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Adoption of augmented virtual reality in higher education during Amrit Kaal: A systematic literature review

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Abstract
This systematic literature review aims to investigate the adoption of augmented virtual reality (AVR) in higher education during the Amrit Kaal. The Amrit Kaal is a period characterized by transformative advancements in technology, particularly in the field of virtual reality (VR) and augmented reality (AR). The purpose of this review is to provide a comprehensive analysis of existing literature on the topic, highlighting the current state of adoption, benefits, challenges, and potential applications of AVR in higher education.
The review adopts a systematic approach, following established guidelines for literature search, selection, and analysis. A rigorous search strategy was employed, encompassing multiple academic databases, conference proceedings, and relevant literature.

Keywords: Immersive media, augmented reality, virtual reality, higher education

Introduction
The Amrit Kaal is a transformative era characterized by significant advancements in technology, and one such advancement that has gained substantial attention is augmented virtual reality (AVR). AVR combines elements of virtual reality (VR) and augmented reality (AR) to create immersive and interactive experiences that blend digital content with the physical world. In the context of higher education, AVR holds great promise in revolutionizing teaching and learning methodologies, offering unique opportunities for enhanced engagement, experiential learning, and skill development.
The adoption of AVR in higher education has the potential to address various pedagogical challenges and transform traditional classroom environments. By leveraging immersive technologies, AVR can offer students realistic and engaging experiences that go beyond the limitations of traditional textbooks and lectures. It enables students to interact with digital objects, explore virtual environments, and manipulate virtual elements, fostering a deeper understanding of complex concepts across various disciplines.
It goes without saying that the potential, the technology, or even the applications that are presently in use are not the most important aspects of virtual and augmented reality to underline. The important thing to remember is that these are instruments. The ultimate goal is to enhance student outcomes across the board for the whole educational process in which they participate. These resources are only intended to expand the number of students who can acquire the essential knowledge needed by a rapidly evolving competitive market. Millions of experts from numerous organizations work every day to achieve this. People currently discuss virtual and augmented reality, but tomorrow they might bring up holography or any other incredible development. In the end, these are just tools, and the improvement of student understanding will always be the industry's primary objective.

Literature Review
Tycho T De Back *et al.* (2020) [1], Benefits of immersive collaborative learning in CAVE-based virtual reality, International Journal of Educational Technology in Higher Education, 51

This study investigated whether academic learning using a state-of-the-art Cave Automatic Virtual Environment (CAVE) yielded higher learning gains compared to conventional textbooks. The present study leveraged a combination of CAVE benefits including collaborative learning, rich spatial information, embodied interaction and gamification. Results indicated significantly higher learning gains after collaborative learning in the CAVE with large effect sizes compared to a textbook condition.

Michael Detyna & Margaret Kadiri (2019) [2]: Virtual reality in the HE classroom: Feasibility, and the potential to embed in the curriculum, Journal of Geography in Higher Education

Learner engagement is a challenge within Geography education, and Higher Education more generally and immersive Virtual Reality (VR) has a wealth of possibilities, but finding simple, straightforward applications that are also pedagogically worthwhile can be a challenge. Three trial runs of full earth simulations in VR in classroom environments were conducted using high-end VR hardware. The trials were conducted with Geography and Digital Humanities students and the aim was to evaluate the use of immersive VR would enhance learner engagement.

Erturk Emre and Reynolds Gabrielle-Bakker (2020) [5], the expanding role of immersive media in education, international conference e-learning

This paper seeks to understand the impact of immersive media, in particular augmented reality, within the education sector. A small experimental methodology was adopted alongside a current literature review. Three research questions were posited as follows: (1) What are the affordances of immersive media within education? (2) What are the barriers to immersive media in education? (3) How may immersive media be implemented?

Fernandez M [9]. (2017) Augmented virtual reality: How to improve education systems. Higher Learning Research Communications. 7(1), 1-15. http://dx.doi.org/10.18870/hlrc.v7i1.373

This essay presents and discusses the developing role of virtual and augmented reality technologies in education. Addressing the challenges in adapting such technologies to focus on improving students' learning outcomes, the author discusses the inclusion of experiential modes as a vehicle for improving students' knowledge acquisition. Stakeholders in the educational role of technology include students, faculty members, institutions, and manufacturers. While the benefits of such technologies are still under investigation, the technology landscape offers opportunities to enhance face-to-face and online teaching, including contributions to the understanding of abstract concepts and training in real environments and situations.

Elmqaddem Noureddine (2022) [10], Augmented Reality and Virtual Reality in Education. Myth or Reality?, International Journal of Emerging Technologies in Learning (IJET)

Augmented Reality and Virtual Reality are not new technologies. But several constraints prevented their actual adoption. Recent technological progresses added to the proliferation of affordable hardware and software have made AR and VR more viable and desirable in many domains, including education; they have been relaunched with new promises previously unimaginable. The nature of AR and VR promises new teaching and learning models that better meet the needs of the 21st-century learner.

Hsin-Kai Wu, and *et al*. (2013) [11], Current status, opportunities and challenges of augmented reality in education, Computers & Education, Volume 62, Pages 41-49

Although augmented reality (AR) has gained much research attention in recent years, the term AR was given different meanings by varying researchers. In this article, researchers first provide an overview of definitions, taxonomies, and technologies of AR. They argue that viewing AR as a concept rather than a type of technology would be more productive for educators, researchers, and designers.

Background of the Study

Augmented Reality

Augmented Reality (AR) refers to a technology that overlays digital information, such as images, graphics, or text, onto the real-world environment. AR enhances the user's perception of reality by integrating virtual elements into the physical world they see, creating an interactive and immersive experience.

The primary goal of AR is to provide users with additional context or information about the real world they are experiencing. Unlike Virtual Reality (VR), which completely replaces the real world with a simulated environment, AR enhances and supplements the existing reality.

AR technology can be implemented through various devices, including smartphones, tablets, smart glasses, and headsets. These devices use cameras and sensors to capture the real-world environment and superimpose digital content onto it. The alignment and tracking of digital elements with the physical world are critical for a convincing AR experience.

Virtual reality

Virtual Reality (VR) is a computer-generated simulation that immerses users in a completely synthetic environment, replicating real-world or imagined scenarios. Unlike Augmented Reality (AR), which overlays digital content onto the real world, VR replaces the physical world entirely with a virtual one.

The primary goal of VR is to provide users with a sense of presence, making them feel as if they are truly present and interacting within the simulated environment. To achieve this, VR typically employs specialized hardware, including head-mounted displays (HMDs) or VR goggles, motion tracking sensors, and sometimes handheld controllers.

Augmented reality in higher education

In higher education, augmented reality (AR) has the potential to alter conventional teaching strategies and offer interesting, interactive learning opportunities for students. Start-ups with significant investment funds, like MetaVisión, have released applications that are awaiting verification for education in many fields of expertise, including engineering or health. (Villarán, Ibañez, & Delgado Kloos, 2015) [16]. In other fields, such as design, augmented reality is positioned as the key tool that will produce digital prototypes based on the physical elements'

manufacturing reality. Augmented reality in educational settings will enable students to work more creatively without worrying about production risks and expenses. (Di Serio, Ibáñez, & Delgado Kloos, 2013) [17].

Similar sessions will allow teachers to impart knowledge to students using visuals superimposed on the reality of their classrooms in the fields of engineering and health (Boletsis & McCallum, 2013) [18]. The teacher can access any kind of information on the components of the digital human body model displayed in three dimensions of space, split out each part to reveal details, or even have students engage with the model at their leisure to create any kind of activity. Teachers would have a digital model of an engine, printed circuit board, or even an architectural building if this idea were applied to engineering. All of these models would enable student engagement while also taking into account the social aspect of having peers present for the experience in real time (Ibáez, Di Serio, Villarán, & Delgado Kloos, 2014) [19].

Virtual reality in higher education

With the use of virtual reality (VR) in education, students can engage in immersive and interactive learning experiences outside of the traditional classroom. Virtual reality has discovered a new setting in education where it may realise its full potential. Education possesses all the necessary components for this technology to not only be valuable but also to become extremely differentiating (Kumar, 2017) [20]. The teaching methods that have the biggest impact on today's educational systems are those that present students with a real-world problem that they must solve using the theoretical knowledge they have learned, or by forcing the students to develop skills that have been absent or underdeveloped up to that point. Up until this point, descriptions of the incident were limited to text or, in rare instances, audio with or without video. Virtual reality technology allows for the programming of a specific situation with a variety of surroundings and variables on which the student can act. Each subject, field of study, demographic subgroup, or geographic region can have an entirely unique set of applications. All students will be able to get the message, matching it to the situation as indicated (Falloon, 2010) [21]. These kinds of technologies will make knowledge more widely available. Students will now be able to successfully complete learning objectives that they previously struggled to complete with a low success rate. This assertion is supported by logic. These technologies will help numerous abstract ideas that these students should develop in their heads become concrete. These tools will complement this practice, boosting the rate of success because not all pupils possess these kinds of skills.

Additionally, there are huge opportunities for simulation in virtual reality. Students can engage with the gadgets in fully simulated laboratories using this technology (Hoffmann, Meisen, & Jeschke, 2014) [22]. The fact that measuring instruments would just need to be updated with a new version of the environment is one of the obvious direct benefits. Students would have access to the most recent technology without needing the physical components, which would obviously need a bigger investment from the schools. Furthering this investigation would result in significant cost reductions for spaces. The centres' underutilised spaces would be drastically decreased, and their place would be taken by "multi-laboratory" rooms where one or more laboratories could be accessible (Lindgren, Tscholl, Wang, & Johnson, 2016) [23]. These products are currently starting to appear on the market. The traditional education sector's dedication to these products will determine their development since it is impossible for it to be any other way.

Benefits and Risks

Virtual reality's advantages are currently being studied. Undoubtedly, they should concentrate on enhancing pupils' academic performance. There hasn't been much time since the initial experiments that brought the first virtual learning experiences into mainstream education. Both training in authentic places and circumstances and the knowledge of abstract concepts have made significant contributions. Students can engage in learning experiences that make the best use of all their senses by immersing themselves in custom-made surroundings. This might seem unimportant, yet such knowledge is crucial for helping a person understand ideas that are foreign to them (Huang, Rauch, & Liaw, 2010) [24]. In the early phases of integrating virtual reality into the education sector, some of the most successful applications include travelling the depths of the human body or spatially representing a difficult mathematical function. The adage "a picture is worth a thousand words" develops to a new level in virtual reality, creating an experience that goes beyond an image. The phrase "an experience is worth more than a thousand images" could be used instead. Thus, virtual reality's primary advantage is its usage as a tool to enhance comprehension of abstract or difficult concepts (Hwang & Hu, 2013) [25].

On the other hand, there are dangers and drawbacks to using this technology in the field of education. The personal isolation of users from their peers might result from the abusive use of these kinds of programmes. Virtual reality can be used in collaborative settings, however, it is nevertheless true that these settings are now less prevalent than those where involvement is individual. Personal interaction is ingrained in human DNA, and it fosters learning through imitation, teamwork, and experience sharing. The biggest danger of virtual reality in education is that it could be misunderstood as a means rather than an aim in itself—improving student outcomes in their learning process.

Facilitators and Barriers to Adoption

The students themselves are the primary enablers of the implementation of this technology within the educational sector. Technically speaking, the trend has reached its maturity. Massive promotion via multiple channels. By introducing experimental projects, applications, and even development platforms, the entire IT sector has already demonstrated its credentials. Accessibility options have been expanded thanks to specialised PCs and popular mobile devices. This has unquestionably been one of the major triumphs since its establishment. The chance to avoid having to make further investments has been proposed by manufacturers in line with the trend of technical democratisation. It is already possible for every smartphone to function as a display device. From a technical perspective, this quickly fulfils predictions of universal access (Kerawalla, Luckin, Seljeflot, & Woolard, 2006) [26].

The institution and its teachers will surely be the following link in the chain of facilitators. They will serve as both the main protagonist and obstacle. To use this technology in

their teaching roles, teachers have not yet received the necessary training. Without a doubt, this is one of the major obstacles. The content comes next, but it's not the last.

Two essential components must be included in teacher training in order to overcome the first obstacle. The first step is technology education: Learning what virtual and augmented reality is and what its potential is. The second, but equally crucial, topic is how to integrate this technology into a lesson plan. This difficulty is important since it is not clear how teachers can use virtual reality and augmented reality effectively in the classroom. The human characteristic of resistance to change is another aspect. Teachers should continually be learning new things and using fresh approaches. Virtual reality presents a significant complexity in terms of adapting existing curricula as well as improving curricula by utilising the enormous opportunities that are made available for professionals, despite being designed for intuitive use and outfitted with accessories that enable interaction (Cheng & TSI, 2013) [27]. There is a demand; in this situation, the barrier is put in front of the bidders.

The content that is made available by this technology is the second major obstacle to overcome. There are a lot of training proposals being supplied by businesses with development experience. The fundamental issue is that the training material is based on experiences that are deemed to be entertaining for the students rather than being tailored to the curriculum. Given this, compatible and nonexclusive choices are provided. On the one hand, these advancements might be applied to already existing elements of the current topic. Utilise them as teaching aids by changing the lesson plan to reflect these experiences. Alternatively, and concurrently, experiences may be created that were tailored to the topic and approved by regulators.

Conclusion

The benefits of augmented virtual reality (AVR) include increased motivation and the extension of traditional teaching methods by engaging pupils in novel ways. The argument that AVR generates novel communication alternatives is supported by an analysis of the literature. Obstacles including a lack of teaching skills, a disorganized educational system, and inflexible software may be caused by a disconnect between educators and developers. As a result, it is suggested that educators and developers interact more. Any critical competency deficiencies may be filled through technical training for teachers.

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