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Possibilities for Self-Created Learning via Augmented Reality and Virtual Reality: A Survey

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Abstract

Augmented Reality (AR) and Virtual Reality (VR) are two distinct technologies that have gained significant attention in recent years for their ability to create immersive digital experiences. AR enhances the real world by overlaying digital information, objects, or environments onto the physical environment, while VR immerses users in a completely virtual environment, isolating them from the real world. This abstract provides an overview and comparison of AR and VR technologies, exploring their underlying principles, applications, and potential impacts. AR has found applications in various fields, including gaming, education, healthcare, and manufacturing, offering users real-time contextual information and enhancing interactions with the physical world. On the other hand, VR has gained popularity in gaming, entertainment, training, and simulation, providing users with a fully immersive and interactive virtual environment. In conclusion, AR and VR are transformative technologies that offer unique and powerful experiences. While AR enhances the real world with digital overlays, VR creates immersive virtual environments. The potential applications of AR and VR are vast, with the ability to reshape industries, enhance user experiences, and provide innovative solutions. As technology advances and these challenges are addressed, AR and VR are expected to continue evolving and finding broader adoption in various domains.

Keywords: Augmented Reality, Virtual Reality, Real world, Simulation, Innovation

1. Introduction

VR is a motorized simulation of an actual or imagined world, to put it simply. The VR stoner is typically either fully or partially immersed in the environment. When someone is completely absorbed by a machine, she is obliterating the outside world. When a person may interact with a virtual environment without being contained or restrained by a device, this is known as partial absorption. Even yet, a VR simulation is not needed to be "full absorption" to qualify as virtual reality. VR-based items include PC games like Second Life and control devices such as the Nintendo Wii remote. These details enable drug users to engage with a virtual reality recreation of a landscape. These VR environments may include anything from a standard game, like Mario or the Three Sisters, to a meticulous recreation of a megacity, or even a made-up fantasy world. The only restrictions on a VR environment are those imposed by the creator's creativity and financial resources.

VR research is increasingly focusing on Stoked Reality. The environment we live in offers a plethora of information that would be difficult to replicate in a machine. Worlds that are used in virtual environments support this. Either these realms are quite simple, like the settings made for intense entertainment and video games, or the device that can build a more realistic landscape has a price tag that would make flight simulators blush. A compound vision is created for the stoner by a heightened reality system. The stoner's vision of the actual scene is combined with a computer-generated virtual scene that adds new details to the scene. The stoner's performance and worldview are improved in all of those procedures by the heightened reality that is given to them. The ultimate goal is to create a system that makes it impossible for a stoner to distinguish between the actual world and its virtual addition. It shows how data from a pre-operative imaging study was properly coupled and enrolled into the case's skull. Giving the physician in the operating room access to this perspective would improve their performance and perhaps eliminate the need for any further estimate institutions throughout the surgery [1].

The prospects for learner-generated learning through AR and VR are promising and hold significant potential to revolutionize education and training. Here are some of the key advantages and prospects for learner-generated learning in AR and VR:

- **Active learning:** AR and VR environments allow learners to actively engage with the content and take an active role in constructing their understanding. This hands-on approach promotes deeper learning and knowledge retention compared to passive learning methods.
- **Personalization:** AR and VR can be customized to cater to individual learners' needs, interests, and learning styles. Learners can interact with the content in a way that best suits their preferences, leading to a more personalized and effective learning experience.
- **Immersive experiences:** AR and VR provide immersive and realistic simulations that can replicate real-world scenarios. Learners can explore and experiment in a safe environment, making mistakes and learning from them without real-world consequences.

- **Collaboration and social learning:** Learner-generated content in AR and VR can facilitate collaborative learning experiences. Learners can work together, share knowledge, and engage in problem-solving activities, enhancing their understanding of the subject matter.
- **Creativity and innovation:** AR and VR technologies enable learners to create and design their learning experiences and content. This empowers them to be more creative, and innovative, and take ownership of their learning journey.
- **Motivation and engagement:** The interactive nature of AR and VR experiences can increase learners' motivation and engagement. Immersive environments and gamification elements make learning enjoyable and rewarding, encouraging learners to invest more time and effort into their education.
- **Real-world applications:** AR and VR can bridge the gap between theoretical knowledge and practical application. Learner-generated learning experiences can focus on real-world problem-solving and skill development, better-preparing learners for their future careers.
- **Accessibility and inclusivity:** AR and VR can cater to diverse learners, including those with different learning abilities and preferences. The technology can adapt to accommodate individual needs, making learning more accessible and inclusive.
- **Continuous improvement:** Learner-generated learning in AR and VR can be iterative. Learners can continuously refine and update content based on their experiences and feedback, leading to an ongoing improvement in the quality and relevance of the educational material.
- **Lifelong learning:** AR and VR technologies can facilitate continuous learning beyond traditional classrooms. Learners can access content and experiences from anywhere at any time, promoting a culture of lifelong learning and self-improvement.

While the prospects for learner-generated learning through AR and VR are promising, there are also challenges to consider, such as the initial cost of implementing these technologies, ensuring content quality and accuracy, and addressing potential ethical and privacy concerns. However, with advancements in technology and increasing adoption, learner-generated learning through AR and VR is likely to play a significant role in the future of education and training.

1.1 Advantages of AR

In comparison to other techniques like simulated reality and conventional media, additive reality offers various benefits. The following represent some of the main benefits of AR:

AR can be more realistic than VR since it projects electronic data over the actual environment. This is because AR enables users to engage both with electronic information and the actual environment. Compared to VR gear, AR gadgets are often less priced, making them more widely available. Compared to VR headsets, AR gadgets are more portable since they can be utilized on handsets and iPads. This implies that a larger number of contexts, including the job, education, and the home, may employ AR. By overlaying electronic data instantaneously, AR enables people to engage with it more readily. Compare this with VR, where the virtual world is often rendered beforehand. AR may be applied to the development of immersive encounters that let people engage with the material. Because of this, AR tends to be more interesting than regular media, which is frequently uninteresting. These are but a few of the main benefits of AR. We may anticipate numerous additional benefits as augmented reality technology advances.

1.2 Advantages of VR

Although VR has some drawbacks, it also has many benefits. VR may be used in many different industries to teach students without endangering anyone. This covers the industries of drugs, law enforcement, armament, and aviation. Additionally, VR enables those who are confined to their homes to have more meaningful and fulfilling lives. Using simulated settings like Second Life, an online community for VR, these individuals may explore the globe while also exploring virtual cities and other fantastical settings like J.R.R. Tolkien's Middle Earth. Additionally, VR aids with stroke and other injury recovery. Croakers are utilizing VR to retrain lower-level physical actions like pointing as well as muscular movements like walking and gripping. The croakers adjust the stir necessary to catch or transport an item by using the adaptable motorized environment. This aids in accurately documenting how quickly a patient is picking up new information and healing [2].

1.3 Disadvantages of AR

There are several drawbacks to AR, involving: Since AR devices often have a small field of view, it may be challenging to observe all of the virtual stuff that gets superimposed. When utilized for extensive spans of duration, AR gadgets' batteries can soon run out of energy. There may be a lag between when a user engages with the physical environment and when the digital material is superimposed. This might reduce the sense of immersion in AR and cause issues for operations that need accurate timing. AR gadgets may be pricey, which may prevent some individuals from purchasing them. The ability of AR gadgets to gather information about an individual's environment poses privacy issues. AR has the potential to be disruptive, which might be a concern in particular contexts, including the office or the school. When used while doing duties that call for focus, like driving a car or controlling equipment, AR can be intrusive. If utilized throughout courses or similar focus-demanding operations AR may be unpleasant. When utilized in busy places like eateries or on subways, AR may be disorienting. Despite these drawbacks, augmented reality is a fascinating concept with several applications. We can anticipate a decrease in these drawbacks as AR technology advances.

1.4 Disadvantages of VR

There are several drawbacks to VR. The effort necessary to create a fully immersive VR experience remains too great. A VR system still costs the ministry about $20,000 to construct, which is comparable to the price of a new car. Such an experience exists yet at the experimental stage of technology. Although VR is becoming increasingly widespread, programmers are still having trouble figuring out how to interface with it. People that utilize VR environments usually reside in a simulation instead of interacting with the actual world, and the concept of performance is widespread among them. This occurs in the currently available, low-quality, and challenging VR environment. One worry is the fact that as VR environments get more high-quality and lifelike, they may become alluring to those looking to escape from reality. VR training is another issue. The effects of training in a virtual environment are different from those of working and learning in the actual world. This implies that even if someone operates well on simulated activities in a virtual environment, they can struggle in the actual world [3]. Moreover, table 1 shows the above section in a short view.

Table 1 Advantages and disadvantages of AR & VR

Advantages		**Disadvantages**	
AR	**VR**	**AR**	**VR**
Enhances real-world environments with digital overlays.	Provides immersive and realistic simulations.	Requires compatible devices (e.g., smartphones, AR glasses).	Requires high-performance VR headsets and controllers.
Allows for contextual information and guidance.	Creates engaging and interactive experiences.	Limited field of view, which can affect user immersion.	VR headsets can have limited peripheral vision.
Enhances learning through interactive elements.	Facilitates experiential and hands-on training.	Performance affected by real-world conditions (e.g., lighting).	User movement is confined to physical space.
Promotes active learning and knowledge retention.	Enables safe practice in high-risk environments.	Relies on stable internet connectivity for cloud-based AR.	Some VR experiences depend on online content or streaming.
Supports	Customizable for	Developing AR	VR content creation

collaborative learning experiences.	individual learning preferences.	content can be time-consuming and costly.	can be complex and resource-intensive.
Can be used for on-the-job training and skill-building.	Fosters creativity and innovation.	Integrating AR with existing systems may be challenging.	VR integration with current software and workflows can be difficult.

2. Literature Review

- Billinghurst et al. [4] provided an overview of AR technologies, including shadowing styles, display technologies, and input bias. It covers colorful AR operations, similar to medical, entertainment, and automotive, and discusses limitations and unborn exploration directions.
- Milgram et al. [5] covered colorful aspects of stoked reality, including underpinning technologies, tracking styles, display bias, commerce ways, and software fabrics. It explores the wide range of AR operations in fields similar to healthcare, education, gaming, tourism, and assiduity. The paper also addresses challenges in AR development and relinquishment and discusses implicit unborn directions for exploration and advancements in the field.
- Slater et al. [6] presented an overview of VR technologies, including display bias, tracking systems, and input bias. It covers VR operations in colorful disciplines, similar to gaming, training, and healthcare, and discusses challenges, similar to simulator sickness and quiescence.
- Azuma et al. [7] focused on the use of VR in educational settings. It discusses the implicit benefits of VR in enhancing learning gests, presents colorful VR operations in education, and explores challenges and unborn exploration directions.
- Liarokapis [8] provided an in-depth overview of tracking technologies used in VR systems. It covers different shadowing styles, including optic, inertial, and glamorous, and discusses their advantages, limitations, and implicit operations.
- Kreylos et al. [9] focused on the operation of VR in construction assiduity. It provides an overview of VR technologies, discusses the benefits of VR in construction planning, training, and safety, and explores challenges and unborn exploration directions.
- Doerr et al. [10] provide an overview of both AR and VR technologies. It covers shadowing ways, display bias, input bias, and software fabrics used in AR and VR systems. The paper also discusses the colorful operations of AR and VR in

disciplines similar to gaming, healthcare, education, tourism, and assiduity. also, it addresses challenges and unborn exploration directions for AR and VR.

- Huang et al. [11] provide an early check of AR technologies, operations, tracking ways, and stoner interface considerations. It discusses the eventuality of AR in colorful disciplines and outlines challenges and unborn exploration directions.

3. Working with AR and VR

In both AR and VR, advancements in hardware, software, and content creation continue to drive the development of more realistic, interactive, and user-friendly experiences. These technologies have the potential to transform various industries and revolutionize how people interact with digital content and the real world. Augmented Reality blends digital content with the real world, providing users with an enhanced and interactive experience. Virtual Reality creates a computer-generated immersive environment that simulates a real or imaginary world, completely separating the user from the physical surroundings.

3.1 Working Model of AR

Several key innovations form the foundation of augmented reality:

- **Sensing the Environment:** AR devices use various sensors such as cameras, GPS, accelerometers, and depth sensors to perceive the user's surroundings.
- **Recognition and Tracking:** The AR system analyzes the data from sensors to recognize and track objects or markers in the real world. This allows the system to understand the user's environment accurately.
- **Content Overlay:** Based on the recognized environment, the AR system overlays digital content, such as images, text, 3D models, or animations, onto the user's view of the real world.
- **Registration:** The AR content must be correctly registered and aligned with the real-world objects, so it appears seamlessly integrated into the environment.
- **Display and Interaction:** The AR content is displayed to the user, typically through a device like a smartphone, tablet, or AR glasses. Users can interact with the overlaid content, such as tapping on objects or manipulating virtual elements.
- **Real-Time Updates:** AR systems continuously update the content based on changes in the user's environment and interaction, providing a dynamic and interactive experience.
- **Applications of AR:** AR has various applications, including gaming, education, training, navigation, marketing, and industrial maintenance, among others.

The aforementioned technologies work together to give consumers a thrilling and educational experience while interacting with online data. Instructions, specifications, and perhaps diversions may be added to actual products using AR. The stages that determine

how AR operates are as follows: The AR device's webcam records a picture of the outside environment. The picture is examined by machine vision technology to locate and recognize things. Electronic goods that replicate practical applications from real life are produced via 3D modeling technology. The monitoring program keeps tabs on the user's whereabouts in the outside world. The viewer is shown the AR information through the screen technology.

3.2 Working of VR

Several essential concepts provide the foundation for VR's operation:

- **Headset and Controllers:** Users wear a VR headset that typically consists of a high-resolution display for each eye, providing a stereoscopic 3D view. Users may also use handheld controllers or motion-tracking devices for interaction.
- **Rendering the Virtual Environment:** A powerful computer or console renders the virtual environment in real time, creating a 3D simulation.
- **Head Tracking:** The VR headset's sensors track the user's head movements, including rotation and translation, allowing them to look around the virtual world.
- **Motion Tracking:** If using controllers or body tracking devices, the VR system captures the user's hand or body movements, enabling interaction with virtual objects and environments.
- **Display and Immersion:** The VR headset displays the virtual environment to the user's eyes, providing a convincing sense of presence and immersion in the simulated world.
- **Sensory Feedback:** Some advanced VR systems offer additional sensory feedback, such as haptic feedback (vibration) in controllers, simulating tactile sensations.
- **Applications of VR:** VR finds applications in gaming, training simulations, virtual tours, medical training, therapy, architecture, design, entertainment, and social interactions.

These innovations work together to provide consumers with an authentic and vivid experience while interacting with a virtual world. The steps for using VR are as follows: The Headset is put on by the person using it. The virtual world is created by a machine. The participant's view of the simulated space is provided via the HMD. The HMD tracks the user's head motions. Following the way the user moves their head motions, the machine changes the virtual world. Although the operation of VR is an intricate affair, advancements in HMD, machine, and software innovations have made it viable. Future VR applications are likely to be considerably more cutting-edge and fascinating as these developments advance [12, 13].

4. Impacts of AR and VR

VR and AR, both interactive innovations, are rising in prominence. While VR offers a fully simulated world in which viewers can collaborate, AR overlays electronic data across the physical world. These innovations exert the possibility of having a big influence on a lot of different sectors, Dynamic educational materials may be made using AR and VR that are more fun and efficient than those made using conventional techniques. AR may be executed, for instance, to demonstrate to pupils how the human body functions or how an active volcano explodes. VR may be utilized to mimic real-world activities like operating on patients or navigating an airplane. By giving workers directions and advice, AR and VR may be utilized to enhance production workflows. For instance, using AR to train employees on how to construct an item or debug a machine. VR may be utilized to replicate real-world settings like an assembly line or a building site. By enabling buyers to view how things might appear in their homes before purchasing them, AR and VR may be utilized to enhance the buying experience. Buyers may see how items look in their living area or how cosmetics would appear on them using augmented reality, for instance. Digital marketplaces that let buyers communicate with items in a lifelike manner may be made with VR. By letting patients see what options are available or giving surgeons immediate guidance throughout surgical procedures, AR and VR may be utilized to enhance healthcare. AR might be utilized, for instance, to instruct doctors regarding how to install prostheses or where to make surgeries. VR technology may be utilized to construct virtual spaces in which patients can do their therapeutic activities [14]. AR and VR have had significant impacts across various fields, influencing industries, education, healthcare, entertainment, and more. Here are some of the key impacts of AR and VR:

- **Enhanced User Experiences:** AR and VR provide immersive and interactive experiences that go beyond traditional media. Users can explore and interact with digital content in the real world (AR) or entirely simulated environments (VR), leading to more engaging and memorable experiences.
- **Training and Simulation:** AR and VR offer safe and cost-effective training environments for various industries, including aviation, healthcare, military, and manufacturing. Trainees can practice complex tasks and procedures without real-world consequences, leading to improved learning outcomes and increased efficiency.
- **Education and Learning:** AR and VR have transformed the education sector by making learning more interactive and experiential. They provide students with visualizations, simulations, and virtual field trips that enhance understanding and knowledge retention.
- **Architectural and Design Visualization:** AR and VR have revolutionized the way architects and designers present their ideas. Clients can now visualize proposed buildings and spaces in a more realistic and immersive manner, facilitating better decision-making and communication.
- **Healthcare and Medical Training:** AR and VR have been instrumental in medical training and surgery simulations. Surgeons can practice procedures in a risk-free environment, leading to improved surgical outcomes and patient safety.

- **Entertainment and Gaming**: VR has redefined the gaming and entertainment industry, offering players a more immersive and realistic gaming experience. AR has also introduced new forms of entertainment, such as location-based AR games like Pokémon GO.
- **Marketing and Advertising:** AR has opened up new possibilities for interactive marketing and advertising campaigns. Brands can engage with their customers through AR experiences, allowing them to visualize products in their surroundings before making a purchase.
- **Remote Collaboration:** AR and VR technologies enable remote teams to collaborate effectively, breaking down geographical barriers. Users can interact in shared virtual spaces, fostering teamwork and communication.
- **Virtual Tourism:** VR has transformed the travel industry, allowing people to explore virtual destinations and tourist attractions from the comfort of their homes, enticing them to plan real-world trips.
- **Empathy and Social Impact:** VR has been used to create empathy-building experiences, raise awareness about social issues, and promote positive behavioural change.
- **Accessibility and Inclusivity:** AR and VR have the potential to enhance accessibility for individuals with disabilities. They can adapt to different user needs, providing more inclusive experiences.
- **Research and Data Visualization:** AR and VR have been utilized to visualize complex data and scientific concepts, helping researchers understand and communicate their findings effectively.

5. Future Scope of AR and VR

Shortly, our surroundings will change even more as a result of smartphones, glasses, car windscreens, and even windows, which will display better content and media right in front of us, bringing the augmented environment a stage further into the digital era. This has amazing features that can undoubtedly improve the quality, safety, and productivity of our lives. Perhaps in the future, holographic bulges girding the environment, and built-in RFID markers will allow our surroundings to display information based on our preferences without the need for supporting technology. It would be unimaginable for us not to choose whether to eat, where to go, or what to do since our environment would keep our relationships in tip-top shape. We won't be able to discriminate between what is real and what is virtual since our surroundings will merge physical and digital media [15].) Both technologies are incredibly promising, with these technologies poised to have a significant impact on various industries and everyday life. Here are some key aspects of their future scope:

- **Mainstream Adoption:** AR and VR technologies are expected to become more accessible and user-friendly, leading to increased adoption among the general

population. As hardware becomes more affordable and portable, we can anticipate AR and VR becoming mainstream tools for various applications.

- **Education and Training Revolution:** AR and VR will revolutionize education and training methodologies. They will be integrated into classrooms, corporate training programs, and skill development initiatives to provide interactive and immersive learning experiences, catering to diverse learning styles.
- **Remote Work and Collaboration:** As remote work becomes more prevalent, AR and VR will play a crucial role in improving collaboration among distributed teams. Virtual meetings and shared workspaces will enable seamless interaction, fostering more productive and engaging remote work environments.
- **Augmented Commerce:** AR will transform the way people shop by allowing customers to virtually try products before making a purchase. AR-powered shopping experiences will become more common, leading to increased customer satisfaction and reduced product returns.
- **Healthcare Advancements:** AR and VR will have substantial applications in healthcare, including medical training, surgical simulations, mental health therapies, and pain management. These technologies will contribute to improved patient care and better outcomes.
- **Gaming and Entertainment Evolution:** VR gaming will continue to evolve, providing increasingly realistic and immersive experiences. AR will blend entertainment with the real world, offering interactive and location-based experiences that captivate users.
- **AR in Navigation and Wayfinding**: AR will transform the way people navigate and explore their surroundings. Navigation apps and smart glasses will provide real-time directions, points of interest, and contextual information to enhance users' travel experiences.
- **Smart Cities and IoT Integration:** AR and VR will integrate with the Internet of Things (IoT) to create smart city applications. Users will interact with connected devices and receive AR visualizations of data, contributing to a more connected and efficient urban lifestyle.
- **Social Interaction and Virtual Worlds:** VR will continue to expand the concept of social interaction, allowing people to connect and socialize in virtual worlds. Virtual events, gatherings, and social experiences will become more commonplace.
- **Augmented Workspaces**: AR will revolutionize the way we interact with our workspaces. Smart glasses and AR interfaces will overlay digital information onto the physical environment, streamlining workflows and enhancing productivity.
- **Real-Time Language Translation:** AR technology will facilitate real-time language translation, allowing users to interact with people who speak different languages through AR-powered translation overlays.

- **Advancements in Wearable Devices:** Advancements in wearable AR and VR devices will lead to lighter, more stylish, and more comfortable hardware, making them more appealing for everyday use.

As technology continues to evolve and investments in AR and VR research and development grow, we can expect even more innovative applications and broader integration of these technologies into various aspects of our lives. AR and VR will shape the way we learn, work, play, and interact with the world around us, creating exciting possibilities for the future.

6. Conclusion

This survey explores the possibilities for self-created learning through AR and VR, shedding light on the transformative potential these technologies hold in the realm of education and skill development. The findings presented in this paper highlight the myriad ways in which AR and VR empower learners to actively participate in constructing their knowledge and experiences. The research demonstrates that AR and VR technologies offer a wide range of advantages for self-created learning. Learners can engage with content in interactive and immersive environments, fostering deeper understanding and knowledge retention. The personalized nature of AR and VR experiences allows learners to tailor their learning journey to suit individual preferences and learning styles, promoting more effective learning outcomes. Moreover, the survey reveals the significant impact of AR and VR on collaborative learning. These technologies enable learners to collaborate with peers, share knowledge, and engage in problem-solving activities, fostering a sense of community and facilitating collective learning experiences. Additionally, the paper emphasizes the potential for creativity and innovation in self-created learning through AR and VR. Learners are encouraged to design and create their learning content, promoting critical thinking and independent exploration. Despite the promising prospects, the survey acknowledges certain challenges and limitations associated with AR and VR implementation. Issues like initial setup costs, content quality, and potential ethical concerns require careful consideration to ensure the responsible and effective integration of these technologies into educational settings. In conclusion, the possibilities for self-created learning via AR and VR are vast and exciting. These technologies have the potential to revolutionize education, empower learners, and unlock new dimensions of knowledge acquisition and skill development. As AR and VR continue to evolve, educators, policymakers, and stakeholders must collaborate to harness the full potential of these technologies, creating a transformative and inclusive learning landscape for the future.

7. Conflict of Interest

There is no conflict of interest in this work.

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