads a magazine.

3.2.3 Direct Interactions

There are changes in attitude of the health care providers with or without a direct therapeutic relationship. One example is the communication style of the anaesthesiologist just before the start of the inductive phase of anaesthesia (patient is induced into a state of unconsciousness and analgesia (pain relief) before the start of the surgical procedure) as shown in Figure 5.

In the negative video, the anaesthesiologist administers the medication, however, the communication shows limited effort to establish rapport (Butt, 2021; Hall et al., 1995; Hoek et al., 2023a). Furthermore, the potential side effects of the drugs are explicitly mentioned, thereby increasing the likelihood of the patient experiencing these adverse effects (Lang et al., 2005; Zech et al., 2014).

In the positive experience, the anaesthesiologist uses hypnotic linguistic techniques to induce relaxation (Boselli et al., 2018), enhance focus and promote a smooth start of general anaesthesia. The anaesthesiologist sits beside the patient (Swayden et al., 2012).

Figure 5: Anaesthesiologist sits next to the patient, uses suggestive language to induce relaxation.

3.2.4 Shadow Actions

An example of a suggestion used in the final script was having an OR-nurse pass by to bring blood for the transfusion of another patient to enhance authenticity of the dynamics of the operating theatre. Subtle changes between the experiences are shown in Figure 6.

One portrays an OR-nurse that politely smiles to the patients without showing any concerns. The other portrays an OR-nurse that expresses a sense of urgency. He seems bothered, and tells the preoperative nurse he has to deliver blood. The preoperative nurse seems worried.

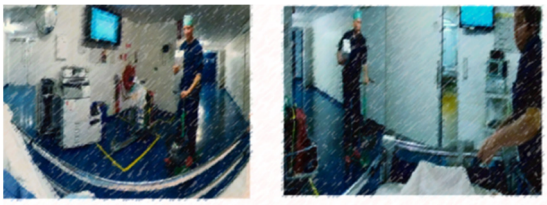

Figure 6: Left: the operating room (OR) nurse remains silent and smiles politely without showing his concerns. Right: the OR nurse conveys a sense of urgency to bring blood to another patient, and the preoperative nurse appears annoyed and worried.

4 DISCUSSION AND CONCLUSION

4.1 Discussion

This study describes the development of two patient-embodied VR experiences. The specific linguistic features were validated by an independent hypnotherapist and were based on validated and relevant research (Boselli et al., 2018; Lang, 2019; Lang & Berbaum, 1997; Lang et al., 2005; Swayden et al., 2012; Watzlawick, 1978; Zech et al., 2014).

Internal validity of the VR experiences was confirmed given that healthcare providers participated in the development of these experiences themselves. Between the two experiences, small changes in setting, interactions and shadow actions would implicitly suggest a more or less welcoming experience. Indeed, the development included addition of these several elements enhancing authenticity of the VR experiences.

This type of immersive storytelling with VR offers for learners a possibility to create their own story in 360°; as they were able to look around freely in VR. Additionally, healthcare providers played their own roles during the filming of the scenes.

4.2 Limitations

One of the limitations of the VR experiences lies in the limited interaction within the VR-environment. The learner had the ability to observe their surroundings; however, due to the recorded nature of the experiences, learners were not able to freely move around as they would have in a virtual environment utilizing computer-generated 3D video imagery.

We selected this setting based on the believe that a patient typically finds themselves confined to a hospital bed with limited mobility or free choices. We contend that utilizing a genuine operating theatre and

real actors enhances fidelity, thereby intensifying the sense of immersion.

4.3 Innovation

The findings and insights presented in this study can contribute to the growing knowledge in the field of educational VR development. They demonstrate the feasibility and potential of leveraging immersive technologies to create engaging, authentic and impactful virtual experiences (Hoek et al., 2023a)

4.4 Conclusion

By using immersive VR technology, one can create an interactive and engaging virtual environment that allows learners to experience a simulated reality, that is the experience of being a patient.

This development process involves careful consideration of user experience, technical implementation, content creation and validation. In our opinion, key elements of the content creation should be based on the cooperative development of a patient journey, with participation of the involved parties using a storyboard and script that distinguishes between direct actions and indirect (shadow) actions.

4.5 Future Directions and Study Validation

The findings of this study can contribute to further research and healthcare education programs avid to use experiential learning with patient-embodied VR. We conclude with a call for further research to fully unlock the potential and drawbacks of patient-embodied VR as an educational tool and its usefulness in medical training. Also, further research may examine how patient-embodied VR might affect patient reported outcomes like preoperative anxiety.

Initial validation of our patient-embodied experience consisted of a qualitative study analyzing the lived experience of anaesthesiologists (Hoek et al., 2023a). Further validation may include evaluation of the effects of the implementation of a training in therapeutic communication with an integrated patient-embodied VR experience.

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COMPETING INTERESTS

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