Revue Internationale du Chercheur
ISSN: 2726-5889
Volume 7 : Numéro 1

Virtual Reality as a Cognitive Intervention in Pediatric Procedural Anxiety Management: Mechanisms and Clinical Applications

La Réalité Virtuelle comme Intervention Cognitive dans la Gestion de l'Anxiété Procédurale Pédiatrique : Mécanismes et Applications Cliniques

Ben khaled Souhail
Doctrant
Faculté des Sciences humaines
Université Ibn Tofail
Hommes,Société et Valeurs
Maroc

Chekkouh Nabil
Enseignant chercheur
Faculté des Sciences humaines
Université Ibn Tofail
Hommes,Société et Valeurs
Maroc

Date de soumission : 16/11/2025

Date d'acceptation : 08/01/2026

Pour citer cet article :

Benkhaled. S (2025) «La Réalité Virtuelle comme Intervention Cognitive dans la Gestion de l'Anxiété Procédurale Pédiatrique : Mécanismes et Applications Cliniques », Revue Internationale du chercheur «Volume 7 : Numéro 1» pp : 69 - 82

Résumé

Cette revue narrative a pour objectif d'analyser et de synthétiser les mécanismes cognitifs par lesquels la réalité virtuelle (RV) réduit l'anxiété procédurale chez l'enfant. En nous appuyant sur une analyse critique de la littérature scientifique récente, nous postulons que l'efficacité de la RV s'articule autour de trois mécanismes centraux : la compétition pour l'allocation de ressources attentionnelles limitées, la restructuration proactive des schémas cognitifs dysfonctionnels liés aux soins, et l'engagement modulé des fonctions exécutives. Notre synthèse, fondée sur l'examen d'études cliniques et de méta-analyses publiées entre 2010 et 2023, indique que les interventions par RV sont associées à une réduction significative, bien que variable, de l'anxiété perçue. Ces résultats plaident pour une intégration raisonnée de la RV dans une approche multimodale et non pharmacologique de la détresse pédiatrique, tout en soulignant la nécessité de recherches futures pour standardiser les protocoles et personnaliser les interventions.

Mots-clés : réalité virtuelle, anxiété procédurale, pédiatrie, mécanismes cognitifs, distraction, revue narrative, interventions non pharmacologiques.

Abstract

This narrative review aims to analyse and synthesise the cognitive mechanisms through which virtual reality (VR) reduces procedural anxiety in children. Based on a critical analysis of recent scientific literature, we posit that the efficacy of VR revolves around three core mechanisms: the competition for limited attentional resources, the proactive restructuring of dysfunctional cognitive schemas related to medical care, and the modulated engagement of executive functions. Our synthesis, founded on the examination of clinical studies and meta-analyses published between 2010 and 2023, indicates that VR interventions are associated with a significant, albeit variable, reduction in perceived anxiety. These findings advocate for a deliberate integration of VR into a multimodal, non-pharmacological approach to paediatric distress, while simultaneously underscoring the necessity for future research to standardise protocols and personalise interventions.

Keywords : virtual reality, procedural anxiety, paediatrics, cognitive mechanisms, distraction, narrative review, non-pharmacological interventions.

1. Introduction

Medical procedures, although necessary, often constitute anxiety-inducing experiences for children, with a reported prevalence reaching up to 75% in certain populations (Tas et al., 2022). This procedural anxiety, far from being an epiphenomenon, can lead to significant psychosocial consequences, including adjustment disorders, subsequent medical phobias, and a lasting impairment of the trusting relationship with the medical environment (Trottier et al., 2019). Faced with the limitations of conventional pharmacological approaches, particularly the risks associated with sedatives and analgesics (Faber et al., 2013), the development of effective non-pharmacological interventions represents a primary clinical concern.

Among these interventions, distraction techniques hold a prominent place. Their principle rests on the capacity to divert the patient's attention from the aversive stimuli of the procedure. Virtual reality (VR) emerges as a superior distractive modality, offering a deep sensory immersion that intensely mobilises attentional capacities (Malloy & Milling, 2010). However, while its effectiveness is increasingly documented, the precise cognitive mechanisms underlying this efficacy often remain implicit in the literature, which focuses primarily on clinical outcomes (Eijlers et al., 2019; Smith et al., 2020). This review therefore seeks to address the following research question: What are the specific cognitive mechanisms by which virtual reality modulates and reduces the anxious experience of children during medical procedures, and what are their implications for optimised clinical practice?

To address this, we will adopt a methodology of critical narrative review, aiming to synthesise and interpret current knowledge rather than conduct a quantitative meta-analysis. Our approach will consist of a thematic analysis of recent scientific literature, focusing on dissecting the attentional, emotional, and executive processes at play.

This article is structured as follows. First, we will describe the methodology employed for selecting and analysing scientific works. We will then present the theoretical framework integrating cognitive models of anxiety and immersion. The third part will be devoted to a detailed analysis of the three postulated cognitive mechanisms of action. We will subsequently review clinical applications and efficacy data, before addressing practical limitations and ethical considerations. Finally, we will discuss implications for practice and future research directions.

2. Narrative Review Methodology

This research is based on a critical narrative review of the literature. This approach aims to provide an in-depth, contextualised interpretation of existing knowledge. It is particularly suited to exploring an emerging field, integrating different disciplinary perspectives (cognitive psychology, paediatrics, health technologies) and formulating a novel conceptual framework.

2.1. Search Strategy and Sources

A literature search was conducted between January and March 2024 using the electronic databases PubMed, PsycINFO, ScienceDirect, and the Cochrane Library. The following combinations of keywords were used: ("virtual reality" OR "VR") AND ("pediatric" OR "child*") AND ("procedural anxiety" OR "medical fear" OR "distress") AND ("distraction" OR "cognitive"). The search was limited to articles published between 2010 and 2023, in French and English.

2.2. Selection Criteria and Process

Articles were selected based on the following criteria: (1) studies focusing on the use of immersive VR (headset) in a paediatric medical context; (2) assessment of impact on anxiety or distress as a primary or secondary outcome; (3) original articles (clinical trials, pilot studies) or syntheses (reviews, meta-analyses). Studies focusing exclusively on pain without anxiety measurement, or using non-immersive 2D screens, were excluded. This selection, while not exhaustive in a systematic sense, identified a corpus of approximately thirty pivotal studies, supplemented by fundamental theoretical references in cognitive psychology. The numerical claims presented in this article (e.g., prevalence, reduction rates) are explicitly sourced from the cited meta-analyses and clinical studies (Tas et al., 2022; Eijlers et al., 2019; Smith et al., 2020).

2.3. Analysis and Synthesis

The analysis was qualitative and thematic. The extracted data (proposed mechanisms, methodologies, results, limitations) were organised around the central themes identified: attentional mechanisms, cognitive restructuring, and executive engagement. This narrative synthesis allows for proposing an integrative model of the cognitive processes at play, discussing convergences, contradictions, and gaps in the literature.

3. Theoretical Framework: Procedural Anxiety and Virtual Immersion

3.1. Procedural Anxiety Through a Cognitive Lens

Anxiety in a medical context can be conceptualised as a complex emotional response, mediated by cognitive processes.

The transactional model of stress (Lazarus & Folkman, 1984) is illuminating here: procedural anxiety emerges from the child's appraisal of a situation (the procedure) as threatening, exceeding their perceived resources to cope. This appraisal is biased by pre-existing cognitive schemas (e.g., "hospitals are dangerous," "injections are intolerable") that orient attention toward threat signals (needles, white coats), thereby amplifying the perception of danger and distress (Woo, 2010). Distraction, as an emotion-focused coping strategy, precisely aims to interrupt this cycle by reorienting attentional resources.

3.2. Immersive Distraction: Beyond Simple Diversion

Traditional distraction techniques (toys, videos) involve passive or active attentional diversion (Koller & Goldman, 2012). VR offers immersive distraction, a qualitative leap based on the concept of presence, the subjective feeling of "being there" in the virtual environment (Slater & Sanchez-Vives, 2016). This presence is the result of immersion, i.e., the technical system's capabilities to isolate the user from the real world and stimulate their senses in a coherent and interactive manner. By creating a captivating and self-centred environment, VR does not merely divert attention; it engages the child in an optimal flow experience, characterised by total absorption, loss of self-consciousness, and time distortion (Csikszentmihalyi, 1990), a psychological state profoundly incompatible with maintaining anxious vigilance.

4. Cognitive Mechanisms of Action of Virtual Reality

Our analysis reveals three interdependent mechanisms explaining the anxiolytic potential of VR.

4.1. Mechanism 1: Competition for Limited Attentional Resources

This mechanism is anchored in the model of limited attentional capacity (Kahneman, 1973). Conscious information processing is a capacity-limited process. Anxiety, by mobilising resources for environmental scanning for threats, consumes a significant portion of this capacity. VR, through the richness and coherence of the multisensory stimuli it delivers (visual, auditory, sometimes haptic), creates a relevant and engaging cognitive load that directly competes with anxious processes. The child must process information from the virtual world to navigate and interact within it, leaving less cognitive "bandwidth" available to process the unpleasant or threatening sensations of the real procedure. Eye-tracking studies confirm this

reorientation, showing a drastic reduction in fixation time on medical instruments during immersion (Won et al., 2017).

4.2. Mechanism 2:

Restructuring of Cognitive Schemas and Emotional Learning

VR enables a form of graded and controlled therapeutic exposure. Unlike classical exposure where the patient confronts the real situation, VR can create a hybrid or metaphorical environment. For example, the application "Aqua" (Allday, 2016) places the child in a calming underwater world, thereby completely dissociating the psychological context from the medical act. This dissociation allows for emotional neutralisation of the caregiving context. Furthermore, by offering a positive, autonomous, and controlled experience in a moment usually associated with loss of control, VR helps rewrite the cognitive script associated with medical care. It facilitates a relearning process: the "hospital" context can become associated with an experience of curiosity, play, or mastery, thus modifying anxious expectations for future procedures. This process resembles the cognitive restructuring mechanisms targeted by cognitive-behavioural therapies (Beck, 1976).

4.3. Mechanism 3:

Engagement of Executive Functions and Reinforcement of the Sense of Control

Many VR applications require active interaction: throwing snowballs in "SnowWorld" (Faber et al., 2013), feeding virtual animals, solving simple puzzles. These activities mobilise executive functions with a set of high-level processes including planning, inhibition of inadequate responses, working memory, and cognitive flexibility (Miyake et al., 2000). Engaging these prefrontal circuits has a dual beneficial effect. On one hand, it contributes to the competitive cognitive load mentioned above. On the other hand, and crucially, it restores a sense of agency (control and personal efficacy) in the child. In contrast to the passivity often experienced during care, the child becomes an agent again, their actions having immediate and visible consequences in the virtual world. This reinforcement of the sense of control is a powerful antidote to anxiety, which is fundamentally linked to the perception of an uncontrollable danger.

5. Clinical Applications and Synthesis of Efficacy Data

The overall efficacy of virtual reality in reducing procedural anxiety in paediatrics is now supported by several rigorous meta-analyses. The synthesis by Tas and colleagues (2022) concludes a significant, medium to large effect size on the reduction of perceived anxiety and

pain. These results are corroborated by earlier work from Eijlers and his team (2019). However, a nuanced reading of the literature reveals considerable variability in the magnitude of observed effects. This heterogeneity reflects the diversity of clinical contexts, study populations, and intervention modalities. It primarily underscores that the efficacy of VR is not uniform but depends on a fine alignment between the technology, the child, and the procedure. For example, the anxiolytic impact measured after a simple vaccination may differ substantially from that observed during longer, more invasive burn dressings, both in its intensity and its predominant mechanisms.

This variability leads us to emphasise the crucial importance of developmental adaptation. A child's cognitive and emotional engagement with a virtual environment is profoundly linked to their age and emerging skills. For younger preschool children (3-6 years), optimal efficacy seems to rely on simple, highly predictable, and minimally interactive sensory environments, where familiar narrative elements like animals serve as reassuring anchors. Conversely, school-age children (6-12 years), whose executive functions are rapidly developing, derive greater benefit from applications introducing moderate interactivity, simple cognitive challenges, and gamification mechanisms (scores, rewards) that stimulate their sense of competence. Finally, adolescents, seeking autonomy and sensitive to social image, may perceive overly childish environments as infantilisin. Their engagement relies more on graphical realism perceived as credible, a certain narrative complexity, and, above all, a significant degree of control and freedom in interacting with the virtual world. Thus, personalising the choice of environment becomes a major lever of efficacy for this age group, as illustrated by the work of Dumoulin and colleagues (2019).

Table 1: Synthesis of Applications, Targeted Mechanisms, and Suitable Populations in Paediatric VR

Application (Type)	Description & Key Characteristics	Primary Cognitive Mechanism(s) Leveraged	Suitable Procedure Profiles	Optimal Age Range & Observations	Example Empirical Reference
SnowWorld (Interactive Immersive)	Interactive immersive icy landscape environment. Patient throws snowballs at targets (snowmen, igloos). Strong sensory saturation (visual, auditory).	1. Maximal attentional competition (multisensory saturation). 2. Active executive engagement (motor planning, continuous interaction).	Long and/or particularly painful procedures: • Extensive burn dressings. • Complex wound care.	6-12 years and Adolescents. • Physical interaction suits motor abilities. • "Cold" theme contrasts with burning sensation.	Faber et al. (2013)

Aqua / Underwater Environments (Passive to Low Interactivity)	Exploration of a calming underwater environment (fish, dolphins, landscapes). Primarily visual and auditory immersion, with gentle navigation.	1. Cognitive restructuring / Dissociation (complete disconnection from medical context). 2. Moderate attentional competition (visual captivation).	Short to medium-duration procedures, requiring rapid relaxation: • Injections, blood draws. • Minor dental care. • Short catheter placements.	3-6 years and 6-12 years. • Reassuring and predictable environment, ideal for young children. • Minimal interaction required, limiting frustration.	Allday (2016)
Simple Educational VR Games (Interactive, Goal-Oriented)	Games requiring simple, repetitive action (feeding a virtual animal, catching objects, solving a basic puzzle). Immediate positive feedback.	1. Targeted executive engagement (response inhibition, short-term working memory). 2. Reinforcement of sense of control (agency).	Standardised procedures of controlled duration: • Vaccinations. • Examinations like MRI (for immobility). • Minor sutures.	6-12 years. • Challenge level should be adjustable. • Simplicity of rules is crucial to maintain engagement without cognitive overload.	Dumoulin et al. (2019)
VR Hospital Tours / Preparations (Exposure, Education)	Simulation of the hospital environment (operating room, care trolley) or the schematic progression of a procedure (e.g., vaccine journey).	1. Cognitive restructuring via exposure (familiarisation, desensitisation). 2. Reduction of anticipatory anxiety (predictability).	Used in the pre-procedural phase, for: • Preparation for first surgery. • Reduction of pre-operative anxiety. • Explanation of a new examination (CT scan).	> 6 years (depending on comprehension). • Efficacy depends on perceived fidelity and child's abstraction capacity.	Eijlers et al. (2019)

Table 1: Synthesis of representative VR applications in paediatrics, linked to the discussed cognitive mechanisms, suitable procedures, and developmental characteristics.

The analysis of specific applications embodies these principles. Take the example of SnowWorld, initially developed for pain management in major burn patients. Its efficacy rests on a careful balance: a simple, repetitive motor interaction (throwing snowballs), a sensory universe thematically opposite to the burning sensation (cold), and complete immersion that isolates the patient. This application paradigmatically illustrates the mechanisms of attentional competition and active engagement of executive functions. At the other end of the spectrum, an application like Aqua favours passive immersion in a calming underwater environment, promoting visual exploration and a state of relaxation. Its use is often preferred for shorter procedures or in younger children, demonstrating the importance of the dissociation and emotional restructuring of the anxiogenic context. These two examples underline that there is no universal application, but rather a repertoire of tools whose selection must be guided by a fine-grained analysis of the clinical situation and patient characteristics.

6. Limitations, Practical Challenges, and Ethical Considerations

Despite its promising potential, the integration of virtual reality into paediatric clinical practice faces several practical limitations and ethical questions that warrant frank discussion. The most frequently reported is the incidence of cybersickness, a set of symptoms including nausea, dizziness, and headaches. As reported in the meta-analysis by Smith and colleagues (2020), this phenomenon affects on average 5 to 15% of paediatric users. It originates from a sensory conflict between the visual system, which perceives motion in the virtual environment, and the vestibular system, which does not register the corresponding bodily movement in reality. This risk, increased in young children, imposes a de facto limit on immersion session duration and requires attentive monitoring of non-verbal signs of discomfort. Beyond this side effect, concrete barriers persist: the non-negligible cost of equipment and software licenses, the time required for setup, learning, and rigorous disinfection of equipment between patients, and the imperative need to train caregivers not only in the technique but also in the underlying psychological principles, as highlighted in the integrative review by Addab and team (2022). Parallel to these practical challenges, a critical reflection on the existing scientific literature is necessary. Our analysis highlights several recurrent methodological shortcomings that temper the interpretation of promising results. Many studies suffer from modest sample sizes, limiting statistical power and the generalisability of conclusions. Pronounced heterogeneity in protocol design (exposure duration, application choice, measurement timing) considerably complicates direct comparisons between studies. Finally, the scarcity of longitudinal studies leaves us

ignorant of the long-term impact of VR on children's attitudes towards healthcare in the long run. A particularly concerning limitation is the frequent exclusion, in clinical trials, of the most vulnerable paediatric populations, such as children with autism spectrum disorders or intellectual disabilities. This exclusion creates a knowledge gap precisely when these children, often particularly anxious during care, could either greatly benefit from this type of tool or, conversely, present contraindications or atypical reactions.

Finally, the deployment of this innovative technology cannot bypass an in-depth ethical reflection. One pitfall to avoid is the instrumentalisation of VR as a tool of soft coercion, aiming to obtain the child's compliance through a distraction so effective that it circumvents the necessary process of age-adapted information, preparation, and consent. Consent must therefore pertain dually to the medical procedure itself and to the use of the technological tool, guaranteeing the child the right to refuse either. Another fundamental question is that of equity of access. VR, through its cost and infrastructure needs, risks exacerbating disparities between well-resourced and under-resourced institutions, creating a form of double standard in the management of paediatric distress. These ethical challenges are not isolated and reflect structuring issues common to the integration of cognitive technologies into sensitive sectors, requiring governance attentive to the principles of transparency, accountability, and equity (Boumbick, 2025).

7. Implications for Clinical Practice and Recommendations

For a successful and ethical integration, we propose a structured model articulated around three distinct yet complementary phases.

The first phase, pre-procedural, is one of preparation and choice. It requires an individual assessment of the child to gather their preferences, evaluate their prior experience with technology, and screen for potential contraindications such as a history of cybersickness. Whenever possible, it is essential to offer the child a personalised choice among several virtual environments suited to their age and the nature of the procedure, while clearly explaining the device's operation and obtaining their informed assent. This step of dual consent, covering both the medical procedure and the technological tool, is fundamental to respecting the child's autonomy and avoiding any feeling of coercion or manipulation.

The second phase, per-procedural, concerns the actual implementation and monitoring. The headset fitting must be meticulous to ensure optimal comfort and complete immersion, limiting leaks from the real visual field that could break the sense of presence. The caregiver's role

during this phase is crucial and nuanced. It is not a matter of withdrawing but of maintaining a reassuring presence, sometimes through discreet verbal contact, while performing the procedure with technical expertise that minimises its duration and discomfort. Attentive monitoring for non-verbal signs of distress or cybersickness is essential, with the possibility for the child or caregiver to interrupt the session at any time. The caregiver's posture thus evolves from that of a technical operator to that of a mediator facilitating immersion while ensuring physical and psychological safety.

The third phase, post-procedural, aims for debriefing and consolidation. A brief but meaningful debriefing with the child allows for valuing their endurance and linking the positive experience lived in the virtual realm with the successful completion of the real procedure. Formulations such as "You did a great job exploring the ocean, and at the same time, the care is finished" help anchor the experience as an overall success. Systematic documentation in the medical record of the application used, tolerance, and observed response is also recommended, thus creating a clinical memory that will guide and optimise future choices for the same child. This three-phase approach underlines that training for care teams must go beyond simple technical mastery of the tool. It must integrate a solid understanding of the underlying psychological mechanisms, principles of communication adapted to the anxious child, and awareness of specific ethical issues, thereby enabling a use that is flexible, secure, and truly centred on patient well-being. This proposal for an operational framework thus responds to the broader imperative of responsible ethical framing for immersive technologies (Boumbick, 2025).

8. Conclusion and Research Perspectives

In conclusion, this narrative review has allowed for structuring and deepening the understanding of the cognitive mechanisms by which virtual reality modulates procedural anxiety in paediatrics. By articulating the concepts of attentional competition, restructuring of cognitive schemas, and engagement of executive functions, we propose an integrative framework that moves beyond the simple notion of distraction to envisage VR as a genuine tool for emotional regulation and active reassurance. The evidence, albeit varied, converges to affirm the significant potential of this technology when implemented thoughtfully and in a child-centred manner.

The path towards optimal and ethical clinical integration, however, remains paved with challenges that must guide future research. A first priority lies in fundamental cognitive

neuroscience research to objectively identify, through brain imaging, the neural correlates of the proposed mechanisms, particularly the interaction between attentional networks, the prefrontal cortex, and the amygdala during immersion under stress. On a technological level, the development of "adaptive" or "intelligent" applications, capable of modulating their content in real-time based on behavioural or physiological indicators from the child, represents an exciting prospect for dynamic personalisation. From a clinical perspective, large-scale randomised comparative trials, using standardised measures and systematically including neurodiverse populations, are necessary to refine indications and contraindications. Finally, research in the humanities and social sciences must accompany this deployment, analysing sustainable economic models for equitable access, organisational impacts on services, and, most importantly, the perceptions and lived experiences of children, families, and caregivers. Beyond technological advancements, the essence of VR's success in paediatrics will reside in clinicians' ability to make it a relational mediator, a bridge to restore dialogue, control, and the child's dignity at the heart of the care experience. The ultimate challenge, as highlighted in contemporary reflections on cognitive technologies, is not to technicise the care relationship, but to humanise technology so that it serves our imperatives of benevolence and individualisation of practice (Boumbick, 2025). It is under this condition that VR can fully realise its promise: transforming a moment of vulnerability into an experience of resilience and competence for the child.

Bibliography

- Addab, S., Hamdy, R., Thorstad, K., Le May, S., & Tsimicalis, A. (2022). Utilisation de la réalité virtuelle dans la gestion de la douleur et de l'anxiété liées aux procédures pédiatriques : une revue de la littérature intégrative. Journal of Clinical Nursing, 31(21-22), 3032-3059.
- Allday, E. (2016). For children in pain, virtual reality offers dolphins and hope. San Francisco Chronicle.
- Beck, A. T. (1976). Cognitive therapy and the emotional disorders. International Universities Press.
- Boumbick, M. (2025). Intelligence artificielle dans toutes ses disciplines. Revue Belge, 11(130), 27-49.
- Csikszentmihalyi, M. (1990). Flow: The psychology of optimal experience. Harper & Row.
- Dumoulin, S., Bouchard, S., Ellis, J., et al. (2019). A randomized controlled trial of the use of virtual reality for needle-related procedures in children and adolescents in the emergency department. Games for Health Journal.
- Eijlers, R., Utens, E. M., Staals, L. M., de Nijs, P. F., Berghmans, J. M., Wijnen, R. M., ... & Legerstee, J. S. (2019). Systematic review and meta-analysis of virtual reality in pediatrics: effects on pain and anxiety. Anesthesia and Analgesia, 129(5), 1344.
- Faber, A. W., Patterson, D. R., & Bremer, M. (2013). Repeated use of immersive virtual reality therapy to control pain during wound dressing changes in pediatric and adult burn patients. Journal of Burn Care & Research, 34(5), 563-568.
- Kahneman, D. (1973). Attention and effort. Prentice-Hall.
- Koller, D., & Goldman, R. D. (2012). Distraction techniques for children undergoing procedures: a critical review of pediatric research. Journal of Pediatric Nursing, 27(6), 652-681.
- Lazarus, R. S., & Folkman, S. (1984). Stress, appraisal, and coping. Springer.
- Malloy, K. M., & Milling, L. S. (2010). The effectiveness of virtual reality distraction for pain reduction: a systematic review. Clinical Psychology Review, 30(8), 1011-1018.
- Miyake, A., Friedman, N. P., Emerson, M. J., Witzki, A. H., Howerter, A., & Wager, T. D. (2000). The unity and diversity of executive functions and their contributions to

complex frontal lobe tasks: A latent variable analysis. Cognitive Psychology, 41(1), 49-100.

- Slater, M., & Sanchez-Vives, M. V. (2016). Enhancing our lives with immersive virtual reality. Frontiers in Robotics and AI, 3, 74.
- Smith, V., Warty, R. R., Sursas, J. A., Payne, O., Nair, A., Krishnan, S., ... & Vollenhoven, B. (2020). The effectiveness of virtual reality in managing acute pain and anxiety for medical inpatients: systematic review. Journal of Medical Internet Research, 22(11), e17980.
- Tas, F. Q., van Eijk, C. A., Staals, L. M., Legerstee, J. S., & Dierckx, B. (2022). Virtual reality in pediatrics, effects on pain and anxiety: A systematic review and meta-analysis update. Pediatric Anesthesia, 32(12), 1292-1304.
- Trottier, E. D., Doré-Bergeron, M. J., Chauvin-Kimoff, L., Baerg, K., & Ali, S. (2019). La gestion de la douleur et de l'anxiété chez les enfants lors de brèves interventions diagnostiques et thérapeutiques. Paediatrics & Child Health, 24(8), 522-535.
- Won, A. S., Bailey, J., Bailenson, J., Tataru, C., Yoon, I. A., & Golianu, B. (2017). Immersive virtual reality for pediatric pain. Children, 4(7), 52.
- Woo, A. K. (2010). Depression and anxiety in pain. Reviews in Pain, 4(1), 8-12.