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Email: [transylvanianreview@gmail.com](mailto:transylvanianreview@gmail.com)

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# Augmented Environment: Learning through Augmented Reality for Children with Pervasive Developmental Disorders

Rim LARIBI<sup>1</sup>, Ahmed BOUAJILA<sup>1</sup>, Adel FRIDHI<sup>1</sup>, Rahim KOUKI<sup>2</sup>, Naila BALI<sup>2</sup>

<sup>1,2,3,5</sup>Higher Institute of Childhood Executives (ISCE), UC, TUNISIA

<sup>1,4</sup>Higher Institute of Special Education, Tunisia

<sup>1,4</sup>Research Laboratory on Disability and Social Unsuitability, LRI3AS01, ISES, UMA, Tunisia

## ABSTRACT

The potential of augmented reality in the educational action of people with pervasive developmental disorders is the focus of our article. In specialized education, the teacher is encouraged to seek new support to enhance the abilities and skills of the people we are studying. The teacher is perceived as: "a person who promotes the implementation of specific methods and techniques... within a class or in a daily living environment". Our investigation focuses on the advantages of using virtual reality in the care of children and adolescents with developmental disabilities. Our article aims to highlight the advantages of using AR in the treatment of people with PDD, pervasive developmental disorder. The creation and three D modeling of avatars and a daily virtual environment (DVE) close to reality have established themselves in the realm of specialized education, offering numerous advantages.

**Keywords:** Augmented reality; Pervasive developmental disorders; specialized education; 3D modeling; Avatars; Daily virtual environment

## 1. Introduction

Psychologists, doctors, and neurophysiologists are focusing on a group of mental disorders called "pervasive developmental disorders" (PDD) The manifestation of these disorders in children is a significant lapse in the development of a certain number of essential functions, such as communication and socialization. New technologies have led to the creation of 3D models of virtual environments prior to reality and the application of virtual reality to avatars. The term refers to an interactive experience of the real-world environment in which certain things residing in the real world (objects, people, events, etc.) are supplemented (enhanced) by computer-generated perceptual information. A system corresponding to three basic characteristics can be defined as augmented reality [1]. The investigation of a person's cognitive, emotional, and cognitive abilities through the creation of AR has piqued the curiosity of researchers. The research in this area is still in its infancy, but the potential contribution of AR to the evaluation of children with PDD appears promising, and these children are likely to benefit from this technological breakthrough [2]. AR for the assessment of children with pervasive developmental disorder (PDD) appears very promising, and our target population will benefit from this new technology. The condition of children with pervasive developmental disorders (PDD) is generally assessed by expert teachers via "paper and pencil" methods, which are currently traditional. Traditional methods have also been reproduced in digital mode thanks to new technologies, and subsequently the question is whether augmented reality would be a modality to assess our PDD population? ". The aim of our research is to provide an answer to our problem by providing complete information on the use of augmented reality. First, the cognitive functioning of children with PDD will be discussed according to various hypotheses. Next, AR and associated modeling will be described, as well as the advantages of this new technology. *Avatar* creation will be considered *both* a means of intervention with PDDs and a means of evaluating emotions. The discussion will *also examine* whether AR would be a more appropriate *method for evaluating and enhancing* the behavior of children with PDD [3].

## 2. Methodology

The advantages of *using* AR in the care of children suffering from a pervasive developmental disorder *are addressed in our research*. Several studies and research have demonstrated the use of digital media and their beneficial role in the care of a population with specific needs, which requires immersive and interactive technical means. *Several studies and research have demonstrated the use of digital media and their beneficial role in the care of a population with specific needs, which requires AR could be a teaching aid for people with PDD, helping them improve qualitative changes* in communication and social interaction [4]. To this end, specialist educators for PDD children advocate the interest of using new technologies in improving the skills of this population and thanks to models and avatars, created by AR [5]. It is important for specialized educators to take advantage of the interest of people with PDD to work with people from various fields by inspiring multiple and diverse methods and activities. Professionals in special education and families and parents of people with PDD use these instruments because they serve as facilitators and mediators. As part of this research project, the following research question will be asked: What is the impact of using AR in improving learning in children with PDD? [6]. We pose the following research questions that we may or may not want to address during our study. What role does AR play in the care of people with PDD, according to specialized educators?

### Object modeling and interactive training

Interactive and immersive training for children with pervasive developmental disorders helps to master more knowledge in each lesson, which is why augmented reality applications aimed at this population can be one of the ways to learn anatomy. Augmented reality essentially consists of interacting with avatars modeled in 3D, learning by this method is very easy because this model (Figure 1) is interactive with sound recording in such a way that the child can be in total immersion in the scene modeled in 3D while hearing (the words: two, three, four, etc....) (Figures 1a, 1b & 1c). In many teaching cases, theoretical knowledge is not enough to acquire adequate skills for PDD children and in specialization in general. in our case PDD learners should not be simple listeners and passive observers, this is why we need practice and concrete experience. Thanks to interactivity, augmented reality functionalities can transform a virtual environment into a nearreal environment. With AR and 3D modeling, PDD can gain some experience later. It is no surprise that this population will be engaged, understand the subject better and learn faster (Figure 2) [7].



Figure 1a: Teach a TED child to say “two”



Figure 1b: Teach a TED child to say “three”.



Figure 1c: Teach a TED child to say “four”

***Learning in augmented reality at all ages***

- The education system can be profoundly disrupted by augmented reality. And this, because it is applicable to all ages.
- Primary and secondary. AR tools can be used in the classroom to enhance comprehension of the topic. They let you get into deeper topics (like math, physics, etc.) with a

lot of fun and excitement. Young people can be stimulated by it.

In the higher education. Universities are increasingly using augmented reality solutions. They're used in the arts and sciences to get kids excited and make learning more fun. In chemistry, for instance, AR aids in acquiring skeletal information (Figure 3)

Professional training. AR learning makes it easier for DPs undergoing retraining to pick up fresh abilities. Learning in augmented reality will allow them to handle new equipment in complete safety. But also to get a feel for their work environment. The results of a study show that immersive learning with virtual reality boosts comprehension for children with intellectual disabilities by 40%. This increase is thanks to real-time interaction and immersion.

### 3. Results and Discussion

#### *Classic method*

Learning methods have always been an attractive subject for me. They evolve over time according to current technologies. This is why I can't help but read the articles that talk about it. Even when I happen to come across these by coincidences that I would describe as fortunate.

The latest one dealt with a dynamic teaching method that I wanted to learn more about. This quest ultimately led me to take a closer look at other educational methods and to share with you the analysis that follows. It will cover 3 traditional teaching methods and 3 alternative teaching methods.

#### *Traditional or classic methods*

When it comes to transmitting knowledge, if you are of the old school, it is certain that the image that appears to you is that of the trainer who stands masterfully in front of the learners, a painting in the background. The instructor transmitting, the learner receiving within a fairly strict standardized framework.

This is the typical classic system which uses several means of transmission, 3 of which will interest us.

Let's discover the interrogative, active and demonstrative methods through their functioning, their advantages and their disadvantages.

- The traditional interrogative or maieutic method

This educational process uses questioning techniques to get the learner to identify the subject, to bring out what they already know, to somehow teach themselves part of the course content.

Planned in advance, these questions aim to engage students in discussion and stimulate critical thinking. They can be open, closed, hypothetical or direct.

- Advantages of the interrogative method

The good communication that is established immediately between the teacher and the learners.

Significant student involvement which increases their understanding of the information provided.

The awakening of the logical mind because the student establishes links between information.

- Disadvantages of the interrogative method

The disadvantages of the interrogative method are to be considered not in the method itself but in the way in which it is carried out by the teacher.

Time-consuming preparation for the trainer.

The skill of the trainer put to the test; he must constantly redirect the debate through the learners' responses

The high probability of a heavy atmosphere when questions remain unanswered for a long time.

#### *The traditional active or discovery method*

It is impossible to think of the college years without remembering the groups formed to prepare and submit work requested by the teacher. This learning process used to solve a problem is the active method.

It can be individual but it is often carried out in groups. It allows you to discover and learn from a concrete case, to work collaboratively and to acquire practical experience.

- Advantages of the active method

The incentive for motivation, self-reflection, and argumentation for the learner who searches and finds by his own means.

Extended comprehension and long-term memorization.

Strengthening relationships between members of the working group, the spirit of collaboration.

#### *Disadvantages of the active method*

The trainer needs more time or appropriate management of this time because group work takes up a large part of it.

The difficulty for the trainer in leading the different groups because he may have difficulty supervising without leading.

The difficulty for the learner to concentrate or get involved if they have no knowledge of the subject to be covered.

#### *The traditional demonstrative or affirmative method*

The demonstrative method consists of first demonstrating a process to the learner, then having him reformulate said process and finally apply what he has learned.

Demonstrative pedagogy therefore consists of three stages, the first of which highlights the teacher who presents a process. The second highlights the learner who repeats the steps learned. The third highlights learner and trainer, the first of whom takes action to reproduce the process while the second observes it.

- Advantages of the demonstrative method

Increased memorization of the lesson through its repetition.

The assurance of know-how acquired by concrete reproduction. Easy verification of acquired knowledge.

- Disadvantages of the demonstrative method

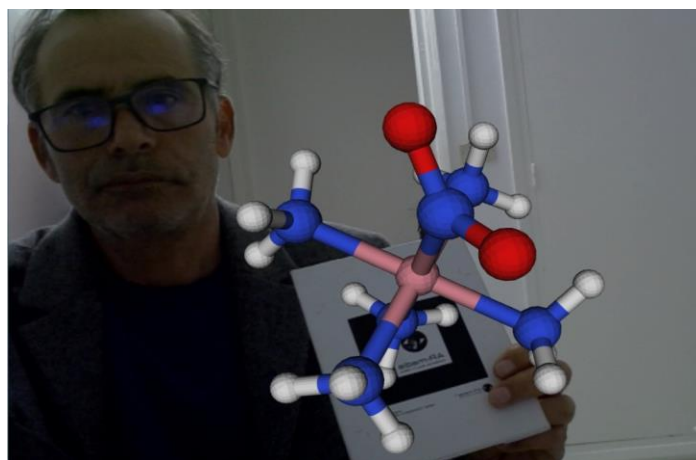
Limiting the number of learners to 12 for good monitoring. The requirement for perfect mastery of the subject by the trainer. The need for great involvement of the trainer.

#### *New method*

Sports education has been considered a therapy session for children suffering from a pervasive developmental disorder. It could be a very innovative approach for the target people to use immersive and interactive real-time augmented reality in this area. To adapt this technology, evaluation of these devices is essential. Therefore, AR is an innovative technique we used to measure the acceptance of several children with PDD [8]. Our research relies on the inherent effectiveness of digital abilities and attitudes to demonstrate favorable acceptance of augmented reality among this group [9]. We have this technology to evaluate the acceptance of augmented reality to promote physical activity [10]. *Several models are used to analyze AR and its influence on individual behavior of this population [11].* Public health problems of the 21st century include physical inactivity linked to PDD. The latest tech likely to boost the physical and mental readiness of people with developmental disabilities is AR, which has seen significant progress in the past decade. The dazzling progress in the creation of 3D and 360-degree virtual environments gives athletes the chance to train differently beyond their usual routine. Augmented reality allows you to play around with the environment, focusing on the skills the learner needs to master to train them on their own. A real asset for PDD children, who can repeat certain movements in isolation, in an environment close to real life, while minimizing the risk of injury. The equipment made available for the project allows for the following activities: (Figure 5) In a free space, for PDD participants, the sporting gestures are played. Our example is played in a closed space. An avatar appears in a simulated physical position [12].



**Figure 2:** Interaction of TED children with avatars.



**Figure 3:** Example of application of AR in chemistry.



**Figure 4:** Teach DP children not to touch fire.



**Figure 5:** Teach PDD children's sports gestures.

#### 4. Conclusion

The integration of augmented reality in large stores is becoming an increasingly common practice, more precisely in the field of education. With this new method of learning aimed at PDD children, the present research aimed to analyze from a practical point of view how the application of AR affected several huge skill variables in this population. The results of our research work in the analyzes after carrying out the practical part showed how the experience with AR improved all the evaluated variables [13]. Moreover, contacting this technology has enabled children with PDD to improve their perception of learning and to arouse their interest and knowledge. Finally, and based on the questions asked at the beginning of this research, the results obtained provided motivating answers to go very far with this new learning method.

#### References

- [1] Fridhi A, Bali N, Rebai N, Kouki R (2020) Geospatial Virtual/Augmented Environment: Applications for Children with Pervasive Developmental Disorders. *Neurophysiology* 52(3): 239-246. DOI 10.1007/s11062-020-09876-z
- [2] Bali, N., & Fridhi, A. (2023). Impact of augmented reality on sports performance of disabled. *Romanian Journal of Rheumatology/Revista Romana de Reumatologie*, 32(1). DOI: 10.37897/RJR.2023.1.7
- [3] Fridhi A, Bali N (2021) Science Education and Augmented Reality: Interaction of students with Avatars Modeled in Augmented Reality. *Int J Environ Sci* 6.
- [4] Fridhi A, Benzarti F, Frihida A, Amiri H (2018) Application of virtual reality and augmented reality in psychiatry and neuropsychology, in particular in the case of autistic spectrum disorder (ASD). *Neurophysiology* 50(3): 222-228. DOI 10.1007/s11062-018-9741-3
- [5] Fridhi A, Bali N (2023) Augmented Reality in Sports Education and Training for Children with an Autism Spectrum Disorder. *Neurophysiology* 54: 74-79. DOI 10.1007/s11062-023-09937-z
- [6] Bouajila A, Jebahi A, Fridhi A (2023) Use of Augmented Reality in Education. *Int J Innovative Sci Res Tech* 8(9).
- [7] Bali N, Fridhi A, Hassen Z (2022) Coronavirus: introduction of the application of augmented reality to help children with disorders to overcome the phobia of contamination facing an indefinite end of the pandemic. *Romanian J Neurology* 21(2). DOI: 10.37897/RJN.2022.2.13
- [8] Pedroli E, Greci L, Colombo D, Serino S, Cipresso P, et al. (2018) Characteristics, Usability, and Users Experience of a System Combining Cognitive and Physical Therapy in a Virtual Environment: Positive Bike. *Sensors (Basel)* 18(7): 2343. doi.org/10.3390/s18072343
- [9] Fridhi, A., Laribi, R., & Bali, N. N. (2023). 3D Modeling and Augmented Reality for Learning. *Computational Engineering and Physical Modeling*, 6(3), 52-61.
- [10] Syed-Abdul S, Malwade S, Nursetyo AA, Sood M, Bhatia M, et al. (2019) Virtual reality among the elderly: a usefulness and acceptance study from Taiwan. *BMC Geriatr* 19(1): 223. doi.org/10.1186/s12877-019-1218-8
- [11] Laribi, R., Fridhi, A., & Rebai, N. (2021). The impact of augmented reality in improving non-verbal communication in children and young adults with autism spectrum disorder (ASD). *International Journal of Education and Learning Systems*, 6.
- [12] Bull FC, Al-Ansari SS, Biddle S, Borodulin K, Buman MP, et al. (2020) World Health Organization 2020 guidelines on physical activity and sedentary behaviour. *Br J Sports Med* 54(24): 1451-1462. doi:10.1136/bjsports-2020-102955
- [13] LARIB, R., FRIDHI, A., & Naila, B. A. L. I. (2024). Augmented Reality: Interaction of students with Avatars. *Transylvanian Review*, 32(2).