Emerging Market of Augmented Reality in Online Education: A Bibliometric Analysis

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Abstract

There has been a lot of interest in Augmented reality (AR) technology as a possible tool for online education in recent years. This study summarises the research on the benefits and drawbacks of using AR in Online learning. The present study explores augmented reality effects on student engagement, behaviour, and purchase decisions. The use of AR in online learning is also discussed, as well as its potential benefits and drawbacks. The intent of this study is to assess the benefits of the 4.0 industrial revolution. Augmented reality technology, according to the study, may change how students interact with digital products. These technologies can also provide unique and enjoyable shopping experiences, which can increase client satisfaction and loyalty. However, AR is widely used in online-learning, a number of technological, usability, and ethical issues must be addressed. Finally, this study provides recommendations for how businesses and marketers can make progress on Augmented reality technology's potential to improve student satisfaction and online-learning efficiency.

Keywords: Augmented Reality, E-learning, Online-learning, Technology.

Introduction

Augmented reality (AR) has gained significant attention in recent years, particularly as a tool for online education and e-commerce. Studies have investigated the potential advantages and disadvantages of using AR in E-learning, such as improved product visualisation, higher conversion rates, and better customer interactions. AR technology has the potential to provide unique and enjoyable shopping experiences that can increase students' satisfaction. However, there are still several technological, usability, and ethical issues that need to be resolved before AR can be extensively used in E-learning [1].The use of AR in online education has the potential to enhance the learning experience by providing immersive, interactive, and engaging content. AR can simulate real-life scenarios and offer hands-on training that can improve retention and skill development. However, AR technology is still in its early stages, and there are concerns about the high cost of development, hardware requirements, and potential side effects such as motion sickness. Additionally, ethical issues related to data privacy, intellectual property rights, and accessibility need to be addressed. In the context of e-learning, studies have shown that AR technology can increase student engagement, behaviour, and purchase choices [2]. AR can provide student with a realistic and immersive preview of products, which can enhance their understanding and reduce the risk of dissatisfaction. Additionally, AR can create a unique and memorable studying experience that can increase loyalty and repeat purchases behaviour of students. However, there are concerns about the potential for AR to be used to manipulate students behaviour and the ethical implications of using AR to collect data on students preferences. [3]

The development of communication technologies has made it possible for students to have more influence over usage choices. As technology advances, there are more tools available to encourage students to purchase products. A recently accepted but still-evolving technology is Augmented reality (AR). Because they make life simpler for people, especially for those who find it challenging to make in-person purchases and those who are disabled, e-learning are becoming more popular. A cutting-edge e-learning tool called v-commerce can urgently fill the gap left by the separation of social and technical aspects of online learning. It is proving to be a fascinating new instrument [4]. The major objectives of the study is to explore that AR technology emphasises interaction that are timely nature of interactive input between the students and the system in an Augmented world. Secondly, the user's point of view typically shows students interest towards augmented reality in E-learnings.

Research Question

- What are the factors of adopting augmented reality in online learnings?
- How to quantify the identified enablers and barriers in online learning?

Literature Review

As the industrial revolution transform from the conventional to the informational and augmented levels, Industry 4.0 is currently changing meticulously. It is referred to as "augmented reality" when a three-dimensional computer-generated simulation can be

watched and interacted with using specialized equipment like head-mounted displays, haptic gloves, and motion-tracking sensors [6]. Users can interact with and experience augmented environments and objects in a manner that is exactly like the real thing [8]. A wide range of sectors have embraced augmented reality, including entertainment, gaming, education, healthcare, engineering, and construction. Users can take part in real-time remote work, interactive training simulations, local trips, and experiences. As a result of ongoing advancements in hardware, software, and content production, the AR market is growing rapidly. New augmented reality applications and use cases are being developed because there are more accessible low-cost intervention choices and because people are more interested in immersive experiences [3]. Users can engage with 3D simulated models online through a fake version of augmented reality. (AR). Currently, e-learning concept are utilizing augmented reality (AR) to provide students with a distinctive learning experience [4]. By utilizing the appropriate technology, a student can connect to an augmented environment, engage with its objects as if they were in the real world, and derive feelings and emotions that are comparable to those found there [7]. Although immersive and interesting online purchasing experiences made possible by Augmented reality and Augmented reality have the potential to fully transform the e-learning industry, there are several challenges that must be overcome before they can be used effectively. AR in online schooling has some disadvantages, including the following [10]

- AR technology is still in its infancy, there are still some technical hurdles to overcome, including poor resolution, sluggish loading times, and device incompatibility.
- The cost of implementing AR technology in e-learning can be high because it calls for a sizable expenditure on software, hardware, and qualified people. As a result, it might not be cost-effective for smaller businesses or those with limited means.
- Some consumers may be hesitant to embrace new technology and uneasy about making purchases using AR devices. Because there are fewer prospective customers, sales may suffer [11]
- Since not all hardware and operating systems support AR technology, not all users may be able to fully enjoy AR experiences. This might restrict the market reach of AR-based e-learning companies.

Barriers of augmented reality

Augmented reality (AR) technology has the potential to revolutionize various industries, including education, healthcare, and entertainment, there are still several barriers that need to be addressed before it can be widely adopted. Some of the common barriers include: cost, Technological restrictions, accessibility, Health concerns, Usablity, Ethical concerns and more [12].

Table 1. Augmented Reality barriers			
S.No	Barriers	Definition	Source / References
1	Cost	AR technology is still relatively expensive, and the cost of developing and implementing AR systems can be prohibitive for some organizations.	Alkhattabi, M. (2017)
2	Technical limitations	AR requires high-performance hardware, and many computers or devices may not be able to meet the technical requirements needed to run AR applications smoothly.	Saidin, N. F., Halim, N. D. A., & Yahaya, N. (2015)
3	Accessibility	Not everyone has access to AR technology, which can create an unequal playing field in terms of educational or professional opportunities.	Alzahrani, N. M. (2020)
4	Health Concerns	Some users may experience motion sickness or other health issues while using AR technology, which can limit its practical use.	Kılıç, A. Ö., & Çalışkan, F. (2019)
5.	Usability	AR technology can be difficult to use for some people, especially those who are not tech-savvy or who have disabilities that may limit their ability to use AR systems.	Alkhattabi, M. (2017)
6.	Ethical Concerns	There are ethical considerations that need to be addressed, such as data privacy and potential misuse of AR technology.	Han, J., Jo, Y., & Park, J. (2019)
7.	Content Creation	Creating high-quality AR content can be challenging and time-consuming, and there is a shortage of skilled professionals with experience in AR content creation.	Kebritchi, M., Lipschuetz, A., & Santiague, L. (2017)
8.	Lack of skilled professionals	There may be a shortage of skilled professionals with experience in AR development and content creation, which can limit the adoption and use of AR technology in developing nations.	Mahlangu, V. P. (2018)
9.	Education and training	There may be a lack of awareness and education about the potential benefits of AR technology and how it can be used in various industries, including education, healthcare, and entertainment.	Mahlangu, V. P. (2018)
11.	Language barriers	The adoption of new technologies can be met with skepticism and resistance in some cultures, which can limit the uptake of AR technology.	Al-Emran, M., Mezhuyev, V., & Kamaludin, A. (2019)
12.	Power supply	Access to reliable power supply is often	Li, B., Liu, Z., Li, Z.,

		limited in developing nations, which can be a significant barrier to the adoption of AR technology.	Li, R., & Wang, Y. (2021)

Hypothetical Interpretation

The adoption of AR technology in developing countries confronts several challenges that need to be addressed. To surmount these challenges, investment in infrastructure, education and training, and support for AR content creation can help to drive adoption and expand access to this technology in developing nations. Despite of several challenges, AR can help the E-learning by offering several interactive and engaging learning opportunities. Such as: Mobile Devices, AR Headsets, 3D models and animations, Marker Based AR, Could Base AR[13].

Smartphones and tablets are the most prevalent enablers of AR in online education. These devices have built-in sensors such as cameras and accelerometers that enable them to capture images and track motion. AR apps can be loaded on these devices to provide a virtual layer of information on top of the real world. Similarly, AR glasses provide a more complete AR experience. These devices usually have sensors and cameras that enable them to track the user's head movements and adjust the AR content accordingly. AR devices can provide a more hands-free and immersive learning experience. 3D models and simulations of objects and concepts that are challenging to visualize otherwise. This can help students comprehend complex concepts and visualize abstract thoughts. Cloud-based AR utilizes remote servers to process AR material and transmit it to the user's device. AR authoring tools enable educators to build their own AR content without requiring extensive technical knowledge. Therefore, with several advantages as stated above AR tools can be extremely beneficials in mentioned barriers can be taken care of in developing nations**.[14]**

In this study, we also provided the word cloud, using the search term as “Augmented Reality” and “Online Education” followed by “E-learning” in the Scopus Database. We found, a total of 50 articles based on the key words. It has been shown in the figure 1 that most frequent term as AR, Online Education, and E-learning are most widely researched in the available literature. Still, the numbers of research articles are significantly less in this area and can be gap for further research.

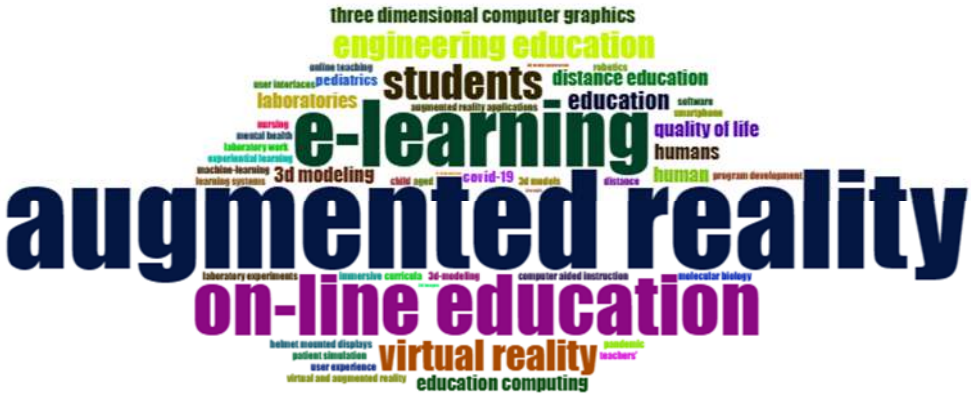

Figure 1 word cloud on online-Learning using Augmented Reality (Using RStudio)

Managerial Implications of AR tools in E-Learnings

The following recommendations for using AR in e-learning are made considering the analysis and studies stated above:

- Using augmented reality, student can try on products like apparel, eyewear, and cosmetics. With augmented reality, it can go even further by enabling students to try on products in an entirely immersive setting [15].
- Students can now watch augmented reality product demos online learning for items like classes, tests, and e-tutorials etc. This can be used by students to thoroughly investigate goods before avails services.
- Users of AR might have access to real-time user guides for various devices. Product refunds are becoming less common, and students' knowledge of the product is growing.

Conclusion

E-learning may have high influence of virtual reality technology. Augmented reality (AR) in e-learning can give businesses a competitive edge by giving students a more engaging and immersive learning experience. AR can help students make more interactive learning experience by providing them a more accurate representation of the content. Augmented reality should be used more frequently in online schooling as technology advances. The virtual reality sector might influence e-learning. Student can enjoy a more personalized and interesting learning experience, which can increase sales, client loyalty, and general happiness of AR market. A complete transformation of E-learning is possible with augmented reality technologies by utilizing immersive and engaging learning experiences. Despite the potential of solutions, these instruments face barriers in their adoption. We anticipate significant innovation and development in the use of augmented reality (AR) in e-learning to provide students with a more engaging and dynamic learning experience. Augmented tools are playing a bigger role in the world of online learning education. Both technologies offer students enjoyable user experiences that can increase knowledge.

Suggestion

- This study aims to demonstrate how e-learning businesses use Augmented and Augmented reality technologies to provide genuine and contented student experiences.
- The development, use, outcomes, and significance of Augmented and Augmented reality for both companies and students are examined in this study. It also contributes to the body of knowledge in academia about online education. By providing a systematic description and classification of how AR is used in e-learning, the research aids in understanding the functions of technologies used in the field.
- To comprehend the benefits that companies, organisations, and students can receive from using AR in e-learning experiences.
- The methods that technology is improving and advancing society are outlined in this article.

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