

Augmented Reality

Subjects: **Nursing**

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Research shows the beneficial effects of applying Augmented Reality technology to improve different abilities in children and adolescents with Autism Spectrum Disorder: cognitive and emotional processes, social communication, theory of mind, attention, and functional and motor outcomes.

autism

augmented reality

children

adolescents

outcomes

technology

1. Introduction

Virtual reality (VR) provides sensory experiences in artificial environments through the computer, enabling virtual interactions. Augmented reality (AR), that constitutes a part of VR, allows an interaction in a physical world, which is not as artificial as in the case of VR^[1].

2. Applications

The majority of the analyzed studies demonstrated the beneficial effects of applying AR technology to improve diverse cognitive and emotional processes, social communication, theory of mind abilities like facial emotion recognition, attention, as well as functional and motor abilities. In effect, persistent difficulties in social communication and social interaction across multiple contexts as manifested by restrictions in social-emotional reciprocity, in developing and understanding relationships, or in nonverbal communicative behaviors used for social interactions^[2] represent core characteristics of ASD. This symptomatology along with the problems associated with such a heterogeneous and complex disorder like ASD drives the need for specialized, individualized, and evidence-based interventions^[3]. Thus, in the last decade, technological interventions addressed at children and adolescents with ASD have increased as a complement to cognitive-behavioral treatments based on observational learning proposed by Bandura^[4].

From a qualitative perspective, these findings support the claim that the use of AR can provide a meaningful and enjoyable experience. In fact, many of the studies included in this review^{[5][6][7][8][9]} report that AR applications not only promote social skills and new ways of learning among individuals with ASD but also offer them an engaging and cognitively demanding experience. The use of AR makes them feel more motivated and helps them understand information. Specifically, the majority of participants of the studies included in this review faced the experimentation with enthusiasm and, during the sessions, showed improvements in attention and response time^{[10][11][12]}. Additionally, parents reported a high level of satisfaction with the different AR applications^[13]. In

general, the literature evidences that caregivers and teachers reported that children with ASD improved social interactions through advancements in nonverbal communication, social engagement, and eye contact while using AR technology^{[14][1]}.

Findings indicate that AR technology is an effective instructional strategy for teaching a multitude of behaviors in real-world settings for children and adolescents with autism^[15]. AR applications can contribute to the way individuals with ASD learn daily life skills as well as can facilitate individuals' understanding of social communicative behavior, enhancing attentional capacities and contributing to the recognition of facial emotions, among other advantages. The higher degree of realism provided by AR plays a key role in promoting a wide range of abilities that facilitate the autonomy and quality of life of children with ASD, allowing further approximation to the interactions with the real world.

Studies have identified the advantages provided by computerized learning of different functional and social skills^{[14][15]}. Specifically, among the strengths of the use of technology in interventions addressed at children with ASD, the possibility to clearly define tasks, to keep the focus of attention, to minimize distractions, and to facilitate personal skills and strategies with a tool that can be used for many applications is noteworthy. Another important advantage of the interventions based on AR technology is the reduction of social demands, sometimes unpredictable, that may be problematic for individuals with ASD. Likewise, the multimodal component provides an extensive multi-sensory experience (giving opportunities for users to use touch screens, sensors, cameras, and visual and audio cues), which is recommended in interventions directed at the population with ASD. However, caution must be taken with the use of programs based on technology like AR because there is a risk of more social isolation of children/adolescents with ASD. Another possible disadvantage is the lack of generalization of the benefits obtained after treatment.

AR is a kind of virtual reality technology that provides the individual with a mixed interactive experience, in other words, real and virtual, in an environment where it is possible to learn new behaviors and their generalization. Empirical studies that have analyzed at the moment the strengths of this technique with individuals with autism show promising results. Despite there being still scarce empirical investigations that the EBP criteria, the findings of this review suggest that AR techniques may be an effective complement in the field of cognitive-behavioral interventions in children and adolescents with ASD.

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