Special education: Teaching by Augmented Reality - a new learning method for primary school students with low interaction

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Special Education: Teaching by Augmented Reality
A New Learning Method for Primary School Students with Low Interaction

(Medical field)

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Abstract: On the one hand, this article presents an overview on the application of augmented reality (AR) in blended or immersive education for primary school students with low interaction, AR as a tool in several fields, especially in medical or biological training. In a world where the use of AR tools in procedural, practical and declarative education continues to advance, these technologies are still in the experimental stage, prototyping or testing for students. The use of AR in education is moving from an experimental era to a regular and formal integration of technology into training.

On the other hand, this article offers a global vision of the application of AR in the teaching of medical modules. In an ever-changing world, AR is a new frontier. After defining the meaning of AR in the context of learning medical filds , some answers to these questions are provided in the light of recent publications.

Keywords: Augmented reality, blended or immersive teaching, primary school students, medical field, low interaction education.

1. Introduction

Augmented reality in higher education: opportunities for blended and immersive education

Augmented reality (AR) has long been considered an entertainment technique and a tool for primary school students with low interaction education, and in recent years AR has proven its usefulness in many professions, especially in health care and technology, and in learning at all levels. Education Simulation remains one of the main applications of augmented reality technologies in the field of education. They offer the opportunity to participate in difficult or real dangerous virtual simulations and studies. This applies to surgical simulators in medical education or systems that allow primary school students with low interaction education to practically study very distant periods of human history [1].

In addition to simulating and facilitating the use of multiple resources, AR holds great potential for new forms of online learning. These techniques improve and facilitate learning, increase memory capacity and make better decisions while working in pleasant and stimulating conditions. By giving him the possibility of accessing, even virtually, the object environments of learning, the primary school students with low interaction education feels more involved, more motivated, more receptive and ready to learn and communicate with others [2]. In the literature interested in studying the fields of application of augmented reality in education, the predominance of applications related to health care (35%), general education (28%), technology (19%) and science (16%) is underlined. . Below we present examples of AR solutions used in two fields where these technologies are considered quite advanced by the authors, namely medicine and engineering. The educational applications of augmented reality in the field of medicine are based on the application of simulation scenarios of existing practices inspired by the deontological principle, figure 01 shows the effect of AR on the learning of white blood cells.

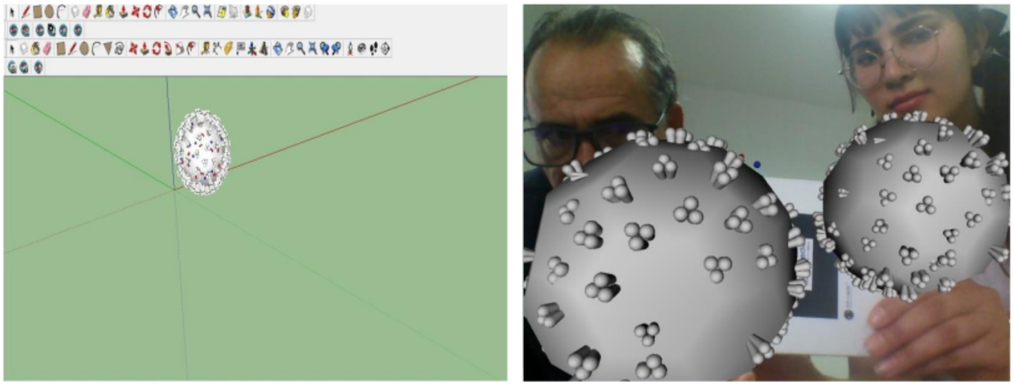

Figure 01: application of augmented reality on a 3D model of a white blood cell: learning for primary school students with low Interaction.

With this in mind, several simulation platforms have been developed to allow medical students with low interaction education to train through simulation, for all types of practice, from patient consultation to surgery, including hospital administration of the patient. With the growing need for innovation in medical education and technological advancements, especially 3D visualization technology, a range of teaching solutions for different branches of medicine have been developed in the field of augmented reality. These technologies have the advantage of being safe, less expensive than traditional engineering devices and fully controllable [3] (Figure 02).

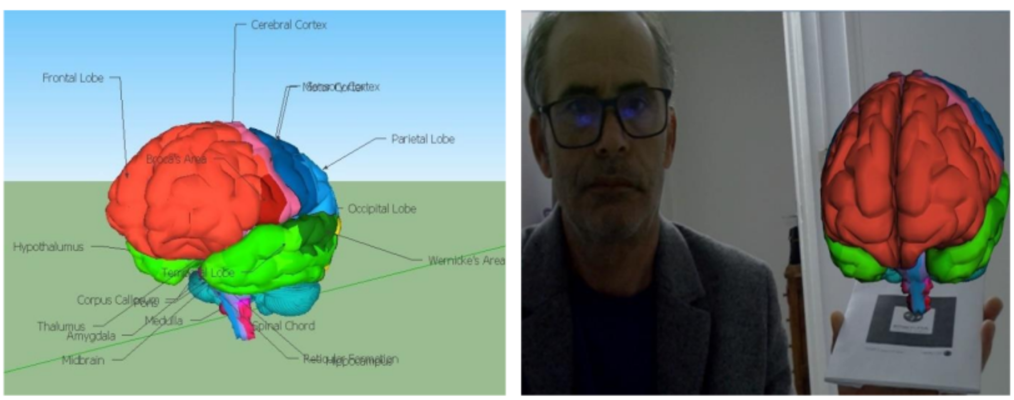

Figure 02: application of augmented reality on a 3D model of a brain: learning of primary school students with low Interaction.

2. Research problem

Although augmented reality (AR) is increasingly fashionable, one can wonder about its importance in an educational context. AR also uses a headset or smartphone to overlay images, text, or other virtual objects onto 3D models based on real content. Virtual technologies are not new. The series allowed the user to enter a computer-generated universe. According to the researchers, virtual architectures generally consist of three elements: an advanced visualization system capable of creating 3D objects and making them real, a control system capable of simulating the behavior of these objects, and a human-machine interface. Who interacts with them. Objects [4]. Several devices followed, including the first optical glove, the Data Glove, invented by Thomas Zimmerman in 1982; this optical glove allows a computer system to record the movements of the human hand [5]. However, recent advances have made them more accessible, including technological maturity and the availability of AR devices, including the release of the Oculus Rift and HTC Vive standalone headsets for consumers [6]. [7] Shows that the study of immersive virtual technologies is still in its infancy and offers many opportunities in education, especially from a cognitive point of view. According to [8], the feeling of immersion in AR is similar to what we perceive in our daily reality, as AR uses an interface to integrate computer-generated objects into the real world, enabling a feeling of immersion. Most importantly, however, according to [9], good immersive equipment, especially the HMD headset, is still expensive for schools to study scientific enlightenment. In this context, our research question is the following: Is the use of educational objects in augmented reality in the field of medicine important for primary school students with low interaction education in a school context? If so, what principles might guide their design?

3. Methodology

The increasing use of information and communication technologies has considerably changed the behavior of pupils in learning. It is a thriving field of study that has seen significant technological advancements that further promote primary school students with low interaction education participation and involvement in following educational programs. It is in this dynamic of technological development that the use of augmented reality has moved from the field of entertainment to personal development in quite different and diverse fields such as psychology, health and education. In this section, we will try to provide some answers to the following question: How can we successfully transition from the era of experimentation with augmented reality technologies in education to their effective and regular integration into curricula? We believe that this would only be possible if the communities of researchers, educators and computer scientists provide the necessary answers to the questions raised in the previous section. From a theoretical and conceptual perspective, it is important that the development of educational applications of AR be firmly grounded in existing learning theories that provide guidance on motivation, educational process and outcomes. This will encourage greater acceptance of the use of these technologies by universities and schools. In the development of AR applications for education, in addition to the theoretical and conceptual framework, it is important to refer to the principles of rich user interfaces, or user experience (UX), and information architecture. more generally. The transition to virtual and 3D content requires taking into account new parameters to facilitate the acquisition and access to content by learners...

- **The perspectives offered by augmented reality for science teaching and learning**

Several definitions have been cited in the scientific literature of augmented reality. In their review of the literature, Pellas et al. (2020) define augmented reality as an environment created by a computer system that provides a sense of reality, spatial presence, and involvement. Some key characteristics describe the experience offered by augmented reality, namely immersion, presence and interaction. Three types of reality can be distinguished: computer-based virtual reality (RV), augmented reality (AR) and immersive virtual reality (IVR). RV using 2D applications on a computer screen is generally characterized by a lower degree of immersion. AR, which uses the layering of virtual elements on real elements, offers medium immersion. The IVR, which requires the use of virtual reality headsets, on the other hand, offers the highest level of immersion to the user

experimental learning	virtual learning environments can be used to organize experimental learning activities that would be impossible to organize in reality
spatial representation	virtual learning environments can be used to organize learning activities that promote spatial knowledge of a certain domain
motivation	virtual learning environments can be used to organize learning activities that promote intrinsic motivation
transfer of learning	virtual learning environments can be used to organize learning activities that promote learning and skills in real-life situations by contextualizing learning
collaboration	virtual learning environments can be used to organize learning activities that promote collaborative learning more effectively than 2D environments

Table.01 : les affordances d'apprentissage de l'environnement virtuel 3d.

AR offers a variety of educational avenues. [10] Identified five learning affordances for 3D virtual learning environments (Fig. 03). According to these authors, AR enables experiential learning, such as experiences that would be difficult or impossible to achieve in real life. For example, we can handle objects safely in dangerous environments or learn about equipment that is too expensive for laboratories.

Additionally, these environments can help primary school students with low interaction education visualize abstract concepts by interacting with objects in a 3D environment. The spatial representation provided by AR combined with 3D modeling and the ability to see these objects from many different angles can definitely help learning, especially in those where spatial skills are important, such as molecular imaging [11]. Figure 03.

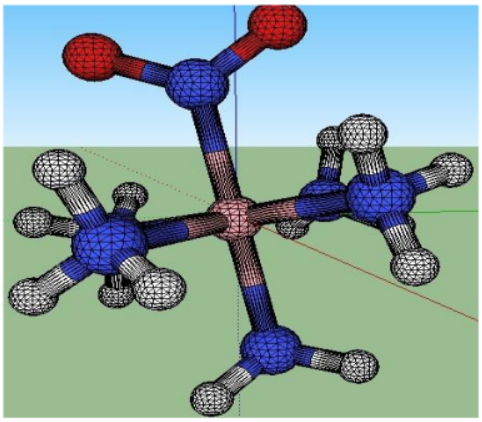
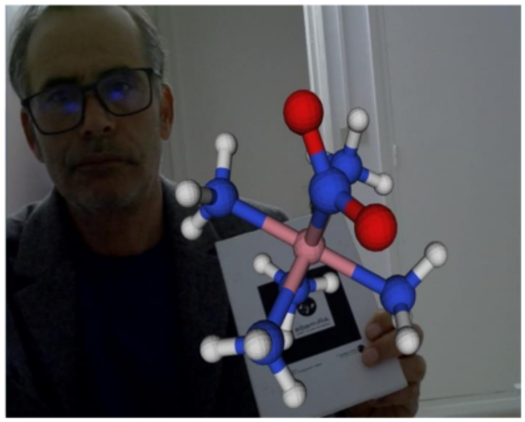

Figure 03: application of augmented reality on a 3D model of a molecules: learning of primary school students with low Interaction.

AR can also help teaching teams to provide engaging learning activities that promote intrinsic motivation due to the possibility of making choices in the environment, often game-based approaches, high degree of concentration (Figure 04a, b, c, d).

Figure 4a : application of augmented reality on a 3D model to increase the concentration of primary school students with low Interaction

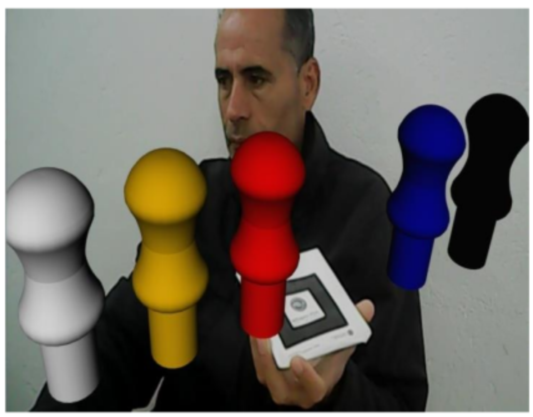

Figure 4b : application of augmented reality on a 3D model (let's remove an object) to increase the concentration of primary school students with low Interaction

Figure 4c : application of augmented reality on a 3D model to increase the concentration of primary school students with low Interaction (04 objects)

Figure 4d : : application of augmented reality on a 3D model (let's remove an object) to increase the concentration of primary school students with low Interaction (03 objects)

4. **Research project: Result and discussion**

Our research focuses on pedagogical scenarios that incorporate AR applications, rather than AR applications themselves, as the research literature shows that pedagogical teaching and writing are linked to engagement and motivation. 'Learning. It is therefore not only a question of using a tool in a course, but rather of integrating it into an educational framework allowing primary school students with low interaction education to derive the maximum educational benefits from it. Teachers develop a pedagogical scenario that integrates an augmented reality simulation with an educational advisor and tests the scenario in class. The model has proven to be very useful in motivating teams to plan different activities at each stage of developing a training scenario. It encourages them to alternate individual work, group work and large group work, to reflect on activities outside or in class, and to combine active learning and cooperative learning [12].Figure.05

Our research, which follows a design-oriented research type methodology, involves data collection.

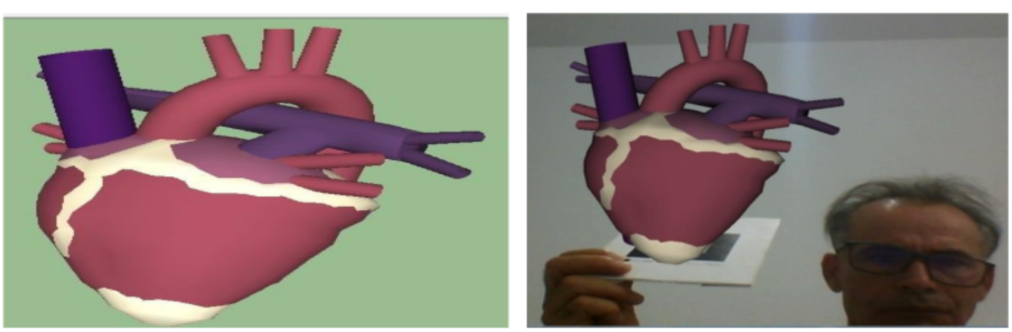

Figure.05: application of augmented reality on a 3D model (heart): learning of primary school students with low Interaction.

- **The importance of the pedagogical scenario**

The results of the first two iterations, linked to the AR component with simulations, show the importance of the quality of the scenarios developed by the teachers. Indeed, our preliminary quantitative results lead us to believe that, in general, more complex pedagogical scenarios produce higher results on various scales related to academic interest, motivation and engagement. Extensive quantitative analyzes (multilevel analyses) confirm the importance of the quality of the pedagogical scenario on the affective commitment of the pupils.

Implication 1:

Optimal use of augmented reality in science education requires the development of carefully designed instructional scenarios for each stage of the scenario. The teacher must activate the primary school students with low interaction education in his scenario by providing them, among other things, with sufficient preparation, which may require, for example, a review of prior knowledge (pre-information) and orientation instructions before the simulation (information) , which provides support during the simulation and provides feedback on the contexts of the simulation and the reuse of information (debriefing).

- The perceived benefits of AR

As a result of their augmented reality experience, teachers and primary school students with low interaction education discovered a number of educational benefits of the simulations provided. The advantages presented in Table 02 lead us to formulate another practical practice.

Perceived benefits	**Description**
Diversification of teaching methods	Offers a different avenue for teaching and learning.
Visualization	Allows representing abstract, invisible concepts.
Consolidation of Learning	Allows you to better understand content that has already been taught, in particular through repetition.
Introduction of theoretical content	Used to introduce concepts that will be taught more explicitly later.
Contextualization of Learning	Provides a context for scientific learning.
Improved Lab Prep	Allows you to prepare well before the labs, to fully understand the steps, the function of the instruments, which reduces stress.
Fun aspect of simulations	Provides an educational benefit due to its fun and engaging appearance.

Table 02: Benefits of AR perceived by teachers and primary school students with low interaction education.

Implication 2:

A science teacher can use AR embedded scenarios to diversify teaching methods, contextualize learning, and visualize abstract concepts that are problematic elements of science education [13].

Five main conclusions emerge from these results:

• Primary school students with low interaction education have a very positive perception of the use of these simulations and a very high average value for the question "To what extent was your AR experience negative or positive?" ".

• Primary school students with low interaction education see two main components in the value of these simulations: a utilitarian component and an affective component. Although these two perceptions show very high results, the affective perception shows a slightly higher result.

• The pleasure, perception of learning, interest, flow and affective commitment scales all show particularly high scores.

• The use of simulations in some courses, which are generally associated with lower primary school students with low interaction education interest, has significantly increased student with low interaction education interest. In addition to the fact that students generally enjoy AR simulations, our results suggest that these simulations have the rare potential to engage them both cognitively and affectively. Thus, they turn out to be promising tools to solve the problems mentioned in the introduction.

Implication 3:

A science teacher wants to use augmented reality-based instructional scenarios to provide an immersive experience that promotes interest and affective engagement, as well as perceived task value. Few methods or tools allow it.

5. Conclusion

In this work, we have made the most important applications of augmented reality of mapping as mixed and deep learning tools in the field of education, based on a review of the literature specializing in the use of these technologies in education. The corpus studied was also an opportunity to focus on the obstacles to the implementation of AR in educational programs. Finally, we develop proposals to ensure a successful transition to an effective integration of AR into educational curricula. We plan to continue this work by researching the market for AR applications in engineering and medical education and by interviewing teachers and primary school students with low interaction education in these fields in Tunisian universities to determine their perceptions, expectations and potential barriers to the integration of technology into Tunisian higher education programs. Different issues that can affect both academic motivation and science learning, such as the level of abstraction of concepts.

Our research to date has allowed us to increase the educational potential of AR in science teaching and learning. Indeed, the simulations used with an AR component have advantages perceived by both primary school students with low interaction education and teachers, simulations mostly compatible with the themes described above, namely visualization, contextualization of learning and diversification of methods. . Although the simulations used may seem pedagogically perfect, they must be integrated into relatively complex pedagogical scenarios to maximize the learning benefits. Finally, educational scenarios that incorporate simulations also provide benefits, particularly in terms of pleasure, learning, interest, fluidity and affective engagement.

6. References

[1] Fridhi, A., & Bali, N. (2021). Science Education and Augmented Reality: Interaction of students with Avatars Modeled in Augmented Reality. *International Journal of Environmental Science*, *6*.

[2] Abderrazak, B. E. N., & ELMQADDEM, N. (2022). Usage de la réalité virtuelle et de la réalité augmentée dans l'enseignement supérieur: de l'expérimentation à l'intégration effective dans les cursus de formation. *Journal of Information Sciences*, *21*(2), 194-202.

[3] Harrath, Z., Bouajila, A., & Fridhi, A. (2023). Artificial Reality and Science Learning. *Computer Science*, *18*(4), 697-705.

[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.

[5] Lowood, H. E. (2019). Virtual reality. Dans *Encyclopædia Britannica*. Récupéré le 28 mai 2020 du site https://www.britannica.com/technology/virtual-reality.

[6] Jégou, G. et Pallamin, N. (2017, mai). L'évaluation des usages et des comportements en univers immersifs : Quelques enjeux actuels. *Réalités Industrielles*, 50-53, 94, 98, 104,106-107.

[7] Cook, M., Lischer-Katz, Z., Hall, N., Hardesty, J., Johnson, J., McDonald, R. et Carlisle, T. (2019). Challenges and Strategies for Educational Virtual Reality: Results of an Expert-led Forum on 3D/VR Technologies across Academic Institutions. *Information Technology & Libraries*, *38*(4), 25-48. https://doi.org/10.6017/ITAL.V38I4.11075

[8] Blevins, B. (2018). Teaching digital literacy composing concepts: Focusing on the layers of augmented reality in an era of changing technology. *Computers and Composition*, *2018(*50): 21-38. https://doi.org/10.1016/j.compcom.2018.07.003.

[9] Garzón, J., Pavón, J. et Baldiris, S. (2019). Systematic review and meta-analysis of augmented reality in educational settings. *Virtual Reality*, *23*(4), 447-459. https://doi.org/10.1007/s10055-019-00379-9.

[10] Bouajila, A., Jebahi, A., & Fridhi, A.(2023) Use of Augmented Reality in Education. International Journal of Innovative Science and Research Technology, Volume 8, Issue 9, September, 2023.

[11] 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.

[12] 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 indefi nite end of the pandemic. *Romanian Journal of Neurology*, *21*(2).

[13] 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*.