Augmented Reality (AR): The New Trend in Transforming Teaching and Learning in Education

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Abstract-

With growing diffusion of technology in our lives, there is an intensifying need of adapting digital technologies in educational ecosystem. Educational Institutions need to restore and change their operational strategy to go well with a digital landscape which can enhance traditional face-to-face learning environment and make a shift to online mode learning environment. By means the teaching profession gradually shifts from teacher-centered to student-centered learning environment. In India, Educational institutions from primary schools to colleges are leaping on the new technologies like Smart classrooms for content delivery, Webcast Lecture, Open Educational Resources (OER), Video and Interactive video tutorials, Virtual Lab, Virtual Reality, Augmented Reality, Individualized Learning using portable devices, Personalization, Blended Learning, Flipped Learning, Small Private Online Course (SPOC), Massive Open Online Course (MOOC), Mobile Learning (M-learning), Gamification, Cloud-based, Artificial Intelligence, Chat bots, Internet of Things and Big Data are slowly finding their way into educational institutions. However, the students should employ and develop higher order cognitive skills. These are vital to find solutions for complex real-world problems. Although the physical world is three-dimensional, we mostly prefer to use two-dimensional media in education. The combination of AR technology with educational content creates a new type of automated application. It acts to enhance the effectiveness and attractiveness of teaching and learning for students in real-life scenarios is a new medium, combining aspects from ubiquitous computing, tangible computing, and social computing. These unique connecting physical and virtual worlds, with continuous and implicit user control interactivity. This paper provides an introduction to the technology of Augmented Reality (AR) and its possibilities for education. Fundamental techniques and methods discussed in the context of education.

***Keywords*: Technology, Augmented Reality, Learning environment, Technologies in Education, self-learning**

Objectives:

1. To inculcate required knowledge and skills in students effectively by adopting and integrating new technologies in the teaching and learning process.
2. To explain the features of Augmented Reality in education in Teaching and Learning.
3. To discover the use of open educational resources in teaching and learning.
4. To explore the use Virtual Reality and Augmented Reality in education in teaching and learning.
5. To explore the benefits, challenges and issues of Augmented Reality in education in Teaching and Learning Activities.

INTRODUCTION

Augmented reality in education will soon affect the conventional learning process. AR has the potential to change the location and timing of studying, to introduce new and additional ways and methods. Capabilities of Augmented Reality technology may make classes more engaging and information more apprehensible. Educators know that the learning process should be all about creativity and interaction. While teachers do not necessarily need to recruit all students into science, their goal is to get them interested in a subject. That's where AR could come in handy. Nowadays, young people own smart phones. Most of them are active Smartphone users that use these gadgets to access social platforms, play games, and to be in connection with friends and relatives. In the meantime, the much lesser part of young adults uses phones for studying purposes, for doing

the homework, dig information about a subject, etc. The potential of combining smart phones and Augmented Reality for education is significant, though it still has to be fully discovered. AR, in various ways, could grant students extra digital information about any subject, and make complex information easier to understand. Nowadays, we may find some excellent examples of augmented reality in education worldwide. The ability to connect existence and digital content have been steadily improving, opening more options for teachers and students.

Rapid development of the technology has influenced its inevitable entrance in the learning processes. Teachers are often challenged to use the appropriate educational technology in the process of teaching in order to ease the learning process of students. Introducing new technology in the teaching process should utilize the new technology in any possible way in order to assist the teacher in transferring the knowledge and assist the students in grasping that knowledge.

TECHNOLOGIES FOR AUGMENTED REALITY

Augmented Reality and Virtual Reality use the same hardware technologies and share lots of factors like computer-generated virtual scenes, 3D objects, and interactivity. The main difference between them is where virtual reality aims to replace the real world while augmented reality respectfully supplements it.

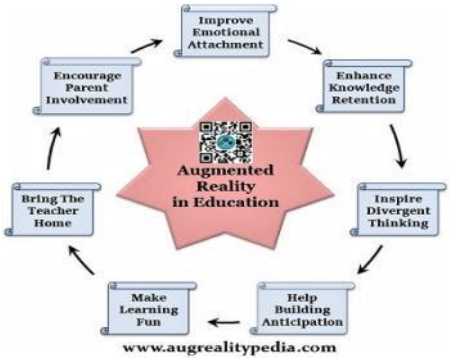
The primary devices for augmented reality are displays, computers, input, and tracking devices. See-through and Monitor-based displays are two significant types of screens used in augmented reality.-both images of see-through and Optical see-through systems.

TECHNOLOGIES AND STUDIES

Augmented Reality technology is not a new issue. It has been used in fields such as medicine, engineering design, robotic, tele-robotic, manufacturing, maintenance and repair applications, consumer design, psychological treatments, etc. (Azuma, Baillot, Behringer, & Feiner, 2001). Displaying information by using virtual things that the user cannot directly detect with his senses can enable a person to interact with the real world in ways never before possible. We can change the position, shape, and other graphical features of virtual objects with interaction techniques where augmented reality supports. Using our fingers or motions of handheld devices such as shake and tilt, we can manipulate virtual objects, as well as the physical objects in the real world.

Augmented Reality can provide for learning, entertainment, or edutainment by enhancing a user's perception andhis interaction with the real world. Users can 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 actual- world tasks. Tangible Interface Metaphor is one of the critical ways to improve learning. This property enables manipulation of three-dimensional virtual objects by merely moving real cards without mouse or keyboard.

Augmented Reality can also enhance collaborative tasks. It is possible to develop innovative computer interfaces that



Augmented Reality in Education: 7 Creative Ways to Improve Student Engagement in the Classroom

Source: https://www.augrealitypedia.com/augmented-reality-in-education-increase-student-engagement-classroom/

merge the virtual and real worlds to enhance face-to-face and remote collaboration. These augmented reality applications are more similar to natural face-to-face collaboration than to screen-based partnership (Kiyokawa et al., 2002).

Web technologies and the internet are popular; as a practical situation, people still prefer reading books instead of facing screens, and textbooks are still widely used. Another exciting application of this technology is in augmented reality textbooks. These books usually point a webcam to the book, brings visualizations and interactions designed is possible by installing special software on a computer, using individual mobile apps or a web site. This technology allows any existing book to develop into an augmented reality edition after publication. Using 3D objects and views, miscellaneous and imaginative media, simulations with different types of interactions are the easiest ways of connecting the two isolated worlds. Through the use of Augmented Reality in printed book pages, textbooks will become dynamic sources of information. In this way, people with no computer background can still have rich interactive experience.

USES OF AUGMENTED REALITY IN LEARNING

1. **Augmented Reality classroom**

Augmented reality animated content in classroom lessons could catch students' attention in our dynamic day and age, as well as motivate them to study. Adding extra data, e.g. a short bio of a person, fun facts, historical data about sites or events, visual 3D models, would give students a wider understanding of topics. While doing homework, students may scan certain elements of a book and receive text, audio or video tips from teachers. Or they may find useful information about the course, a teacher or other students which could lead to better communication.

2. Explaining difficult concepts

AR technology has an ability to render objects that are hard to imagine and turn them into 3D models, thus making it easier to grasp the abstract and difficult content. This is especially good for visual learners and practically anyone to translate theoretical material into a real concept.

3. Engagement and interaction

By incorporating Augmented Reality into lessons teachers are able to involve students into the process with 3-dimensional models. It may be just a part of the lesson, like a teaser, or the support of the main topic with extra info from a different perspective. Like this case, when a Canadian tech company CASE transformed the wall of the school gym into a ball

game by adding Augmented Reality layer to it. Kids through balls onto a wall to hit floating shapes and so have fun physical exercises.

4. Discover and learn

Visitors of museums could access AR via smart phones and discover historical content related to objects. Additional information about what they see, though due to space or budget limitations, not all museums and landmarks can afford this. Once AR becomes more available, there will be new great opportunities for museums. The upside is that Augmented Reality is already accessible to visitors through mobile devices.

5. Objects modeling

Manual training, hand exercises, quizzes solving etc. help to earn a better knowledge of any lesson. AR apps for medical students may be one of the ways to learn human anatomy, explore knowledge more deeply. Augmented Reality basically means interaction with 3D models. And you can set the rotation, transparency, color scheme, styles etc. Finally, there could be more advanced animations via special gadgets like holographic lenses, instead of smart phones.

6. Training

In many cases, theoretical knowledge is not enough to obtain proper skills in professional areas. Students shouldn't be mere listeners and passive observers. Students of technical faculties especially need practice and hands-on experience in their areas. Through interaction, unlike VR, AR features could help to perform a virtual practice – with augmented tutorials, digital modeling, and simulations, and acquire some experience in the end. It is not a secret that motivated and engaged students to understand the subject better and learn faster.

STEM EDUCATION

In educational settings, AR has been used to complement a standard curriculum. Text, graphics, video, and audio may go into a student's real-time environment. Textbooks, flashcards and other educational reading material may contain embedded "markers" or triggers that, when scanned by an AR device, produced supplementary information to the student rendered in a multimedia format 2015's Virtual, Augmented and Mixed Reality, the 7th International Conference on Google glass as an example of augmented reality that can replace the physical classroom. These technologies help learners engage in authentic exploration in the real world, and virtual objects such as texts, videos, and pictures are supplementary elements for learners to conduct investigations of the real-world surroundings. As are evolves, students can participate in interactively and interact with knowledge more authentically. Instead of remaining passive recipients, students can become active learners, able to interact with their learning environment. Computer-generated simulations of historical events allow students to explore and learning details of each significant area of the event site.

In higher education, Construct3D, a Studiers tube system, allows students to learn mechanical engineering concepts, math, or geometry. Chemistry apps enable students to visualize and interact with the spatial structure of a molecule using a marker object held in hand. Virtual demonstrations of how to use laboratory instrumentation Anatomy students can visualize different systems of the human body in three dimensions. Using these tools to learn anatomical structures has to increase the learner's knowledge and provide intrinsic benefits, such as increased engagement and learner immersion.

AUGMENTED REALITY EDUCATION APPS

Augmented Reality (AR) is a technology that overlays interactive digital elements — such as text, images, video clips, sounds, 3D models and animations — into real-world environments. Not only does AR enhance learning, but it also provides students with opportunities to create their own content. Teacher librarians and technology integration specialists are often the

ones to help their fellow educators integrate new technologies into classroom instruction. A search of the internet reveals a variety of web-based AR tools and apps for almost any subject. Many of these apps promote 21st century skills such as creativity, problem-solving, critical thinking, analysis, coding and iterative testing. Within augmented reality in education, we can have 3 categories of apps:

i. The ones specialized for students,
ii. The ones specialized for kids, and
iii. The apps for self-education.

Let's start off with a few examples of AR apps for students.

AUGMENTED REALITY APPS FOR STUDENTS

- **Elements 4D** (Android / iOS) by an app for studying chemistry. It allows combining different elements as the simulation to see how they would react in reality. To start it, particular triggers on printed cards on their website, you can find lesson plans suitable for high school, secondary, and elementary school programs. Take a look:

- **Anatomy 4D** (iOS / Android) is the best fit for medical students. By scanning printed targets, the application shows 3D models of a human body and allows them to interact with it. Users may change and adjust any part of the human body, learn more about roles, joints, functions, etc.

- **Corinth Micro Anatomy,** available for mobile**,** is another human anatomy application that may be interesting for medical staff. Or **Human Heart 3D** app with less content, but more specific – to explore the human heart in detail. 3D model of a heart completed with various animations and textual tips about it.

- **AugThat (**Android &iOS), designed by a former teacher, is the application that brings AR in a classroom. AugThat mainly targets students who lack motivation with the help of 360-degree virtual photos and multiple 3D experiences.

AUGMENTED REALITY APPS FOR SCHOOL CHILDREN (KIDS)

Math alive, developed for kids in up to 3rd grades, connect a computer, a camera, and specially printed cards. Pupils under teacher supervision place cards in front of a camera, practicing necessary counting skills. Animal Alphabet AR Flashcards is a similar AR app, but for learning letters, the application brings cards "into life" by showing live animals when the answer is correct.

ZooKazam or Bugs 3D. ZooKazam (Android &iOS), teach about animal species, offers animated 3D models and various info-graphics about mammals, insects, fish, birds, and reptiles. Bugs 3D (Android &iOS) helps kids to know more about insects, placing quests and questions about them, and showing descriptions and images to play

For fun activities, art, and drawing, there are Quiver, and Chromville learn about plants and flora, there are Arloon Plants Android &iOS) For the smallest kids, check out Pete the Cat: School Jam app – it serves "pre-education" goals, like to teach empathy for live beings, as well as creativity.

AUGMENTED REALITY LEARNING AND SELF-EDUCATION APPS.

Google Translate **(**Android &iOS) is just great for studying foreign languages without a dictionary. By using Google Translate special "AR mode" you may instantly checkup unknown words. Works well both for students and tourists, to navigate in cities abroad.

Amazing Space Journey, Sky ORB 3D and Star Walk. All of them have one purpose which is to study the skies with all its secrets. Learn more about stars, constellations, planets of the Solar System, galaxies, etc.

TOOLS/PLATFORMS TO CREATE AR CONTENT

There is a category of AR apps that isn't for educational purposes primarily, but they may serve as a tool to create augmented reality content for various subjects. Check out some of the following (the list is not exhaustive).

- **Augment** (Android and iOS) with packages suitable for educational purposes in schools and universities. The platform provides options to create 3D models, as well as multiple other useful features.
- ZVR, a powerful tool by Zspace that comes with an extensive toolkit to create educational materials. Students equipped with special glasses could interact with AR objects, while there may also be used by engineers and designers.
- Daqri Studio, the application to make AR projects and experiences, with examples of education apps like Anatomy 4D, Elements 4D.
- Blippar (Android / iOS) an AR creation tool already used for many educational projects and partnered with different media outlets. It visualizes topics and objects from print material turning it into 3D interactive models.
- Aurasma and Layar, two powerful and popular tools to create AR content designed by Layar Creator. Both of them have potential in many areas, not just education. Coming with user-friendly constructors, guides and tutorials, YouTube videos, audio tracks, images, https links, 3D models etc.

CONCLUSION

Augmented Reality is used in many areas of the modern era. Augmented reality in education is still new and unsettled. Augmented Reality is an effective tool for this emerging learning paradigm, making the learner in active role of self-directed learning, providing flexibility and interactivity in the teaching and learning process. We need to have interactive teaching-learning process and this changing role of education is inevitable with the introduction of Augmented Reality in education and producing a technologically-savvy generation of youths.

Though the possibilities of AR in teaching are excellent and providing new ways of learning, Teachers need to catch the attention of students and motivate them better by getting them new tools to visualize their subjects and complex concepts, as well as to obtain practical skills. Moreover, even parents can also get benefit by engaging their children to study.

Augmented reality has lots of benefits in education and these can be easily applied in our daily lives. AR's best quality in learning is that it nurtures curiosity and motivates the learner to know more. This is the basic building block of any learning cycle and makes AR highly functional in education.

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