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Augmented Reality: A Novel Opening in Higher Education

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Educational innovation over long years especially, experiments going on in the facet of education for ensuring better teaching-learning experience for teachers and students. Satisfying the present generation is a biggest challenge, faced by both parents and teachers. For this reason, different innovations are experimenting to satisfy the educational need of a student. Each student is different from one another, so it is difficult to give an equal learning experience. Learning is happened almost when it is doing or interacting with the real environment. But in the most cases, the real effect of learning, through interacting with the real environment, is not possible. Normally, in the absence of real environmental experience, students get the experience of two dimensional pictures and images which is more convenient and flexible. Meanwhile the education technology reached in its peak. So the students get a three dimensional virtual experience that is advanced than the two dimensional picture, but it does not ensure the same quality as to interact with real environment. Education technology now become sufficient to introduce a new thing, that helps to wipe out the above defect, which is giving a learning experience using virtual reality along with the real environment, that we call as Augmented Reality.

Augmented Reality (AR) is an innovative learning tool widely accepted in the field of education. In most of the higher education sector, now started experiencing the effectiveness of Augmented Reality (AR) for professional development. The major objective of an every professional courses is to give a shape to an individual by expertizing a particular skill and make them to competent in the specific area. Universities and colleges have always been at the cutting edge of new technologies, driving development and creating the next generation of scientists, developers and entrepreneurs. Virtual and Augmented Reality technologies are at the frontier of development right now.

Augmented Reality

The origin of the word '*augmented*' is derived from French word, '*augment*', which means *to add something or increase*. In the case of Augmented Reality (also called AR), graphics, sounds and touch feedback are added into our natural world. Unlike virtual reality, which requires inhabiting an entirely virtual environment, Augmented Reality uses the existing natural environment and simply overlays virtual information on top of it. As both virtual and real worlds harmoniously coexist, users of Augmented Reality experience a new and improved world where virtual information is used as a tool to provide assistance in everyday activities.

Augmented Reality brings virtual information or object to any indirect view of user's real-world environment to enhance the user's perception and interaction with the real world. Augmented Reality tries to augment virtual objects on the real ones or scenes for maximizing natural and intuitive user experience in real time. It is an interactive environment where a real life is enhanced by virtual things real time Kesim & Ozarslan (2012). R. Azuma (1997) defines Augmented Reality as a platform that include both virtual reality and real world environment. For this ambience, an AR user wear the translucent goggles to see the real world as well as computer-generated images projected on the top of that world. Augmented Reality help to move around the three-dimensional virtual image and view it from any vantage point, just like a real object. The information conveyed by the virtual objects helps users perform real-world tasks.

History of Augmented Reality

In 1990, Boeing researcher, Tom Candell, coined the term 'Augmented Reality'. But the real start of augmented reality from 1968 by which, the first head-mounted display system was developed by Ivan Sutherland. The system used computer - generated graphics to show users simple wireframe drawings. Myron Krueger, 1974, built an 'artificial reality' laboratory called the video place. The video place combined projectors with video cameras that emitted onscreen silhouettes, surrounding users in an interactive environment. Louis Rosenbery, 1992, develops virtual fixtures-one of the earliest functioning AR system, built for the Airforce. The Full upper-body Exoskeleton allowed the military to control virtually guided machinery to perform tasks from a remote operating space. In 1994, Julie Martin introduced the first

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augmented reality Theater production, "Dancing in Cyberspace", featuring acrobats who danced within and around virtual objects on their physical stage. The first and ten line computer system is broadcast by sport vision, casting the first virtual yellow first own marker during a live NFL game. In 1999, naval researchers begins working on Battlefield Augmented Reality System (BARS), the robust, original model of early wearable units for soldiers. The NASA X-38 space craft is flown using a Hybrid synthetic vision system that used Augmented Reality to overlay map data to provide enhanced visual navigation during flight tests.

In 2000, AR Toolkit was developed by Hirokazu Kato. It is an open-source software library that uses video tracking to overlay computer graphics on a video camera. The AR Toolkit is still used widely to compliment many Augmented Reality experiences. For the 2003 NFL season, Sport vision unveils the first computer graphic system capable of inserting the first and ten line from the popular Skycam, the NFL's mobile camera that provides the field aerial perspective. Around 2008, smart phones started to use AR in applications such as maps. In 2009, AR Toolkit brings augmented reality to web browsers. Print media tries out AR for the first time. EsQuire magazine prompts readers to scan the cover to make Robert Downey Jv. Come alive on the page.

The Now, AR hardware and software make the leap towards consumer audiences. In 2013, car manufactures begin to use augment reality as the new age vehicle service manuals and the Google Glass, ahead-mounted optical display was released by Google that looks like a pair of glasses. And in the year 2015, Microsoft released the HoloLens—an AR headset that blends computer-generated images (holograms) with the real world around you. Augmented Reality is now become popular among every professionals because it provides versatile advancement in each and every profession that helps to satisfy their needs.

Five Directions of Augmented Reality in Educational Environments

Yuen et al. (2011) introduced Five Directions that enable a classification of AR applications into five groups as follows:

Discovery-based Learning: AR applications that ensure the Discovery- based learning. Because this application provides a chance to interact with real environment. That helps to develop problem solving skill in real life situation.

Objects Modeling: Such applications gives opportunity to the learners for getting immediate visual feedback on how a particular item would look in different settings.

AR Books: The AR Books offer 3D presentations and interactive learning experiences to the students with the help of AR technology by using devices such as special glasses.

Skills Training: By skill training, means the support of training individuals in specific tasks. Especially mechanical skills are likely to be supported by AR Skills Training applications where each step of a repair is displayed, necessary tools are identified, and textual instructions are included. The applications are often realized with head mounted displays.

AR Gaming: Video Games offer highly quality and powerful new favorable circumstances for educators which have been ignored for many years (Squire, 2003). AR Games helps the educators to use as powerful way to show relationship and connections. In addition to that, AR games provide educators a highly interactive and visual forms of learning (Diegmann et al., 2015).

Features of Augmented Reality as a Learning Tool

While using augmented reality in the field of education there are lots of advantages. They are:

- Capture the attention of the students
- Students' active participation
- Better understanding of concept
- Students can assess models from any device at any time
- Students will retain more knowledge for a long period
- Develop intellectual curiosity.

Augmented Reality in Higher Education

Augmented reality is a new technological innovation that can be applied in the higher education system. The introduction of Augmented Reality helps the learner to understand the complex ideas easily. AR is not only helpful to learners but in the case of teachers also it is a significant one, because it will help the teachers to explain about a particular topic to the students as that is involved in the real world. Augmented Reality is used as a learning tool not only supports the formal education but also it encourages the informal education. They are hoping to motivate

students to learn and study more, helping them to interact with facts about history or science in a way that makes it more real for the student. Various distance education programmes can make use of this tool for giving real learning experience to their learners. AR provide a real learning environment to make the complex ideas to simple one. Liarokapis et al. (2004) demonstrated that AR can make complicated mechanisms and difficult theories in higher education accepted and understood by students with contextually enriched interaction using AR technology. According to Rizov & Rizova (2015) augmented reality can be applied as a didactic tool in executing classes in higher education. The application helps the teacher to present the objects in space with adequate visualization. On the other hand, the idea of using new technologies which represent the everyday life of this generation aids in keeping the students' interest. Two major approaches of utilizing augmented reality technology in science education, which are named as image-based AR and location- based AR. These approaches may result in different affordances for science learning. It is found that image-based AR afforded the students' spatial ability, practical skills, and conceptual understanding and location-based AR also supports inquiry-based scientific activities (Cheng & Tsai, 2013).This application is very useful in the field of medicine or design. The potential benefits of Augmented Reality applied to higher education include:

- Multi-modal visualization of difficult theoretical concepts
- Practical exploration of theory through tangible examples
- Natural interaction with multimedia representation of teaching materials.

Augmented Reality in Medical

Augmented reality is now used for more practical purposes rather than entertaining the people. Now a day, we can see the gradual usage of AR technology in the field of medicine for the purpose of understanding the structure and anatomy of human body. Researchers in science and medical fields are already making great use of immersive technology. Although augmented simulations and views inside the body are obviously great tools for learning, something as simple as experiencing the world from the perspective of an elderly patient with dementia can have an enormous lasting impact on a medical students' approach. AR technology to show the inner organs of human beings and how they look by watching 3D computes-generated, moreover, students may able to study human organs independently. This technology is going to be played a paramount role in the future of medicine. In future, similar augmented reality products will be developed and used by doctors and students for improving their practices. In 2013, a group of surgeons from the Alabama University carried out a surgery for shoulder replacement using Google Glass and virtual AR technology.

Anyhow, most of the medical professionals are not aware of the benefits of this technology. Use of AR technology becomes slower in the facet of medicine because of insufficient information about this technological tool. However, some AR gadgets are there which can be used only for medical purpose apart from other uses. For example, Google Glass is one such gadget which has been used for surgical purpose. There are even some AR apps which have been specifically developed for medical usage only.

- Eye DecideApps are used to educate patients on the condition of their eyes
- Doctors have performed tumor surgery using an iPad app developed by Fraunhofer Institute for Medical Image Computing MEVIS in Germany
- Doctor Mole- Skin Cancer app lets users assess moles with real time computer vision technology. They just need to scan a mole to get the feedback related to it
- Evena's Eyes-On Glasses are an AR platform which can be used as an interface with tablets, smart phones and other devices. Medical professionals can use this platform to perform their duties in a proficient manner. For example, nurses can view a patient's veins in real time using the glasses which will help them to insert a needle in the vein without any difficulty.

There are different AR gadgets and apps being developed for the purpose of improving practices and deep understanding of the people working in the field of medicine as well as the students of this particular field. Thus AR become enacts a vital role in the field of medicine in the upcoming years.

Augmented Reality in Engineering

Augmented reality is also widely used in the field of engineering; it helps them to make out the complex ideas. Augmented Reality in Engineering Education

has become a hand to improve academic performance. Students are comfortable working with a 3D graphics tool that did not have to be previously formed and they consider that augmented reality tool to use L-ELIRA is an intuitive application that does not need cognitive learning. This reduces the cognitive overhead needed for its use and allows us to focus attention on the acquisition of knowledge. Students who are using AR based material show the better academic performance than those who are using the traditional class notes. It also increases the motivation of the students (Gutierrez & Fernandez, 2014). Augmented reality techniques is a mean that allows the student to experience sensations and explore learning experiences that, may leads to acquire something more rather than those offered by traditional laboratory classes. The use of ARL improves student outcomes (Andujar, et.al 2011).Students' understanding of the equipment, processes and operational safety will be enhanced by using and seeing the engineering objects in 3D augmented space and interacting with them (Behzadan & Iqbal, 2011).

Augmented Reality in Teacher Education

Augmented reality is applying in the field of teaching, learning and instructional design. AR is basically aligned with constructivist learning theory thus it is used as a cognitive tool and as a pedagogical approach, so the learner can experience within a real-world physical and social context while guiding, scaffolding and facilitating participatory and metacognitive learning processes such as authentic inquiry, active observation, peer coaching, reciprocal teaching and legitimate peripheral participation with multiple modes of representation. While using AR in the field of teacher education it will favourable to make learning strategies, instructional materials, input tools etc. such cutting-edge tools help to make the assimilation and cognition of specific content also possible. Real experiences of each content makes easy acquisition that bring forth the perfection among the instructors.

Limitation of Augmented Reality in Education Settings

When we are using technological applications in the classroom settings, have some limitation like high cost, lack of availability of technological gadgets, connectivity issues, better support services, lack of experience of both teachers and students etc. So, certain efforts we have to take for minimizing such limitations to some extent. The academic results show and support the arrival of such gadgets in teaching- learning process because it enhances learning performance of professionals.

Conclusion

Augmented Reality has wide scope in the field of higher education because this technology ensures long retention of a particular concept and also make easy to pursue the content. While using augmented reality in the professional field it gives real experience of a concept thus make the facile learning and practice made possible. In the days to come the instructional processes of the future classrooms will be monitored with the techniques of IoT and the concept of augmented reality will be practiced by the next generation learners. The concept on its appearance seems to be difficult in its practice but will be simple to comprehend and apply in the days to come. The future learners will be shaped by the maximum scope of AR in higher education; it will lead to an unexpected result of practice. AR used as learning tool in the distant learning i.e., the physical separation of instructor and receiver, because it also encourages self-learning and self-practices. AR will uplift the professional from basic skills to extraordinary talents.

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