**Statistical Study on Increasing Usage of AR/VR in Real World**

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**Abstract**

Augmented and Virtual Reality have emerged as powerful technologies to learn skills, revolutionizing the way people learn skills related to various fields. This study provides a statistical and analytical view using available data about their increasing usage and implementation, the positive impact of various implementations and increasing popularity of commercial AR/VR products. This research helps analyze the current state of AR/VR as well as forecast on the increasing usage of AR/VR.

**1. Introduction**

Augmented Reality (AR) and Virtual Reality (VR) are two great technologies that have evolved the way people interact with the digital world. AR is the technology to add digital elements to the real world around us, while VR is the technology to create immersive digital environments that may or may not replicate the real world in sense and form. Both technologies use special equipment such as headset or glasses to bring these experiences to life.

**Augmented Reality (AR)**

Augmented Reality (AR) enriches the real-world environment by overlaying digital information onto it, enhancing various activities such as gaming, product visualization, marketing, architecture, and education. Utilizing human senses like sight, sound, and touch, AR combines computer-generated data with reality via hardware and software. Its versatility extends to metaverse implementations and corporate applications, contributing to the growing trend of immersive computer experiences.

**Virtual Reality (VR)**

VR involves simulating 3D environments that users can explore and interact with, either replicating reality or creating entirely fictional worlds. It relies on specialized hardware and software, such as helmets and goggles, to immerse users in virtual environments. The goal of VR technology is to create environments indistinguishable from reality, offering users an immersive experience. VR has been instrumental in providing realistic simulations for training purposes, such as flight simulation for military training, and enhancing experiential learning across various domains.

**Education and skill training**

VR systems have revolutionized training by offering realistic simulations for various real-life activities, promoting cost-effective and safer training methods. AR/VR technology enriches the learning process by placing individuals in diverse scenarios, enhancing experiential learning across domains like healthcare and emergency preparedness. These technologies have been instrumental in providing simulated surgical training and emergency scenario training. Police departments in countries like the Netherlands and the UK employ AR/VR for training to prepare for emergency scenarios.

**Increasing Usage and Adoption**

The adoption of AR/VR technology is rapidly increasing, with global shipments of AR/VR headsets projected to reach 43.5 million by 2025**[8]**. [The global extended reality (XR) market, which includes AR, VR, and mixed reality (MR), is expected to rise to over $100 billion U.S. dollars by 2026](https://www.statista.com/outlook/amo/ar-vr/india)**[9]**. The AR & VR market in India is projected to reach a revenue of ₹US$759.9m in 2024 and is expected to have approximately 742.3m users by 2028 **[9]**. Various sectors, including education, healthcare, retail, and real estate, are increasingly employing AR/VR technologies to enhance customer experiences and provide innovative solutions.

**Industry Adoption**

AR/VR technologies are widely adopted across industries, from gaming and consumer goods to education and healthcare. Popular applications and software include OSSOVR, PokemonGo for gaming, Tilt Brush for painting, Enscape for architectural design, Toyota’s TeenDrive 365 and Hyundai Virtual Guide. These technologies are transforming businesses by providing immersive and interactive experiences for customers, driving industry growth and innovation.

This Research paper will further explore and discuss such innovations, their degree of benefit and effectiveness, as well as further and upcoming implementations. This study will mainly employ existing literature, case studies and empirical research to elucidate the role of AR/VR technology in shaping the future of skill acquisition and lifelong learning.

**2. Examples, Implementations and Related Work**

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| --- | --- | --- | --- |
| Reference | Subject | Method | Findings |
| Abdullah M. Al-Ansi et al. | AR and VR development in Education | Analyzing | Adoption of AR and VR in education recent years |
| Dr A Udaya Shankar et al. | Impact of AR and VR in Education | Literature Review | Improvement in teaching and learning experience |
| Patrice Labedan et al. | VR in pilot training | Case Study | Cardiac activities during training |
| Zain Hussain et al. | Use of AR and VR for improving knowledge and skills in medical students | Randomized Trials and Pre-test, Post-test | Effectiveness of AR/VR devices for teaching medical students |
| Min-Chai Hsieh et al. | AR for primary marine wildlife education | ADDIE model with Pre and Post test | Using augmented reality to enhance learning experience of children for marine wildlife education |
| İbrahim Yaşar Kazu et al | Engagement of AR and VR in higher studies | Data Analysis | VR's adaptability and potential for personalized learning experiences contributing to more efficient and effective learning |
| Jing Zhang et al. | Trends in the Use of Augmented Reality, Virtual Reality, and Mixed Reality in Surgical Research | Global Bibliometric and Visualized Analysis | [use of augmented reality (AR), virtual reality (VR), and mixed reality (MR) in surgical research](https://link.springer.com/article/10.1007/s12262-021-03243-w) increased globally |

Table 1: References for related works

**Al Ansi(2023)** analysed AR/VR in education, noticing a dramatic research increase in the preceding decade. Highlighted exponential adoption during COVID-19 and how it enhances e-learning interactions.[1] Similarly, **Dr A Udaya Shankar et al.** conducted a literary review showing how strong the impact of AR/VR is on education by utilising descriptive methods and questionnaires.[2] **Patrice et al.[3]**  Performed a Case study on use of VR in pilot training, comparing real life and simulation data to propose improvements. **Zain et al.[4]** used randomized trials to studying the effectiveness of AR/VR in improving knowledge and skill gain for medical students. **Min-Chai et al.[5]** applied ADDIE model to study the effect of AR in marine wildlife education, finding improvement in learning experiences for children. **İbrahim et al.[6]** performed data analysis on the engagement of AR and VR in higher studies. The findings showed that VR’s adaptability and potential for personalized learning experiences contribute to more efficient and effective learning. Lastly, **Jing et al.[7]** conducted a global analysis on AR/VR/MR trends in surgical research, which indicated rise in its usage globally with USA leading in contributions, also suggesting continued growth.

The amalgamation of such studies shows not only the different areas in which implementations of AR/VR technology being developed but also that AR/VR is helpful and would be growing in usage in the future. Thus comes our hypotheses,

H1: The usage and implementation of AR/VR in various fields is still increasing.

H2: Developing implementations will have a majorly positive impact on the AR/VR technology field.

H3: Common use commercial implementations of AR/VR are becoming increasingly popular.

**3. Information Study**

**Hypothesis 1:**



Table 2: Various stats regarding AR/VR in different fields

Graph 1: Top 5 countries in terms of AR/VR penetration

Graph 2: Top 5 countries in terms of AR/VR revenue

Graph 3: Market Size of AR/VR

The various graphs present the increase in usage, market size and revenue of different distributions, they represent the fact that the usage and implementation for AR/VR in various fields globally is increasing throughout the years thereby suggesting that H1 is true.

**Hypothesis 2:**

AR and VR technologies are continuously reshaping multiple sectors, like education, healthcare, gaming, automotive, engineering, military, manufacturing and entertainment. Throughout all fields it can be said that immersiveness is the common attraction, as the AR/VR technologies allow the simulation of various things with good accuracy, allowing people to gain experience without experiencing those situations in reality. In learning and training part of the various fields especially education, AR/VR also allows catering to different learning styles.

|  |  |
| --- | --- |
| Fields | Use/ Benefits |
| Healthcare | Training, diagnostics, surgery, and fitness. Foster a deeper understanding of complex concepts, ignite student curiosity, and promote collaborative learning. |
| Gaming | Immersive Interaction, smell, touch, physics, movements. |
| Automotive | Design, production, sales and marketing |
| Engineering | Architecture, Engineering and Construction. Enhance comprehension of intricate processes |
| Military | Equipment training, flight training, weapons training etc. Revolutionize the way armed forces personnel access information, plan mission strategy, and conduct critical operations. |
| Manufacturing | Modernize and streamline processes, eliminate costly errors and reduce downtime |
| Entertainment | Enhance product visualization and the customer experience. |

Table 3: Benefits and uses of AR/VR in various fields

Spatial computing integrates virtual content seamlessly into the physical world, enhancing user immersion and interaction in AR/VR applications. This technology enables accurate mapping and overlay of virtual content onto the user's environment, boosting intuitiveness and opening up possibilities for improved productivity, visualization, gaming, and education.

Immersive Commerce Platforms leverage AR/VR to revolutionize online shopping by offering realistic product previews, virtual try-ons, and interactive visualizations, enhancing the shopping experience and increasing customer engagement and conversion rates.

Emotion recognition in VR utilizes biometric sensors and machine learning algorithms to analyze users' expressions and gestures, enhancing emotional engagement and personalization in virtual experiences. This technology dynamically adjusts content based on users' emotional states, improving communication, therapy, and training applications.

Haptic feedback technologies simulate tactile sensations in AR/VR environments, allowing users to feel and interact with virtual objects realistically, enhancing simulations, gaming experiences, and medical applications.

Six Degrees of Freedom Tracking enables users to move freely in physical space while accurately tracking their movements in six dimensions, enhancing immersion, comfort, and reducing motion sickness in VR experiences.

The previously mentioned applications/implementations of AR/VR and many more such implementation indicate the positive impact that such implementations will have in development of AR/VR as well as information science and even commerce. Thereby proving H2 to be right.

**Hypothesis 3:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Apple ARkit | Google ARcore | Meta quest | HTC Vive | Sony Playstation |
| Launched date | 5 June 2017 | 1 March 2018 | 21 May 2019 | 5 April 2016 | 13 October 2016 |
| Developed by | Apple Inc. | Google | Meta platforms | HTC corporation | Sony Group |
| Based on | AR(augmented reality) | AR(augmented reality) | VR( Virtual Reality) | VR( Virtual Reality) | VR( Virtual Reality) |
| Features | * device motion tracking * world tracking * scene understanding * display conveniences | * Motion tracking. * Environmental understanding. * Depth understanding. * Light estimation. * User interaction. * Oriented points. * Anchors and trackable. * Augmented Images. | * Boundary, Pass-through and Spatial Anchors * Voice commands and voice dictation * Display settings * Accessibility features | * Eye tracking * Motion Tracking * Audio Strap * Wireless Adapter * Facial Tracker | * 5.7 inch OLED panel * 1080p resolution * Social Video screen enabled * 3D audio effect * 360 degree head movement |
| Usage Area | IOS Mobile Applications like IKEA place, MeasureKIt, jigshaw, kings of pool etc. | Android applications like Measureapp, INKHUNTER, Mole Catch AR, Beer Pong etc. | Gaming, Entertainment, Fitness and Wellness, Travel, Design and playing virtually with friends | Gaming, Education and business sector | Entertainment and gaming |
| Market Revenue | 50.37 billion in 2023 | No data available | 1.9 billion in 2023 | 3 million | 25.96 billion |
| No. of Units Sold | Not applicable | Not applicable | 2.03 million | 1 million | 50 million |

Table 4: Growing and famous Commercial AR/VR Products

The previously tabulated data well indicates how AR/VR is being used in day-to-day life and how its reach and sales is increasing thereby signifying the increasing popularity of AR/VR commercial products worldwide, proving H3 to be true.

**4. Discussion and Future Scope**

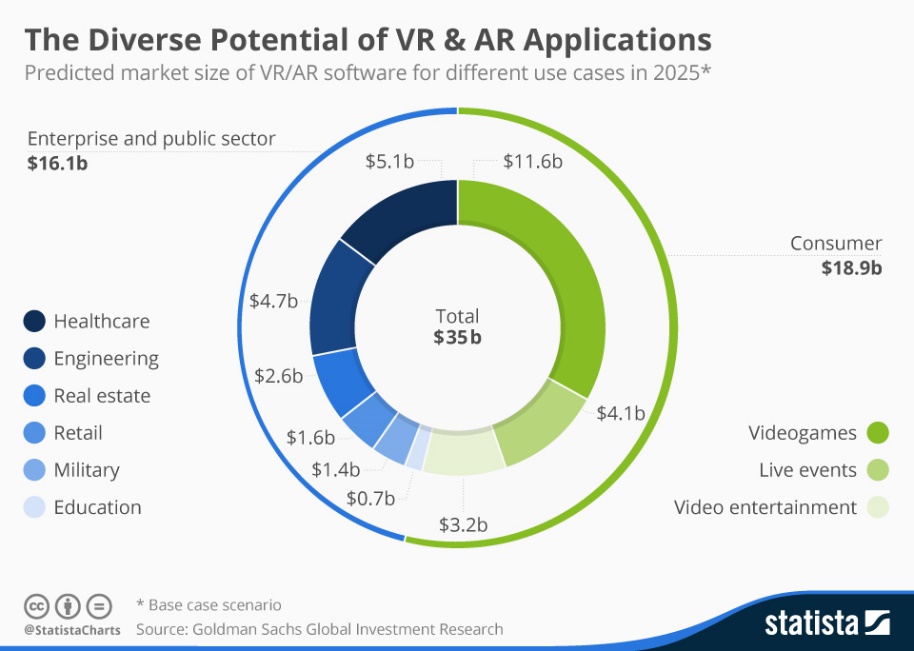
**Apple Vison Pro: Current AR/VR trend**

The Apple Vision Pro, launched in February 2024, has swiftly become a viral sensation, setting new trends in the AR and VR industry. Users are enthusiastically sharing their experiences on social media, wearing the headset while engaged in various activities like running errands, working out, and even driving. The device offers a transformative experience, turning any room into a personal theatre with Spatial Audio, and features Apple's first 3D camera for capturing spatial photos and videos.

Despite its premium price and lower battery life, the Vision Pro saw a pre-order surge, with 180,000 units sold during the pre-order weekend. This reflects significant demand for high-quality AR/VR devices, with Apple leading the charge in meeting this demand. A low return rate of just 1% indicates that consumers are well-informed about the product's capabilities and are satisfied with their purchase decisions.

Looking ahead, the future scope of the Apple Vision Pro is promising. As AR and VR technologies advance, the device is poised to offer even more immersive and intuitive experiences. It has the potential to revolutionize various sectors, including education, healthcare, and entertainment, by providing interactive and engaging platforms for learning, working, and entertainment.

**Future Scope:**



Graph 4: Forecast

The graph titled “The Diverse Potential of VR & AR Applications” provides predictions for the market size of Virtual Reality (VR) and Augmented Reality (AR) software across different sectors in 2025. The total predicted market size is $35 billion, divided into the Enterprise and Public Sector ($16.1 billion) and the Consumer sector ($18.9 billion). The Enterprise and Public Sector is further broken down into Healthcare ($5.1 billion), Engineering ($4.7 billion), Real Estate ($2.6 billion), Retail ($1.6 billion), Military ($1.4 billion), and Education ($0.7 billion).

In the Consumer sector, the market is segmented into Videogames ($11.6 billion), Live Events ($4 billion), and Video Entertainment ($3 billion). The graph highlights the diverse potential of VR and AR applications, with healthcare and video games predicted to have the largest shares in their respective sectors. These predictions, sourced from Goldman Sachs Global Investment Research, represent a base case scenario, indicating that actual outcomes could be higher or lower depending on various factors.

**5. Conclusion**

The Usage and implementation of AR/VR is projected to keep increasing with the same boom as more implementations are added so will sales and market size of AR/VR will increase. This increase in implementations will bring positive impacts to user, companies, the field AR/VR. With the increasing performance from implementations, more convenient and well implemented devices will come to the commercial AR/VR products market, it’s a given these products will do well in said market. It is noted, that all three hypotheses converge and affect each other with various points of connection.

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