



The role of VR and AR in the inclusion of children with autism spectrum disorder in school life

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Abstract. Children with special education needs should be integrated into their surroundings without exclusion or discrimination. This inclusion begins with the school as an educational setting where children spend the majority of their time. Traditional pedagogical methods have demonstrated their inability to fully integrate students with special needs into their school environment. As a result, the search for modern alternatives has become an urgent matter to achieve equal opportunities for all children and ensure their acquisition of life and learning skills that will enable them to participate successfully in their societies. One of the successful methods for achieving the aforementioned objectives is the integration of ICT. The focus of this article will be on the role of VR and AR in bridging the gap between children with Autism Spectrum Disorder (ASD) and the real world to help them develop their creativity and consolidate their self-confidence for later full integration into school life and connecting with the real world without fear or anxiety.

Keywords: Children with ASD, Inclusion, VR/AR.

1 Introduction

An effective education system should provide equal opportunities and integration for all learners, including those with special needs. However, traditional approaches and curricula have demonstrated their limitations in achieving this objective, prompting the need for alternative measures. One of these alternatives is the integration of Information and Communication Technologies (ICT) into the educational process. These technologies offer a diverse learning environment that encourages all types of learners to participate fully in the educational process, particularly those with special needs. Despite the potential benefits of ICT, learners with special needs still require specialized attention and scientific curricula to enable their complete integration into school and society.

Recent research has investigated the effectiveness of incorporating virtual and augmented reality technologies into special education. For example, Cakir and Korkmaz (2019) found that augmented reality (AR) teaching materials were useful in allowing children with special needs to meet their basic needs without being dependent on others. Similarly, Köse and Güner-Yildiz (2021) revealed positive findings regarding the use of AR as a learning material in special needs education. Nuguri et al. (2021) developed a cloud-based virtual reality learning environment (VRLE) system that has potential applications in special education. Dechsling et al. (2021) conducted a scoping review on virtual and augmented reality in social skills interventions for individuals with ASD. They found that VR-based assessments and intervention tools were promising and acceptable among individuals with ASD, and Fridhi et al. (2018) emphasized the role of VR and AR in improving communicative and emotional skills in children with Autism Spectrum Disorder (ASD).

The literature suggests that VR and AR have the potential to improve the integration of children with special education needs into their school environment, particularly for those with ASD. The use of these technologies has shown promise in improving communication and emotional skills in children with special needs. However, further research is needed to determine the optimal way to integrate these technologies into educational settings to achieve equal opportunities for all children.

In this context, this article focuses on children with Autism Spectrum Disorder (ASD). Individuals with ASD often encounter difficulties in fully engaging with the real world, leading to their exclusion from society and exposure to discrimination. However, incorporating virtual and augmented reality technologies in the educational process can create an inclusive environment that provides these children with the necessary skills and experiences to integrate fully into society.

To fully understand the implications of incorporating virtual and augmented reality technologies into the education of children with ASD, it is necessary to examine the behavioral dimensions of the disorder. Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder characterized by deficits in social communication and the presence of restricted and repetitive behaviors (American Psychiatric Association, 2013). These two behavioral dimensions represent the core defining features of ASD, with associated dimensions, such as intellectual and language ability, used to describe the heterogeneity of the disorder (Ousley & Cermak, 2014). It is also important to note the known gender disparity in ASD diagnoses, with girls being diagnosed less frequently and at later ages than boys (Hiller et al., 2016).

Therefore, this article aims to explore how the integration of virtual and augmented reality technologies can improve the education of children with ASD and facilitate their full integration into society. The article will review the current state of knowledge in the field and examine the potential benefits and limitations of using these technologies in education.

2 Challenges faced by Children with ASD in school

The challenges faced by children with Autism Spectrum Disorder (ASD) can pose a significant hindrance to their full engagement in school life and successful integration into classroom activities, as observed in a group of such learners in Moroccan schools. An adequate comprehension of these difficulties constitutes a fundamental precondition for mitigating or overcoming their severity in learners. The following are the most observed difficulties:

- a. The fear of others among children with ASD may obstruct their social interaction within the classroom group, rendering communication with their peers impossible. Consequently, these children may not participate in group activities, leading to isolation and a delay in comprehending social cues and norms. Many children with autism spectrum disorder (ASD) experience high levels of anxiety. (Rogers et al. 2016)
- b. Difficulty with both verbal and non-verbal communication, which can have significant consequences in their academic performance (Golan et al. 2008). To ensure their success, educational approaches need to consider the psychological state of these learners, particularly in relation to their peers, and provide appropriate encouragement and motivation. Any negative experiences, such as verbal violence or discrimination, can worsen their situation and lead to premature school leaving.
- c. Hypersensitivity to external environmental stimuli contributes to distractibility and lack of focus in children with ASD, causing confusion and frustration when they cannot adjust to or perceive the components of the external world (Dirix et al. 2021).
- d. Organizational difficulties such as changes in classroom, school year organization, or class schedules can have a significant impact on children with ASD. These learners require a specific routine or structure to learn effectively, and any disruption to this routine may cause anxiety and confusion. Therefore, providing a structured and organized learning environment is necessary to support children with ASD.

Each person with ASD is unique and will have different symptoms, deficits and abilities. Because of the range of characteristics, this condition is named a "spectrum" disorder, where ones' abilities and deficits can fall anywhere along a spectrum, and thereby, support needs may range from none to very substantial. It is a complex life-long condition that impacts not only the person with ASD, but their families, caregivers and communities. (Ofner et al., 2018)

3 Overview of VR and AR technology

It is only in the last decade that VR and AR technologies have gained increasing interest due to their accessibility to a broader audience. VR creates a computer-generated three-dimensional environment where users can interact and move around within it. On the other hand, AR enriches the real world by adding virtual elements such as video clips and three-dimensional graphics, experienced through various devices like smartphones, headphones, or special glasses. According to Sherman and Craig (2018), virtual reality creates a simulated 3D environment where users can interact with and manipulate objects, while augmented reality superimposes virtual elements onto the real world.

Both VR and AR have wide applications in fields such as gaming, medicine, military, education, and therapy. In education, these technologies offer interactive and engaging learning experiences that motivate learners to interact with the content in innovative ways. However, the integration of AR and VR in Moroccan schools is limited by the high cost of the necessary devices and the scarcity of qualified human resources that can ensure safe and effective use of these technologies.

4 The use of VR and AR in enhancing creativity and self-confidence in children with ASD

When working with children who have autism spectrum disorder, building self-confidence is an essential component that should be fostered and strengthened. Virtual reality and augmented reality technologies provide a controlled and safe environment that enables children with autism to build social skills and self-confidence. By gradually creating somewhat stressful and confusing situations, such as speaking in front of a crowded hall or being in a busy park, these technologies allow children with autism to develop coping strategies and acquire skills to manage their emotions. According to a study by Kandalaf et al. (2013), virtual reality and augmented

reality technologies can improve the social and communication skills of children with autism. These technologies provide a safe and controlled environment for children with autism to practice social interactions and communication, which can help reduce their anxiety and build their confidence.

Using virtual reality and augmented reality technologies, children with autism can gradually and safely engage in real-life situations. These technologies help children with autism gain a better understanding of their emotions and develop the skills to manage them. The interactive environment provided by virtual reality and augmented reality technologies can contribute significantly to the development of creativity and innovation skills, especially for children with autism spectrum disorder.

For children with autism who exhibit excessive movement or hypersensitivity, virtual reality and augmented reality technologies can be used to develop their exploration and creative abilities. Augmented reality technology can offer unlimited possibilities for interaction with the surroundings and enhance awareness of the space they occupy. Virtual reality technology can provide a safe gateway to reality by creating a simulated space for the learner to interact with and communicate with all its components. This technology can stimulate the imagination of children with autism and enable them to blend in with the components of the environment.

According to a study by Yuan et al. (2018), virtual reality can be used to provide a safe and controlled environment for children with autism to explore and develop their creative abilities. The study found that virtual reality technology can help children with autism overcome sensory challenges and develop their ability to perceive and interact with their environment.

Additionally, another study by Lorenzo et al. (2019) found that augmented reality technology can be used to improve the social communication skills of children with autism, by providing a safe and controlled environment for them to explore and interact with their surroundings.

5 Potential benefits of VR and AR in promoting full integration into school life and the real world

Virtual and augmented reality technology has the potential to revolutionize the field of education as an alternative to traditional teaching methods, offering unique and engaging opportunities for learners to interact with educational materials. In particular, children with autism spectrum disorders can greatly benefit from these technologies by simplifying abstract concepts and improving their understanding of subject matter (Chen et al. 2016). For example, virtual reality can be used to create three-dimensional shapes to aid in mathematical understanding or to visit virtual tourist sites to enhance their cross-cultural interaction skills.

Moreover, virtual and augmented reality can promote the integration of children with autism spectrum disorders by encouraging communication and cooperation with their peers within the classroom. By providing interactive educational structures and environments that enhance teamwork, communication, and problem-solving skills, these technologies can help children with autism spectrum disorders to better engage with society. Virtual reality and augmented reality systems can create simulations and virtual environments that allow children to interact with each other in ways that are not possible in traditional classrooms, and this can help to improve social skills and reduce anxiety.

Virtual and augmented reality technology can also reduce risks for children with autism spectrum disorders and shorten their learning curve to adapt to the real world. Virtual and augmented reality systems can provide a safe and controlled environment for children with autism spectrum disorders to practice social and communication skills, reducing the risks of real-life situations (Saiano et al., 2015).

6 Conclusion

The traditional approach to education has limitations in providing equal opportunities and integration for learners, especially those with special needs such as Autism Spectrum Disorder (ASD). Thus, it has become necessary to consider alternative measures such as incorporating Information and Communication Technologies (ICT) in education. Virtual and augmented reality technologies offer a diverse and interactive learning environment that enables full participation of all learners, including those with ASD.

This article highlights the potential benefits of using virtual and augmented reality technologies in enhancing the education of children with ASD and promoting their integration into society. Additionally, the article emphasizes the need for developing new pedagogical approaches based on AI, particularly the use of AR and VR, and creating an interactive curriculum based on these technologies.

Furthermore, conducting precise studies on the impact of VR and AR on students with ASD in Morocco, as well as studying the applicability of these approaches on Moroccan students with ASD in light of their financial and life conditions, and the readiness of government officials to adopt these innovative approaches, are vital for successful implementation.

However, it is crucial to recognize that children with ASD require specialized attention and a robust scientific curriculum to ensure their complete integration into school and society. Therefore, while considering the potential benefits and limitations of virtual and augmented reality technologies, creating an inclusive educational environment for children with ASD should be a top priority.

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