Augmented Reality: A New Tool for Education

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ABSTRACT
Utilizing technology in the classroom can encourage and push kids to learn actively, which will result in a more successful learning experience. However, if technology doesn't encourage critical thinking and problem-solving abilities, it has been observed to result in a passive learning process. An interactive experience that blends computer-generated material with the real world is called augmented reality. Augmented Reality (AR) contributes to a more dynamic, engaging, and productive learning process. It facilitates more effective subject mastery for students by establishing an immersive learning environment. This study examines the use of augmented reality in the classroom. The benefits of augmented reality (AR) over other teaching techniques, such as e-learning, courseware, and conventional methods like chalk and talk and classic books, are also highlighted in this research article. The analysis of this study will demonstrate the general benefits and advantages of augmented reality technology for teaching. Ultimately, it also highlights a few AR limitations that may be investigated in the next studies.

Keywords
Augmented reality, Technology, Education

1. INTRODUCTION
It has been demonstrated that integrating technology into education improves both teaching strategies and the overall learning experience for students. [1]Shapley et al. (2011) discovered that by presenting real-world challenges, utilizing up-to-date informational resources, appropriately representing concepts, and facilitating conversations with subject matter experts, technology may be used in the classroom to stimulate innovation. This method of using technology to enhance education inspires innovative teaching strategies and engaging learning experiences.

In addition to being technically proficient with computers, teachers who want to successfully incorporate technology into their pedagogy must also exhibit a high degree of inventiveness and confidence while utilizing novel technological solutions. When used skillfully, technology may greatly increase student engagement and improve the lecture format's learning experience.[2]Geer and Sweeney's (2012) research indicate that using a wide range of multimedia tools—like statistical software, animations, and simulations—helps students learn complicated concepts more effectively and collaborate with one another.

One relatively new technology innovation being investigated for its potential use in educational contexts is augmented reality (AR). Though much research has been conducted on augmented reality, very few have explicitly examined its application in education. However, with the advancement of technology recently, the possibility of augmented reality to revolutionize teaching methods has come to light. The power of AR rests in its capacity to depict complex systems that are difficult to explain through conventional teaching techniques. Additionally, [3]Singhal et al.'s research (2012) indicates that augmented reality (AR) offers a fluid platform for interaction that unites the physical world with digital content and presents a physical metaphor for interface interaction that streamlines and normalizes the manipulation and inspection of objects.

[4]Milgram and Kishino define augmented reality as "a reality environment where digital media products are used instead of real world objects," which seems to be the most inclusive description. Virtual reality is the parent of augmented reality, claims [5]Azuma. This definition defines augmented reality as virtual environments that support the real world as it exists, rather than creating it from scratch. In this case, consumers are presented with harmonious virtual and real-world things in augmented reality settings. The interface between the virtual and physical worlds is created via augmented reality. This is accomplished by using augmented reality [6, 7]. Augmented reality is commonly defined as actual worlds enhanced with virtual items, based on a review of terminology found in the literature.

2. RELATED WORK
The use of augmented reality (AR) in education has gained a lot of interest recently due to its potential to enhance learning outcomes and boost student engagement. Augmented Reality (AR) technology creates an immersive and engaging learning experience by superimposing digital content over the actual world. This report provides an overview of the current state of research and discusses the benefits and drawbacks of augmented reality in education.

The teaching of maths is one area where AR has demonstrated promise. In 2013, [8] Knezek, G. and K. Poulson carried out research to find out how well AR taught math to middle school students. The findings demonstrated that augmented reality (AR) improved students' engagement and excitement while also improving their grasp of mathematical ideas. The survey also revealed that pupils appreciated augmented reality (AR), with many saying it made math lessons more engaging and enjoyable.

[9]Chang et al. (2016) investigated how AR might be used to teach science to elementary school students. In comparison to conventional teaching techniques, the study indicated that augmented reality (AR) improved student learning outcomes. Students that used augmented reality to learn showed improved comprehension and memorization of scientific ideas.

AR has also been studied in relation to learning a new language. In order to assess how well AR works for teaching Chinese characters to primary school kids, [10]Wang, F., Liu, L., and Chen, Y. (2015) conducted a study. The outcomes demonstrated how AR enhanced students' writing and character recognition skills. According to the study, students found augmented reality (AR) to be more entertaining and engaging

than conventional teaching techniques.

AR has been investigated for use in medical education in addition to math, science, and learning a new language. [11]Saveriano, M., Ouellette, H., Doshi, A., Lee, J., & Wong, A. (2016) investigated of the usage of AR in teaching anatomy to medical students. In comparison to conventional teaching techniques, the study indicated that augmented reality enhanced students' comprehension and recall of anatomical topics.

A smartphone software called Augment uses ARCore to display 3D models in Augmented Reality in real time, integrating them into their true size and surroundings. In their research, [12]Balak and Kısa examined how this application affected the teaching of technical drawing. By watching the data that came from using augmented reality in the technical drawing course throughout the 2015–2016 year. Therefore, the survey's results using the pre- and post-tests applied show that students comprehend and use augmented reality technology, a contemporary teaching tool that piques their interest in the material.

All these research points to the possibility that augmented reality (AR) can improve student engagement and learning results in a variety of educational settings. But there are drawbacks and restrictions to using augmented reality in the classroom. The price of AR equipment is a significant barrier, as it may be out of reach for certain educational institutions. Additionally, some instructors may find it difficult to implement AR technology since it requires specific knowledge and training.

Subsequent investigations ought to concentrate on tackling these constraints and investigating possible solutions. For instance, researchers could look at the usage of less expensive augmented reality equipment or consider methods to increase educators' access to AR through online resources and training. Furthermore, studies might look at how AR affects student performance and learning outcomes over the long run. They could also investigate how AR might help kids who struggle academically.

In conclusion, augmented reality in education has the potential to fundamentally alter how you both learn and transmit knowledge. With the use of AR technology, learning objectives may be raised, student engagement can be increased, and a more dynamic and immersive learning environment can be created. However, there are certain drawbacks to using augmented reality (AR) in the classroom, and they should be explored in more research and development. By doing more research on the possibilities of augmented reality (AR), people will better understand its benefits and limitations in education and develop workable methods for integrating it in the classroom.

3. PROPOSED WORK

This research is committed to improving the educational experience for middle and high school students, or those enrolled in grades six through eleven, in the expanded edition of this initiative. This platform is specifically made to accommodate individual preferences, considering that every student has a different learning style. It presents a variety of study approaches from which a student can choose the most appropriate one for their own educational path.

Presenting each academic topic in three broad formats: traditional theoretical explanations, three-dimensional (3D) models, and Augmented Reality (AR). With AR, students can explore topics in a whole new way and enter an interactive setting where learning turns into an experience. The ability to interact and explore objects and concepts is made feasible by the 3D component, giving education a more hands-on experience that improves comprehension and retention.

Students are encouraged to shift to the theory portion after becoming familiar with the subject through the tactile and visual experiences of AR and 3D. To strengthen their comprehension, students can review in-depth explanations and commit formulas to memory that may be crucial for their exams.

Since accessibility is essential, students can access the instructional materials in the manner that best meets their requirements. A dedicated app as well as a website is available to make sure that learners may access the resources anytime, anywhere, at home or on the go. The seamless transition between learning media is ensured by the intuitive and user-friendly design of each platform.

Additionally, to assess knowledge acquisition in an entertaining way, this platform probably contains elements like progress tracking, individualized learning routes, and maybe even interactive quizzes and challenges. By providing this extensive and adaptable educational resource, it enables students to take charge of their education and delve deeply into academic subjects, use technology to pique interest and foster a lifetime love of learning.

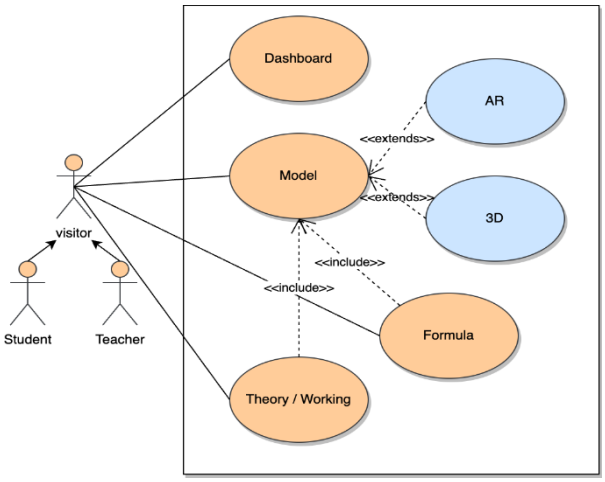

Figure 1. Use-Case diagram of the AR model

4. RESULT

4.1 The website's initial user interface can be accessed at https://explorearedu.abhisheksinghal.in/ A graphical user interface (GUI) with choices to browse to different classes and access different practical materials is offered to users. Students use this interface to interact with the instructional materials available on the platform.

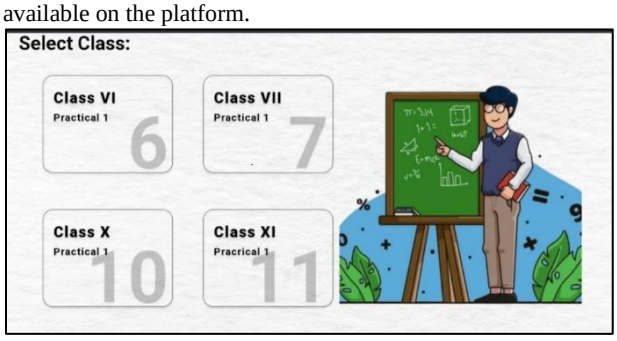

Figure 2. Dashboard of the application

4.2 This page has an interactive description interface that uses a 3D model integrated to explain the text by reading each sentence in turn. For reference, students can also access examples, formulas, and theoretical explanations. Thanks to the technical architecture, theoretical concepts can be reinforced through hands-on demonstrations and additional materials in an interactive learning environment.

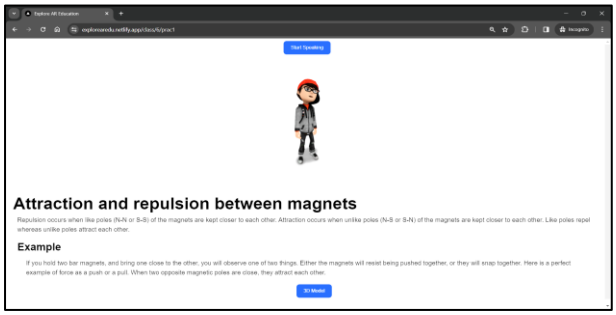

Figure 3. After selecting the practical of the class

4.3 This page displays a three-dimensional model of a real-world example using two bar magnets. When one magnet is brought close to the other, the model shows two possible outcomes: attraction, which causes the magnets to snap together, or repulsion, which causes the magnets to resist being pulled together. This demonstration does a great job of explaining how force can appear as either a push or a pull. The orientation and location of the magnets can be changed using the model. These virtual counterparts, like real magnets, react to interactions between their like and opposite magnetic poles with attraction or repulsion.

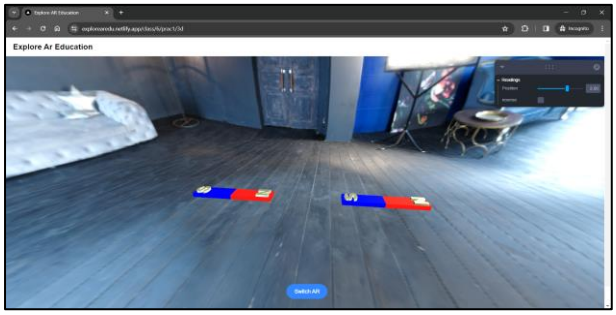

Figure 4. 3D model of the practical

4.4 The model is shown on this page using augmented reality (AR) technology, which lets users see it in their real world. By changing the magnet's location along the x, y, and z axes, users can interact with the model in real time. Moreover, the model can be dynamically scaled to blend in with the user's environment. Users can also control the magnet's movement, allowing for back-and-forth mobility for improved interaction and exploration.

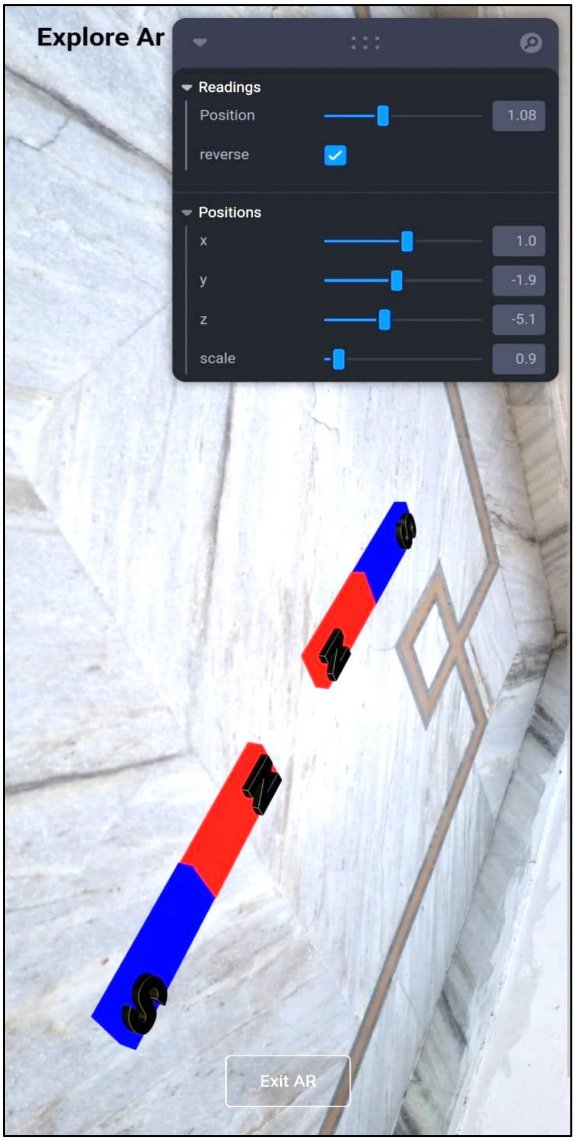

Figure 5. Ar model of the practical

4.5 An illustration of the seesaw principle is provided on this page, explaining the idea of force balance. Every object on either side of the seesaw experiences the force of gravity, which calls for a balance of forces. The basic idea is expressed as follows: w1d1 = w2d2, where Di indicates the object's distance from the seesaw's center and Wi indicates the object's weight. It presents an accurate augmented reality (AR) model that mimics this situation by letting users adjust the pivot point of the seesaw by adding or removing unique weights from either side. By adjusting dynamics based on the given formula, the model faithfully replicates seesaw dynamics found in real life.

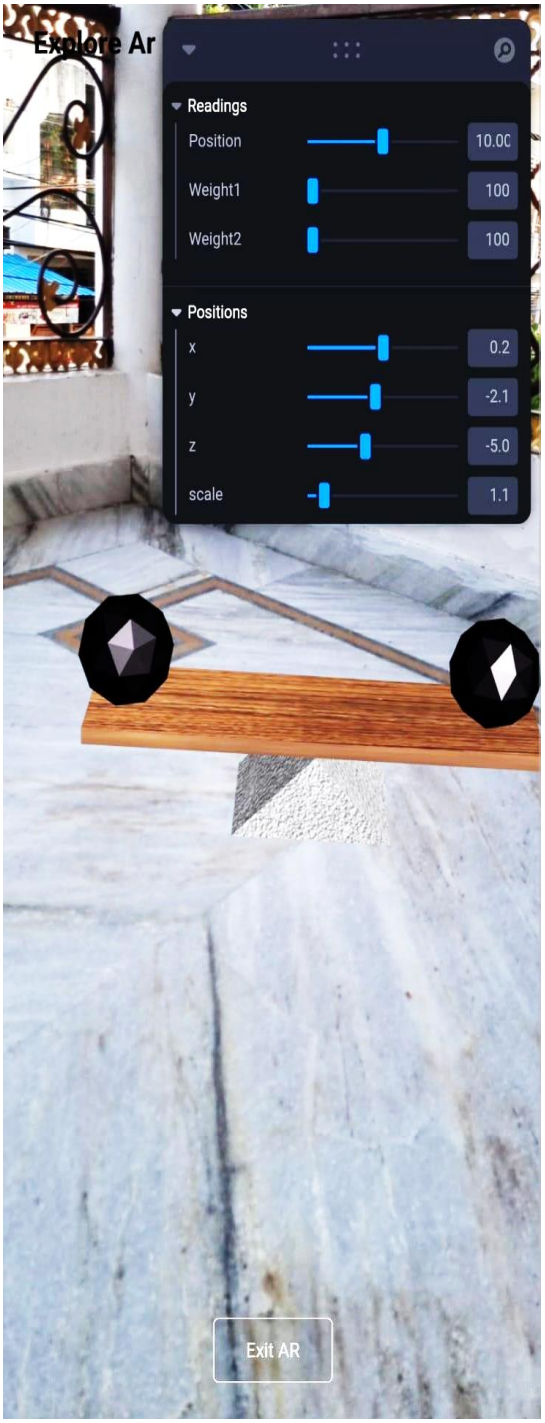

Figure 6. Another AR model of the practical

4.6 This page displays an augmented reality (AR) model that shows how plants use carbon dioxide, sunshine, and chlorophyll to synthesize their food, producing oxygen as a byproduct in the process. Phototropism, the process by which plants develop by orienting themselves towards a light source, such as the sun, is a crucial component of photosynthesis. This effect is faithfully captured in the AR model, which also shows the plant's direction of bending toward the artificial sunlight. Users can watch the complex process of photosynthesis and the plant's reaction to light stimulation in a virtual environment thanks to dynamic visualization.

Figure 7. Another AR model of the practical

5. CONCLUSION

This thorough analysis of studies conducted in a variety of educational fields highlights the emerging but exciting potential of augmented reality (AR) technology in learning environments. The analysis highlights the various benefits and usefulness of AR components, which have the potential to greatly improve students' visual perception and encourage more active participation in the learning process. These qualities also go a long way toward supporting teachers in providing thorough and understandable explanations, which helps students retain and understand the material better.

Feedback from participants and students on the use of

augmented reality technology has been overwhelmingly favorable, and students have shown a notable interest in using AR in their teaching methods. But it's important to recognize that augmented reality technology in education is still in its infancy, which means there are some inherent limitations. These restrictions are mostly the result of technological difficulties that make it difficult to integrate and use AR products effectively.

However, the analysis of the research shows that most of these limitations stem from technological problems, implying that continued developments and additional studies pertaining to the use of augmented reality in education have the capacity to surmount these obstacles. The potential to significantly increase the effectiveness of the teaching and learning process is set to arise as augmented reality (AR) technology continues to advance and its advantageous uses are increasingly accepted across a range of academic fields. To maximize educational experiences and outcomes for teachers and students alike, it is essential to keep investigating and utilizing augmented reality technology to its fullest extent.

6. REFERENCES

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