



Innovations in Child Mental Health: Integrating AI and Virtual Reality Technologies

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Virtual reality



- **Virtual reality (VR)** is a computer-generated simulation of the three-dimensional environment with which one can interact in a seemingly real way
- It generate **realistic images, sounds and other sensations in a virtual environment**
- Users are **“immersed”** in a computer-generated environment via a human-computer interface
- VR provides **rich visual and auditory stimuli**, as well as peripheral tactile and olfactory stimuli.



- **Computer-Generated Simulation**

VR creates **three-dimensional environments**.

- **Immersive Experience**

Rich **visual, auditory, tactile, and olfactory stimuli**.

- **Realistic Perception**

Users know VR isn't real. Yet they may feel they've experienced simulations in reality.

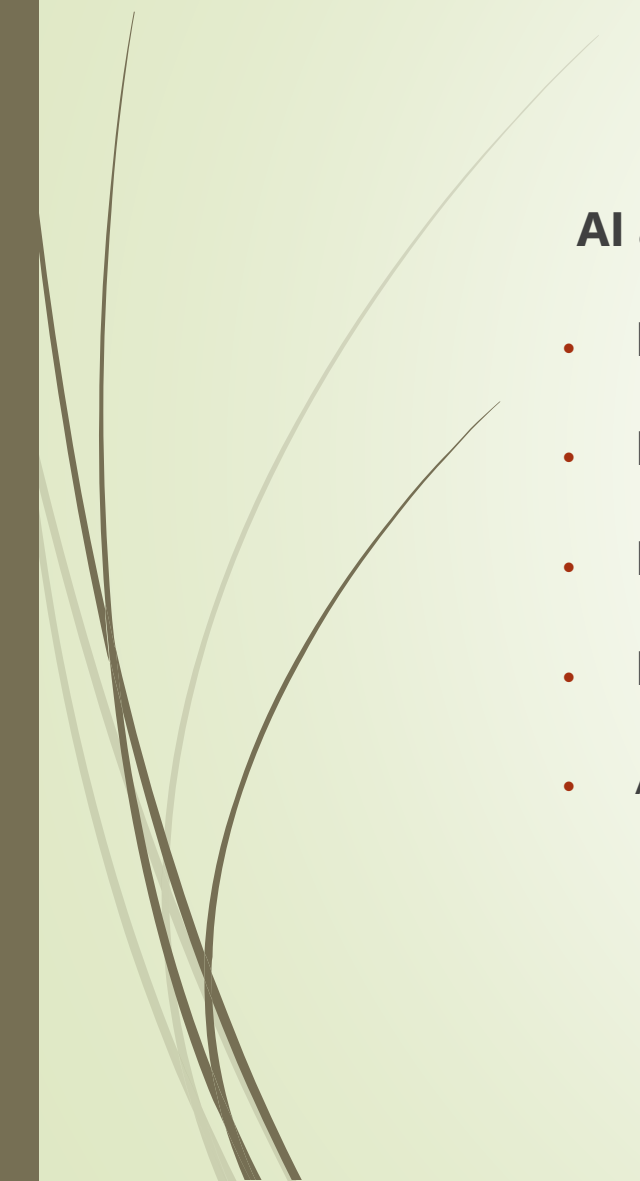
VR in Medicine: A Growing Field

- 1** — 2001
Only 739 VR publications in PubMed.
- 2** — 2019
Publications surged to 10,357.
- 3** — 2025 (Projected)
Expected to exceed 3.5 million publications.
- 4** — Cost Reduction
From \$100,000 (1990s) to under \$100 today.



Implications of AI in Virtual Reality

AI and VR are synergistic technologies where AI enhances VR by enabling:

- Personalized, adaptive virtual worlds
 - Natural and intuitive user interactions
 - Realistic and dynamic content creation
 - Intelligent, responsive virtual characters
 - Accurate spatial understanding and object manipulation
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Advanced Assessment and Treatment

Behavioral Analysis

AI analyzes behavior, speech, and interaction patterns. It identifies early signs of autism, anxiety, depression, and ADHD.

VR provides controlled environments for precise assessment.

Interactive Rehabilitation

Immersive, safe environments allow gradual exposure to challenges. Children can face fears and social situations safely.

AI personalizes each virtual experience for maximum effectiveness.



Advanced Assessment and Treatment

- ▶ Empowering social and cognitive skills
- ▶ Using AI, **interactive games and exercises** are designed within virtual reality environments to **improve children's focus, problem-solving skills, working memory, and executive functions.**
- ▶ These methods are especially useful for children with **ADHD and autism.**
- ▶ **Simulation of real-life situations:** Virtual reality enables simulation of scenarios that are difficult or impossible for children with psychiatric disorders to experience in real life, such as being in public places or interacting with others.
- ▶ AI allows precise adjustment and control of these scenarios

- Increasing treatment effectiveness:
- The combination of AI and virtual reality makes treatments
 - ✓ **more accurate**
 - ✓ **monitorable**
 - ✓ **responsive with immediate feedback**
 - ✓ **allowing closer tracking of progress and optimization of interventions**





Key Benefits

- ▶ **Safety:** Controlled environments eliminate real-world risks.
- ▶ **Personalization:** Tailored interventions match each child's unique needs.
- ▶ **Engagement:** Interactive formats increase therapy adherence.
- ▶ **Measurable Outcomes:** Precise tracking of therapeutic progress.
- ▶ **Adolescents have a high acceptance of new technology.**
VR technology is very attractive to them



Implications in Child & Adolescent psychiatry

➤ Anxiety disorders

- ✓ The most studied area is that of anxiety disorders
- ✓ Several meta-analyses have reported on the effectiveness of VR intervention on the assessment and treatment of various anxiety disorders
- ✓ **Measurements of objective bio-signal data**, such as changes in the heart rate and galvanic skin reflex
- ✓ Bio-signals related to anxiety can be monitored in real time, and exposure to the anxiety-inducing stimulus can be gradually increased

Applications in Anxiety Treatment



Evidence-Based Treatment

Meta-analyses confirm VR effectiveness for various anxiety disorders.



Bio-Signal Monitoring

Real-time tracking of heart rate and galvanic skin reflex.



Graduated Exposure

Anxiety-inducing stimuli gradually increased based on bio-feedback.



Applications in Anxiety Treatment

- **Specific phobias (SPs), particularly flight phobia,** are among the most studied areas of VR therapy
- **Social anxiety disorder (SAD):** treatment methods include the use of computer-generated scenarios which are created using VR namely, presentations, interviews, and meetings for patients to deliver a speech
- **PTSD:** By simulating traumatic situations in VR in a controlled and safe environment



Other Implications

- **ADHD** (Assessment and attention training)
- **ASD**
- **Social Skills training and education**
- The biggest advantage of VR therapy is that **it enables simulation of various social situations**, in which each social element is planned and controlled by the therapist in a virtual situation

Virtual Classrooms: Enhancing Attention and Social Skills

1 School Environment Simulation

Realistic classroom settings that mirror real-world educational environments

2 Attention Span Improvement

Structured activities designed to gradually increase concentration abilities



3 Academic Skills Development

Interactive lessons that adapt to individual learning patterns and needs

4 Social Adaptability Training

Scenarios that teach appropriate social interactions in educational settings



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- For non-clinical groups, VR is widely used in **smoking-prevention** education in teens
 - VR can simulate **relaxing situations** such as natural landscapes and meditation spaces

Implication in Eating Disorders

- VR uses visual stimuli : 1)to **control craving** for high-calorie foods 2) to **change the patient's body image**

Results:

- changes in the individual's body image
 - increased motivation to change
 - increased self-esteem
 - reduced body image disturbances
 - binge eating, and purging behavior.
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- These therapeutic effects **lasted for about a year .**



VR-Based Biofeedback for Self-Regulation

- Evaluation of the feasibility of a virtual reality–based biofeedback (VR-B) treatment to improve **self-regulation** in youth with psychiatric problems:

Repeated playthroughs of the game showed an **improvement in emotional regulation**, which would suggest that participants were better able to regulate after playing the game.

Limitations and Safety Concerns in VR Therapy

Methodological Limitations

- Small sample sizes limiting statistical power
- Lack of adequate control groups for comparison
- Absence of double-blind study designs
- Need for more rigorous research protocols

Physical Side Effects

- Simulator sickness during extended VR sessions
- Symptoms including nausea, dizziness, and disorientation
- Eye strain and potential vision impacts
- Balance disruptions after immersion

Psychological Concerns

- Potential for VR addiction similar to internet addiction
- Risk of dissociation from reality with frequent use
- Possible anxiety triggered by immersive experiences
- Need for safety guidelines and usage protocols



Conclusion

- ▶ **Virtual reality (VR)** techniques work very effectively with artificial intelligence (AI), and their combination significantly enhances the quality, immersion, and interactivity of VR experiences.
 - ▶ As AI algorithms improve in their ability to recognize emotional states and behavioral patterns, VR therapy applications will become increasingly sophisticated in their capacity
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