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COMPARISON OF VIRTUAL (VR) AND ADDED REALITY (AR) IN INFORMATION LEARNING

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Annotation: Virtual laboratories and simulations are becoming the main tool for studying complex subjects such as chemistry and physics, where dangerous experiments can be safely reproduced. AR, on the contrary, adds digital elements to a real-life setting, making it useful for studying visualization-related disciplines such as anatomy or history, where students can see real-time reconstructions of objects or events. An important advantage of AR is accessibility: mobile devices make this technology available for widespread use both in schools and at home.
Keywords: Virtual reality (VR), 3D effect, augmented reality (AR), ICT, 3D audio, field of view (FOV), QR code, 3D models, animation, specialized headsets (such as Oculus Rift or HTC Vive), dedicated headsets (such as Oculus Rift or HTC Vive), dedicated headsets (such as Oculus Rift or HTC Vive), AR glasses (such as Microsoft HoloLens or Google Glass).

СРАВНЕНИЕ ВИРТУАЛЬНОЙ (VR) И ДОПОЛНЕННОЙ РЕАЛЬНОСТИ (AR) В ОБУЧЕНИИ ИНФОРМАТИКЕ

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Аннотация: Виртуальные лаборатории и симуляции становятся основным инструментом для изучения сложных предметов, таких как химия и физика, где опасные эксперименты могут быть безопасно воспроизведены AR, напротив, добавляет цифровые элементы к реальной обстановке, что делает его полезным для изучения дисциплин, связанных с визуализацией, таких как анатомия или история, где студенты могут видеть реконструкции объектов или событий в реальном времени. Важным преимуществом AR является доступность: мобильные устройства делают эту технологию доступной для широкого использования как в школах, так и дома.
Ключевые слова: Виртуальная реальность (VR), 3D-эффект, дополненная реальность (AR), ИКТ, 3D-аудио, goле зрения (FOV), QR-код, 3D-модели, анимация, специализированные гарнитуры (такие как Oculus Rift или HTC Vive), специализированные гарнитуры (такие как Oculus Rift или HTC Vive), специализированные гарнитуры (такие как Oculus Rift или HTC Vive), AR-очки (такие как Microsoft HoloLens или Google Glass).

Introduction

Modern technologies are constantly changing approaches to learning, offering more interactive and engaging ways to transfer knowledge. Virtual reality (VR) and augmented reality (AR) are innovative technologies that are increasingly influencing the educational process, especially in the field of computer science.

Virtual reality (VR) allows for the creation of simulation of real-world tasks, such as modeling the operation of operating systems, networks, or software.

Augmented reality (AR), in turn, can help students visualize abstract concepts and models, such as data structures, algorithms or computer network schemes, improving understanding and accelerating the learning process.

The use of VR and AR in computer science education opens up new possibilities for interaction with the learning material, increases student engagement, and improves the assimilation of complex theoretical concepts. Thanks to them, learning becomes more visual, interactive, and adaptive, making the learning process more interesting and effective.

This study examines how virtual and augmented reality can be used in computer science training courses, what advantages they offer, and what challenges may arise when implementing them.

How does AR differ from VR?

Real and virtual environment: While virtual reality (VR) immerses the user in a completely virtual environment, AR expands the real world by adding digital content to it. VR replaces the physical world, while AR complements it.

Devices: Full immersion in VR usually requires specialized headphones (such as Oculus Rift or HTC Vive), while for AR, mobile device cameras (smartphones and tablets) or AR glasses (such as Microsoft HoloLens or Google Glass) are often used.

Immersion level: AR is not isolated from the physical world; it allows users to stay in a real environment while interacting with augmented digital objects. VR, on the other hand, completely isolates the user in the virtual world, making the experience more exciting, but also more detached from reality.

Virtual reality (VR).

Advantages:

Total immersion: VR allows students to immerse themselves in a completely different environment - be it a historical setting, a scientific laboratory, or even a space. This level of immersion enhances the effectiveness of experimental learning, creating an unforgettable practical experience.

Safe Practice Environments: VR provides students with the opportunity to develop skills or procedures (e.g. surgical operations, hazardous engineering tasks or flight modeling) in a safe, controlled environment where mistakes do not lead to real consequences.

Increased engagement: Immersive nature of VR can increase students' engagement by providing an interactive and visual learning experience. This is particularly effective in subjects such as history, geography, or STEM (science, technology, engineering, mathematics).

Remote experience access: VR can transfer students to locations or scenarios that would otherwise be inaccessible (for example, researching the surface of Mars, ancient civilizations, or molecular structures in biology).

Advantages:

High cost and equipment: VR usually requires expensive headsets, powerful computers or game consoles.

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Isolation: Since VR immerses students in a fully virtual environment, it can isolate them from their peers, reducing opportunities for collaborative learning and social interaction.
Physical discomfort: Some students may experience eye tremor or strain when using VR headsets for a long time.
Limited application in the real world: Since VR completely immerses students in the real world, it can sometimes detach them from the real conditions, making it less practical for solving learning tasks that need to be applied in the physical environment.
Augmented reality (AR).
Advantages:
Improves real-world learning, AR adds digital content to the real world, making it a powerful tool for improving real-world learning effectiveness. For example, students can scan subjects in the classroom to obtain additional information or interactive 3D models, overcoming the gap between theoretical knowledge and its practical application.
The cost-effectiveness of AR can be used with widely used devices such as smartphones or tablets, making it more accessible compared to VR, which usually requires specialized equipment.
Collaborative AR learning allows multiple students to work in the same real environment, facilitating group work and interactive discussions. For example, they can work together on a physical scientific experiment, looking through digital explanations or annotations.
Directly integrates digital content into the everyday environment, allowing students to interact with virtual objects while remaining connected to the real world. This makes it more practical for tasks requiring a real context, such as architectural design, engineering, or medical training.
Advantages:
Limited immersion:
While AR improves the real environment, it lacks full immersion like VR. This can make it less interesting for those types of experience that benefit from fully virtual environments, such as simulation of past historical events or space exploration.
The technical equipment of AR depends on the quality of cameras and sensors in mobile devices. Poor recognition or tracking of images can lead to inaccuracies in the application of digital content, which reduces the quality of learning.
AR overlays can sometimes be distracting or cumbersome, especially in a vibrant real-life environment, preventing students from focusing on key information.
AR is based on the physical environment, the size and layout of the classroom can affect the effectiveness of AR. For example, small or crowded premises may limit the mobility required to interact with AR content.
When to use VR and AR in education.
When is VR better?
Full immersion and simulation: VR is ideal when students need to fully immerse themselves in a different environment or perform complex simulations. For example, VR is best suited for history classes that allow students to virtually "visit" historical places, scientific simulations that reproduce dangerous experiments, or for medical students who practice surgery in a risk-free environment.

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Difficult to reach or hazardous environments: VR is an excellent choice when students need to explore areas that are otherwise inaccessible or unsafe, such as sea depths, outer space or hazardous industrial facilities.

Experimental learning: For experimental, practical learning, for example, to teach specific skills such as piloting, engineering or healthcare, VR allows students to practice tasks that require real-time reactions and attention to details in immersive, controlled scenarios.

When is AR better?

Contextual learning: AR is more suitable for situations where students need to interact with the real world while accessing additional digital information. For example, AR can be used in anatomy classes, where students can scan physical body models to see internal organs, or in chemistry classes to visualize the molecular structures imposed on physical objects.

Collaboration and interaction: AR is perfect for situations where group work is required. Multiple learners can interact with the same physical environment, exchanging supplementary content, such as in collaborative design projects or supplementary textbooks that display interactive 3D models.

Supplementing physical objects: AR is ideal for supplementing traditional learning materials. For example, students can scan pages of textbooks to access additional multimedia content, or manipulate 3D representations of historical artifacts without needing expensive physical copies.

As a result:

VR is better suited for full immersion, experimental learning in conditions that are difficult or impossible to obtain in real life, or when modeling dangerous or complex activities. AR is better suited to enhance real-world learning efficiency by providing additional digital content, facilitating collaboration, and maintaining contact with the physical environment while adding interactivity.

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