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Augmented reality applied to e-learning

What is augmented reality and how can it be used for online training? Here are all the benefits.

Virtual images, drawings and sounds that merge with reality. That's the principle behind **augmented reality** (also known as AR), a technology that allows users to fully immerse themselves in a world that lies somewhere between the one they live in and the imaginary one. But can this system also be useful for distance learning and training? The fields of application of AR are numerous, and with the spread and evolution of e-learning, one could not help but notice the possible benefits of training that makes use of augmented reality.

What is augmented reality?

Augmented reality is an interactive technological system that makes use of special systems and tools to superimpose content, such as images, sounds or animations, on existing reality to enrich (augment, precisely) the user's experience. This technology, then, makes it possible to alter the real world with artificial information, which is added to what is already there.

The first person to create a tool definable as augmented reality was Ivan Sutherland, an American computer scientist who, in 1968, developed a visor that projected 3-D images that were superimposed on reality. AR's name, however, dates back to 1990, when a system was designed for Boeing that could allow workers to see how to place cables inside the plane. Thus, since the 1990s, augmented reality has developed more and more, touching different fields, from the military and medical to industry and education.

Augmented reality is not synonymous with virtual reality. Therefore, it is important not to confuse the two terms and keep in mind the differences. First of all, it should be remembered that virtual reality means an entirely simulated environment, with which one can interact only through special devices. The difference between the two technologies lies in the presence or absence of real elements:

- In the case of virtual reality, a completely artificial world, built entirely from virtual objects, appears on the screen;
- In the case of augmented reality, the screen shows an interaction between the real world and virtual images.

Applications of AR

Augmented reality was initially used mainly in the military and medical fields, but later its applications expanded to more and more areas, eventually reaching that of online education. Specifically, this technology can be used in the following areas:

- **Military**: it is useful both in training and in combat, to guide soldiers in action, helping them to correctly interpret stimuli from outside;
- **Medical**: it allows students to experiment with types of surgical procedures and for already skilled surgeons to keep up-to-date and train in new techniques. AR can also be used to treat certain phobias or disorders and to assess brain damage.
- **Corporate**: the use of augmented reality allows companies to experiment with new work strategies before they are actually implemented, so as to minimize possible risks. In addition, AR can also be an advantage for personnel selection, giving the employer an idea of how the candidate might behave when faced with a possible job assignment.
- **Formative**: it provides a more engaging and effective learning methodology, because it allows the concepts learned to be experienced.

The tools of augmented reality

The application of augmented reality to different domains requires special tools, to enable the user to superimpose virtual images and information on the real world and display it all together on the screen. Some of the possible tools that can be used to take advantage of AR are:

- **Visors** that show, along with the real environment, fictitious images, to allow the user to totally immerse himself in the world proposed by augmented reality and simulate solutions to concrete problems or experiment with new techniques in a wide variety of fields;
- **Smart Glasses**, i.e., transparent glasses that leave open the user's field of vision, which, in this way, can also see the real world. At the same time, however, this can be overlaid with 3D images chosen by the user;
- Particular satellite **navigators**, which through the smartphone camera are able to provide images in addition to the directions, shown directly in the car screen;
- Some **Apps**, which are able to integrate the real world with virtual information. For example, they can show the review of the restaurant in front of which we are standing, information about the mountains we see in the distance or the planes flying over our heads.

This new technology, then, may be within the reach of many because its use may require only the support of a cell phone.

Augmented reality and e-learning

Initially, augmented reality was mainly used in the medical, military or corporate fields. As time has passed, however, another field has undergone exponential development, also considering the use of AR to enhance its effectiveness. This is e-learning, online training, which, thanks to the development of new technologies and the need to reach large and physically distant audiences, has spread like wildfire, driven in part by the Covid-19 pandemic and the lockdown that followed.

The introduction of augmented reality into e-learning allows the course creator to make lessons more engaging and effective. This can happen because human beings have the ability to remember things they see better than things they hear. Therefore, the ability to conduct simulations set in the real world, with the opportunity to practice the concepts first learned, can be a valuable mode of learning. In addition, with AR it is possible to enrich the learning experience through sounds, images and videos, superimposing them on reality. Finally, the application of this technology allows interaction with 3D models to develop the skills for which the course was created.

Therefore, integrating online platforms with augmented reality patterns can lead to more effective learning. On the other hand, trainers can also use it to assess students' participation and achievement. It is also possible to integrate AR to traditional teaching, to transfer knowledge into experience, in a playful and original way, applying the principle of learning by doing, which enables students to understand theoretical concepts by putting them into practice immediately, with an immersive learning process.

Through AR, students can:

- Interact with teachers instantly, as is done in the real world;
- Participate in activities using virtual components superimposed on the real world, to stimulate understanding and put into practice what has been learned;
- Reliving situations addressed in class and becoming a protagonist in historical events, journeys, or moments with which one is familiar;
- Interacting with their peers;

For their part, teachers can monitor and verify pupils' work and knowledge. In this way, the student's education is enriched, becoming an experience comparable to a live class.

The benefits of AR in online education

AR and digital education can be allies. In fact, mixing real life with virtual life allows for "on-the-job" learning, while eliminating the risks of getting it wrong. Immersive and interactive learning such as that provided by augmented reality has several advantages from a training perspective.
The main advantages of using augmented reality in e-learning are as follows:

- Greater ease in learning abstract concepts, because these can be shown in their concreteness;
- Involvement of users, whose attention is stimulated by creativity and interactivity;
- Ease in the enjoyment of augmented reality, accessible even with a simple smartphone, without necessarily having to use specific tools;
- Hands-on but remote exercises, allowing the student to carry them out at any time and from anywhere, without the need for actual physical presence at the training site.

Additional advantages that the application of augmented reality to the field of training presents may be:

- The possibility of "learning by doing," while making use of a screen and not being physically present at the school or training site;
- The ease of research for students, who have the necessary information available directly on the devices where augmented reality is used. Not needing external help, the threshold of concentration and attention is maintained longer, because distractions are decreased;
- The decrease in the possibility of error, since theoretical information is immediately applied;
- The deepening of understanding due to the possibility of using images, video, audio and additional texts;
- The development of mnemonic skills, because it is easier for human beings to recall information learned using different senses, rather than those merely heard;
- The increase in the ease the cooperation and collaboration among e-learning students, who can interact with each other in an easier and more immediate way, connecting with each other in real time;
- The possibility of learning concepts usually exposed in lectures in a stimulating and original way, making the moment of training also fun and more challenging

Augmented reality, then, allows digital education to gain an extra edge to enable teachers, trainers and students to approach learning in new and effective ways.

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