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Validation of a virtual reality environment with a relaxing breathing exercise in a population of children hospitalized in a pediatric unit

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VR ENVIRONMENT

Intervention
10-minute cruise in a relaxing environment in which a guided breathing exercise is offered.

01 INTRODUCTION

In pediatrics, virtual reality (VR) has been mainly used as a distracting task during medical care by disengaging the attention from the anxiety-provoking and painful stimuli (Arane et al., 2017; Eijlers et al., 2019; Gold & Mahrer, 2018). Beyond its distracting potential, some suggest the interest of VR to learn self-regulation techniques, such as deep breathing relaxation (Bossenbroek et al., 2020; Cook et al., 2021; Stassart et al., 2023; Van Rooij et al., 2016. However, studies examining a VR protocol engaging young patients in active self-regulation are rare.

During a hospitalization, fear and helplessness are frequently reported in pediatric unit which lead to negative impacts during the hospitalization (e.g., prolonged care, pain, non-collaboration), and afterwards (e.g., medical fears, prolonged convalescence; Claridge et al., 2020; Fortier et al., 2010; Lerwick, 2016; Li et al., 2016; Sadhasivam et al., 2009; Silva et al., 2017). In addition, children would like to have a tool to regulate their emotions during their stay in the hospital (Bray et al., 2019).

Learning breathing techniques through VR would renders possible to combine the attractive aspect of the tool (Karver et al., 2006; Yamada-Rice et al., 2017) and the use of an active regulation technique in the management of one's own care.

OBJECTIVES

Tool Validity :

- To examine the effectiveness of a deep breathing exercise in VR on **state anxiety variables**.

Tool Satisfaction :

- To examine **sense of presence** and **cybersickness**
- To evaluate different aspects of the VR product based on the holistic model of Ahmadpour et al. (2020) which identifies the elements specific to VR environments that would explain its effectiveness.
  - **Aspects related to experience** (emotions).
  - **Aspects related to the product** (feeling of presence, aesthetic, playful and pragmatic qualities).
  - **Aspects related to the intervention:** user's participation (passive to active), presence or not of feedback, objective of the intervention (distraction to the learning of a skill).

02 METHODOLOGY

Population et recruitment:

N = 43 children, ages 6-15
Recruited in the pediatric department at CHR Verviers, Belgium
M age = 11.2, *SD* = 2.92 (19 boys, *M* age = 10, *SD* = 2.94 ; 24 girls, *M* age = 12, *SD* = 2.61)

Causes of hospitalization:
- Daily hospital (gastroscopy, circumcision, tonsillectomy)
- Trauma (fall, fracture, …)
- Abdominal pain (pancreatitis, constipation, appendectomy, …)
- Respiratory distress
- Emotional difficulties

Scales:

➔ *State-Anxiety Inventory for Children* (STAIC, Spielberger, 1973) of 20-items with a 3-point likert scale (scores from 20 to 60).

➔ *Facial Affective Scale* (FAS; McGrath et al., 1996), which is a self-assessment scale which makes it possible to estimate the level of state anxiety using 9 faces (scores from 1 to 9).

➔ *Gatineau Presence Questionnaire* (Laforest et al., 2016) of 4-items with a Visual Analog Scale (VAS) at 11-points (scores from 0 to 100).

➔ *Cybersickness questionnaire* (Cyberpsychology Laboratory at UQO, 2003) of 11-items with a 3-point likert scale (scores from 0 to 20).

➔ The *tool satisfaction* is assessed based on the holistic model for VR program design developed by Ahmadpour and colleagues (2020). Three aspects are investigated (i.e., intervention, product and experience) through three items on a Likert-type scale from 0-3.

03 RESULTS

Tool Validity

Table 1: Descriptive and inferential statistics for the comparison between *pre* and *post* immertion on the measures of state anxiety

	M pre (*SD*)	*M Post* (*SD*)	*T* (42)	*p*	*Cohen's d*
STAIC	32.02 (5.75)	28.84 (6.20)	4.08	< .001	0.622
FAS	3.98 (2.13)	2.74 (1.88)	5.59	< .001	0.853

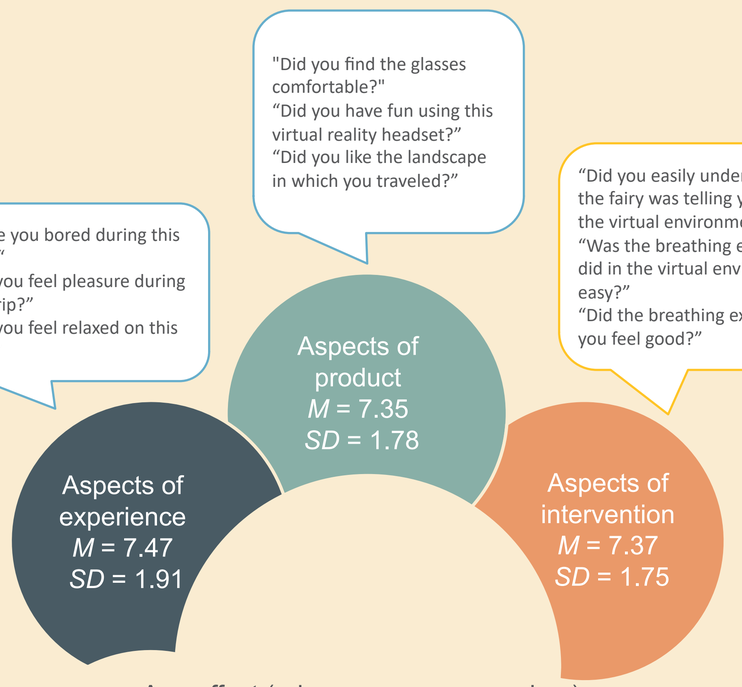
N = 43

Tool Satisfaction

"Did you find the glasses comfortable?"
"Did you have fun using this virtual reality headset?"
"Did you like the landscape in which you traveled?"

"Were you bored during this trip? "
"Did you feel pleasure during this trip?"
"Did you feel relaxed on this trip?"

"Did you easily understand what the fairy was telling you to do in the virtual environment?"
"Was the breathing exercise you did in the virtual environment easy?"
"Did the breathing exercise help you feel good?"



Age effect (primary versus secondary):
ns *p* from .393 to .810
Sex effect: ns *p* from .050 to .915

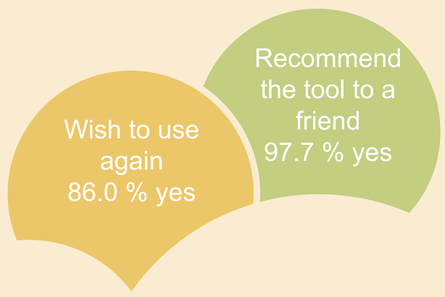
VR Variables

Sense of presence

M = 67.2, *SD* = 24.2

Cybersickness

M pré immersion = 3.58, *SD* = 2.98
M post immersion = 2.53, *SD* = 2.77
t(42) = 3.66, *p* < .001
Cohen's d = 0.558



05 DISCUSSION

Preliminary results support the validity of this relaxing breathing exercise in VR environment in terms of state anxiety reduction.
Good satisfaction with the tool is reported by most children.
These elements are encouraging regarding the healthy and effective use of this relaxing environment for a population of hospitalized children.

Perspectives:

- ↑ *N* of sample
- Introduce physiological measurements (heart rate) to test effectiveness.
- Measuring a longer-term effect (hospitalization anxiety, perceived control) on the child's hospital stay: several immersions in VR during the child's hospitalization.

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