International Journal of Latest Engineering and Management Research (IJLEMR)
ISSN: 2455-4847
www.ijlemr.com || Volume 04 - Issue 10 || October 2019 || PP. 08-13

Transforming education in the age of Augmented Reality: Study

Sandhya Kumar
Faculty, EXTC department
Vidyalankar Polytechnic, Wadala

Shanti Sankara Krishnan
Faculty, EXTC department
Vidyalankar Polytechnic, Wadala

Pratik Tawde
Faculty, EXTC department
Vidyalankar Polytechnic, Wadala

Ashish Ukidve
Principal
Vidyalankar Polytechnic, Wadala

Abstract: Technology is regularly changing and consistently developing. In the recent years, there has been an increasing interest in applying Augmented reality (AR) to create unique educational settings. Personalizing for promoting an inclusive learning using AR is also a growing area. AR can be connected to a wide range of existing innovations, for example, PCs, tablets, and smart phones. AR innovation can likewise be used through wearable parts, for instance, glasses. This paper focuses on how AR technology can be applied for Education and it also includes the, viewpoints of those who have worked with AR applications.
Keywords: Education, Augmented reality, classroom, special education

I. Introduction

In the present society, innovation has turned into a vital piece of our lives. It has changed how individuals think and apply information. One of the most current creating innovations is Augmented reality (AR), which can be connected to PCs, tablets, and smart phones.AR has the ability to connect and overlap images, text, video, and audio components onto existing images or space. AR technology has gained a following in the educational market for its ability to bridge gaps and bring a more tangible approach to learning. Student-centered activities are enriched by the incorporation of virtual and real-world experience. Throughout this literature review on AR applications in education and its effectiveness will be discussed. This new technology can change the education to become more efficient and effective in the same way that computers and Internet.

II. Applying AR in Education

AR allows flexibility in use that is attractive to education. AR innovation can be used through variety of mediums including desktops, mobile devices, and smart phones. The technology is portable and adaptable to a variety of scenarios. AR can be utilized to improve content and instructions inside the traditional class room, supplement instruction in the special education classroom, broaden content into the world outside the classroom, and be joined with. Other technologies to enrich their individual applications. In fig 1 we can see how education can be used in different area of Education.

Fig 1: AR in various field of Education

Augmented reality has a great potential to be used in the classroom because it changes the way students interact with the real world, enhances student engagement, and makes the learning of their subject content a fun. When incorporated into education, AR motivates students to explore and, in this way, learn. It expands student's horizons and fosters their creativity and imagination.(1)

Traditional classroom uses: In any educational setting, there are often limitations in the various resources available. This is often seen foremost in the traditional classroom. Due to budget restraints or constraints on time, the means to teach students in scenarios that allow them to learn by doing can be a challenge. Desktop AR allows students to combine both real and computer-generated images. when desktop AR was used that combined a screen, glasses, headphones, and a pointing device which allowed students to conduct a hands-on exploration of a real object, in this case a flat torso, with superimposed virtual images.(2)as shown in figure (2). In above case it was not feasible to explore the digestive process interactively as these students were able to do along with visualizing the nutrient breakdown and absorption in a classroom setting without the AR technology. Computer images could show the process, but the pointing device allowed students to guide their learning. Classrooms can shift from the traditional lecture style setting to one that is more lab and student- oriented (Fig3). A case study conducted with a visual arts class noted that allowing students to freely explore a room that was set up with webcams and desktops encouraged more activity while the students perceived that they were more motivated to learn(3). Instead of receiving information via images and lecture, students had access to multimodal representations including text, audio, video, and 3D models.

Quick response (QR) codes can also open up opportunities to have a mixed reality setting within the actual classroom (4). In an evaluation study conducted on collaborative classroom environments in a university setting. It was found that, Students had access via their mobile devices to information provided directly from the instructor and other students. The QR codes within the classroom allowed for location determination, which was necessary because the information was not available online. Having the virtual environment accessible in a single location encourages consistent and active participation in person instead of just the virtual environment. The learning experience of the traditional classroom was enhanced by the content sharing of both instructor and peers.

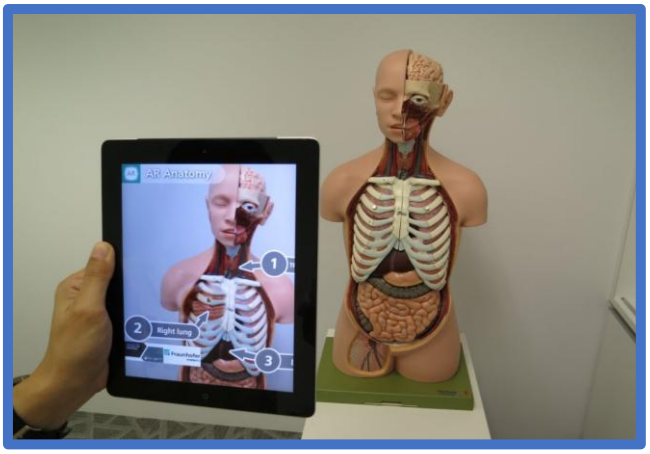
Fig2: AR in Educational Model (5)

Fig 3: AR supporting text book material (6)

Special Education Uses: With the ability to bridge learning and physical barriers, AR has the potential to bring value and high quality educational experiences to students with learning and physical disabilities (Fig 4) as well as the special education classroom. It has been found that using augmented storybooks have led to more positive results as students were able to recall stories and have better reading comprehension (7).Augmented storybooks could especially help students who were less able to comprehend only text- based materials. Physical movement is often a component and consideration for AR tasks. A student who may struggle to engage under normal circumstances can become more actively involved in the kinesthetic nature employed by augmented tasks. It has been found in their interviews that teachers felt that students who were identified as ADD as well as unmotivated students were 100% engaged in the learning process during an AR simulation (8). Because of the variety of tools that can be overlaid in an augmented environment, students with physical disabilities can benefit from the potential learning aides that could be incorporated. Something as simple as overlaying audio for those with visual impairments or text for those with hearing disabilities can be effective tools when considering disability access(9). Physical limitations can make handheld AR devices more difficult to work with. Head-mounted displays (HMD) can provide a hands-free device to project the overlay visuals to a student and adjust the images based on the orientation of the student while other devices enable students to interact with the environment via voice recognition, gesture recognition, gazetracking, and speech recognition (10).Bringing this technology to the classroom has the potential to allow for differentiated instruction and enrichment of the learning experience of students with special needs. Evaluation trials conducted (11) showed that using wearable AR technology with students who had physical disabilities produced, "interestingly comparable results with able-bodied users in terms of "wearability" and pedagogy.

Fig 4: AR for Special Education (12)

Outside the Classroom Mobile applications can extend the traditional classroom beyond the physical walls. It has been reported that the percentage of 12 to 17 year olds who have their own mobile device is 75%, compared to 45% in 2004, and regardless of a student's socioeconomic status, the number of students carrying their own mobile devices is growing exponentially every year (13). Camera phones and smart phones allow users to gather information in a variety of locations. QR codes and GPS coordinates can be used to track and guide movement of the students. Although several researchers chose to take students off campus and conduct investigations in a field trip setting, others- chose to remain within the grounds of the school. In an off campus setting, the AR

technology needs to be portable and relatively easy to use. Students traveling to a local pond have the ability to study water quality at specific locations while having access to overlaid media about the pond from the AR device (14).This type of experience opens up a world of opportunities to mesh classroom information into the real-world environment. In a research with real paper maps and GPS coordinates in a treasure-hunt-style game that allowed for group collaboration. Participants in the game were aware of their surroundings and chose to work together on a task that fostered small group collaboration.(15) An important point to note from this research is that GPS will not work inside of buildings. Therefore, any indoor activity would need to be conducted without a location-based AR technology. Using QR codes allows individuals a means to avoid relying on location-based technology and focus on the augmented experience. Bresslerand Bodzin (2013)(16)chose to use vision-based mobile AR within the confines of the school campus. Students used iPhones that were Wi-Fi enabled to collaborate in small groups to complete a science inquiry game. as shown in Fig 5. Not only did the technology enable the students to move freely about the campus, but also the design of the game fostered a social constructivist approach by using a jigsaw method in which students had independent roles that relied upon one another to complete the task (17), employed a similar approach to jigsaw collaborative methods for successful completion of an AR simulation

Fig5: AR outside the classroom (18)

Combined Learning The technology employed with AR does not need to be exclusive to the AR experience. Motion sensors that modeled force and motion during Learning Physics through Play (LPP) activities and AR in the form of QR codes enabled students to use, visualize ideas and share them with others for discussion (19) Combining the technologies helped to enhance the learning experience (as shown in Fig 6), which is similar to research done by Kamarinen et al. (2013) (20) who pointed out that the combination can help to enhance the learning experience in a way that neither could do alone. If an educator is looking to model scientific practice, AR provides the opportunity to support the multifaceted world of science exploration. As a general rule, scientific researchers typically do not use a single tool for evidence to come to a conclusion. Likewise, a literature review that embodies just research from one scientific journal does not begin to tap the wealth of knowledge widely available. Using probe ware and sensors to collect data and AR technology to guide and visualize helps to bring a more student-centered dynamic to a learning experience, resulting in gains in student engagement and content understanding

Fig 6: AR in combined Learning (21)

Applications Beyond Science Research shows that the use of AR, regardless of grade level or subject area, allows students to be actively engaged in the learning process. "Building and using AR scenes combines active complex problem solving and teamwork to create engaging educational experiences to science, math, or language skills, and studies have found that this activity enhances student motivation, involvement, and engagement" (22). Though most research shows the use of AR in education through middle school science, there are some implementations in other subject areas and age groups. For example, AR was utilized in a visual arts class as researched (23) and during the research by when participants ranging in age from 7 to 50 were observed. Outside of a traditional school setting, AR has many uses and can be applied to other areas of interest as well(Fig 7). The medical field can utilize this technology to see information about the body systems without having to leave the sight of the patient. In addition, families can see what furniture will look like in their house before purchasing, contractors are able to design different components and see how they will fit together before construction, and tourists can find information out about the area without an in-person tour guide. By research it was determined that AR can be particularly helpful in industrial situations in designing and assembling vehicles as well as military applications for combat training (24). Companies such as Volkswagen and BMW have already started to use AR technologies in their assembly lines. Therefore, AR has many benefits outside of the educational field.

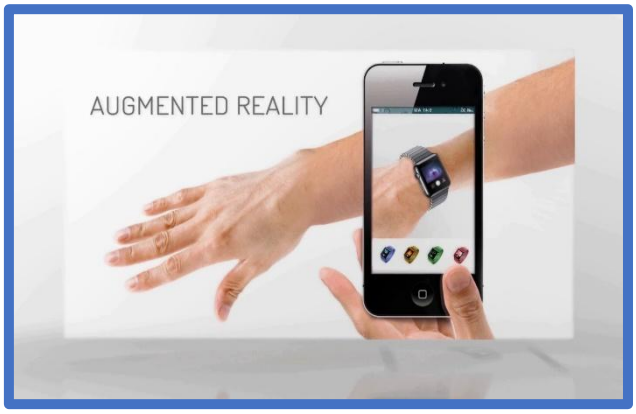

Fig 7: AR beyond science (25)

III. Conclusion

From the above study we have seen that AR is very effective in the field of education and has already begun to help students learn more efficiently as well as increase their knowledge retention. It is also proved to be very useful in children having learning disability. AR has proved to be an engaging way for students to participate in their learning. It is also seen that this technology can be collaborated with paper maps. Computers & Graphics for better understanding, this new technology allows the learning to be student-centered and create opportunities for collaboration that fosters a deeper understanding of the content. AR has been effective for: a better learning performance, learning motivation, student engagement and positive attitudes. However, before AR becomes mainstream in education, like desktops, laptops, tablets, and even cell phones. consideration must be taken into account on the usability, cost, power usage, and visual appearance.

IV. References

[1]. Misty, Antonioli, Corinne Blake and Kelly Sparks,Augmented Reality Applications in Education"The Journal of Technology Studies, Vol. 40, No. 1/2 (Spring/Fall 2014), pp. 96-107
[2]. Iordache, D. D., & Pribeanu, C. (2009). A comparison of quantitative and qualitative data from a formative usability evaluation of an augmented reality learning scenario. Informatica Economica, 13(3), 67-14.
[3]. Serio, A. D., Ibanez, M. B., & Carlos, D. K. (2013). Impact of an augmented reality system on students' motivation for a visual art course. Computers & Education , 68, 586-596. http://dx.doi. org/1 0. 101 6/j .compedu.20 1 2.03 .002
[4]. DeLucia, A., Francese, R., Passero, I., & Tortoza, G. (2012). A collaborative augmented campus based on location-aware mobile technology. International Journal of Distance Education Technologies, 70(1), 55-71.
[5]. https://www.emergingedtech.com/2018/08/multiple-uses-of-augmented-reality-in-education/
[6]. https://www.emergingedtech.com/2018/08/multiple-uses-of-augmented-reality-in-education/
[7]. Billinghurst, M., & Dunser, A. (2012). Augmented reality in the classroom. Computer, 45(1), 56-63.

[8]. Dunleavy, M., Dede, C., & Mitchell, R. (2009). Affordances and limitations of immersive participatory augmented reality simulations for teaching and learning. Journal of Science Education and Technology, 18('), 7-22.
[9]. Forsyth, E. (201 1). Ar u feeling appy? augmented reality, apps and mobile access to local studies information. Australasian Public Libraries and Information Services, 24(3), 125.
[10]. Van Krevelen, D. W. F., & Poelman, R. (2010). A survey of augmented reality technologies, applications and limitations. The International Journal of Virtual Reality, 9(2), 1-20. Retrieved from http://kjcomps.6te.net/upload/paper 1 %20.pdf Wang, X. (2012).
[11]. Arvanitis, T. N., Petrou, A., Knight, J. F., Savas, S., Sotiriou, S., Gargalakos, M., Human factors and qualitative pedagogical evaluation of a mobile augmented reality science education used by learners with physical disabilities. Personal and Ubiquitous 73(3), 243-250.
[12]. https://liu.se/en/article/visualization-and-augmented-reality-as-learning-tools-for-children-with-special-needs-
[13]. Annetta, L., Burton, E. P., Frazier, W., Cheng, R., & Chmiel, M. (2012). Augmented Using technology on a budget. Science Scope, 36(3), 54-60.
[14]. Kamarainen, A. M., Metcalf, S., Grotzer, T., Browne, A., Mazzuca, D., Tutwiler, M.S., & Dede, C. (2013). EcoMOBILE: Integrating augmented reality and probeware with environmental education field trips. Computers & Education, 68, 545-556.
[15]. Morrison, A., Mulloni, A., Lemmela, S., Oulasvirta, A., Jacucci, G., Peltonen, P., Schmalstieg, D., & Regenbrecht, H. (201 1). Collaborative use of mobile augmented reality with paper maps. Computers & Graphics, 35(4), 789-799.
[16]. Bressler, D. M., & Bodzin, A. M. (2013). A mixed methods assessment of students' flow experience during a mobile augmented reality science game. Journal of Computer Assisted Learning, 29(6), 505
[17]. Dunleavy, M., Dede, C., & Mitchell, R. (2009). Affordances and limitations of immersive participatory augmented reality simulations for teaching and learning. Journal of Science Education and Technology, 18('), 7-22.
[18]. http://www.diaryofatechiechick.com/2015/06/why-use-augmented-reality-in-classroom.html
[19]. Enyedy, N., Danish, J. A., Delacruz, G., & Kumar, M. (2012). Learning physics through play in an augmented reality environment. International Journal of Computer-Supported Collaborative Learning, 7(3), 347-378. doi:http://dx.doi.org/10.1007/s 114 12-0 12-9 150-3
[20]. Kamarainen, A. M., Metcalf, S., Grotzer, T., Browne, A., Mazzuca, D., Tutwiler, M.S., & Dede, C. (2013). EcoMOBILE: Integrating augmented reality and probeware with environmental education field trips. Computers & Education , 68, 545-556. doi:10.1016/j.compedu.2013.02.018
[21]. https://www.indiatoday.in/education-today/featurephilia/story/role-of-augmented-virtual-reality-in-education-1417739-2018-12-26
[22]. Billinghurst, M., & Dunser, A. (2012). Augmented reality in the classroom. Computer, 45(1), 56-63.
[23]. Serio, A. D., Ibanez, M. B., & Carlos, D. K. (2013). Impact of an augmented reality system on students' motivation for a visual art course. Computers & Education , 68, 586-596.
[24]. Van Krevelen, D. W. F., & Poelman, R. (2010). A survey of augmented reality technologies, applications and limitations. The International Journal of Virtual Reality, 9(2), 1-20.
[25]. https://blog.banuba.com/5-examples-how-augmented-reality-solves-top-e-commerce-challenges