



شركة وادي الرياض
Riyadh Valley Co

Augmented Reality & Virtual Reality – Imperative for e-learning



February, 2024



شركة وادي الرياض
Riyadh Valley Co

Introduction

In today's digital era, technology is acting as a catalyst for growth in every major industry. Among emerging technologies, Virtual Reality (VR) and Augmented Reality (AR) have significant business use cases across industries. Virtual Reality (VR) and Augmented Reality (AR) technologies have the potential to deliver a £1.4 trillion boost to the global economy by 2030.¹ VR and AR technology is expected to benefit all industries by creating more efficient processes, enhancing training, and offering more ways for people to collaborate and work together. The technology is likely to have a significant positive impact on the gaming, education, healthcare, and retail sectors globally.



The adoption of AR and VR has created a tangible impact in the education industry over the past few years by enhancing the avenues for learning. Globally, the market size of AR and VR technology in the education sector is expected to reach USD 372.7 billion in 2032.² According to PwC, the use of VR and AR in training and development is forecasted to provide a £265.2 billion boost to global GDP by 2030, supporting training in locations that are impractical and dangerous for direct training. The increased demand for AR and VR devices can be linked to factors including improved comprehension through visualization, the continuous innovation and expansion of AR and VR technology in education, and the development of personalized learning experiences.

The market for AR and VR technology is forecasted to reach USD 617.3 million in the GCC region in 2032 due to the rising demand for immersive and interactive experiences across various industries, especially gaming and medicine and rising adoption in the education sector.³ Despite the presence of a large addressable target market, the penetration of VR and AR in educational applications remain at a nascent stage. A report by Frost & Sullivan analyses that a widespread adoption of AR and VR technology in the GCC region can be expected by 2025, marking a giant step in transforming and democratising education, businesses, and medicine industry.

In Saudi Arabia, the adoption of AR and VR technologies in the education sector is gaining momentum, supported by the government initiatives to accelerate digitalization of the education sector. AR and VR technology market in Saudi Arabia is projected to grow at a CAGR of 24.8% between 2022 and 2028, with education and gaming industry serving as major growth drivers. The Saudi Ministry of Education has integrated technology into its educational system by introducing an educational portal called National Education Portal Platform (iEN). The portal offers many technologies that support education, such as AR experiments, e-textbooks, learning games, video clips, and TV channels. Currently, AR materials including textbooks and apps are prominent in Saudi schools.

¹ PwC

² Precedence Research

³ Wantstats

AR and VR: Evolution over the years

Augmented reality (AR) and virtual reality (VR) are reality technologies that either improve or replace a real-life environment with a simulated one. While basic virtual reality systems came into existence in the 1950s and 1960s, the concepts of VR and AR began to gain momentum in military applications during the early 1980s.

Evolution of AR and VR technologies

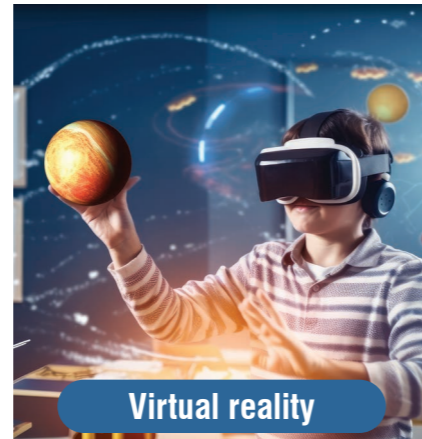


Difference between AR and VR



Augmented reality

- AR augments the real-world scene
- AR is 25% virtual and 75% real
- This technology partially immerses the user into the action
- No AR headset is needed
- With AR, end-users are still in touch with the real world while interacting with virtual objects nearer to them.
- It is used to enhance both real and virtual worlds.

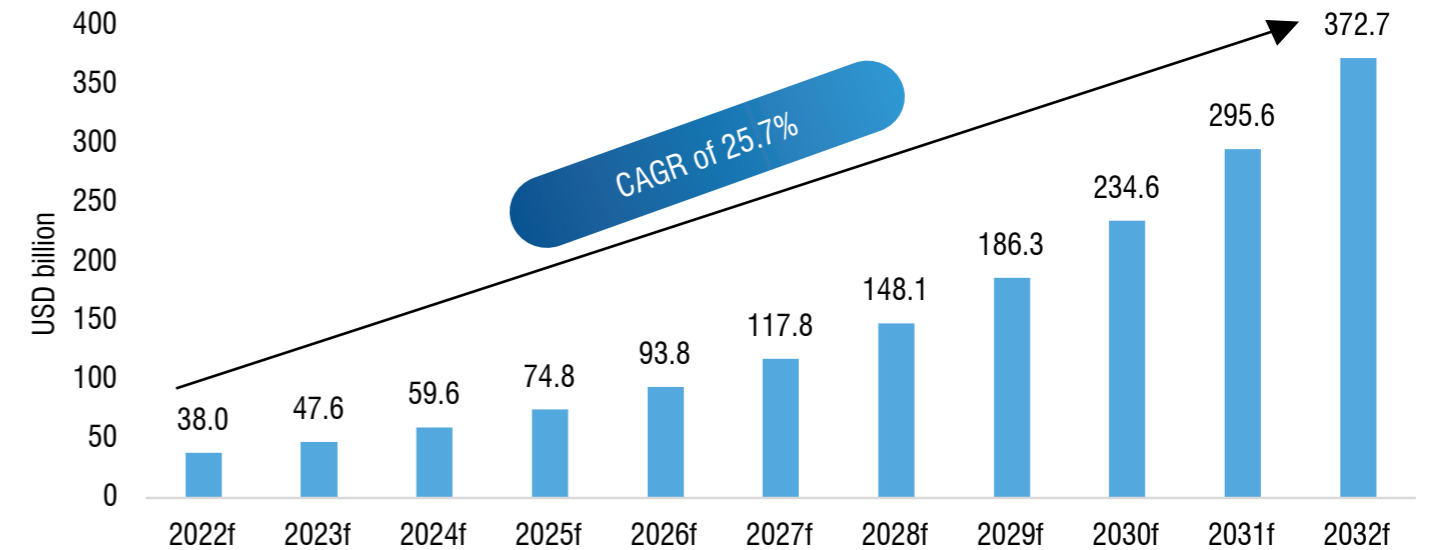


Virtual reality

- VR provides a completely immersive virtual environment
- VR is 75% virtual and 25% real
- This technology fully immerses the user into the action
- Some VR headset device is needed
- By using VR technology, user is isolated from the real world and immerses himself in a completely fictional world.
- It is used to enhance fictional reality for the gaming world.

While both AR and VR are designed to create a simulated environment to the user, each concept is unique and involves different use cases. Advancing education through continuing innovation in AR & VR technology, heightened understanding via visualization, real world applications of AR technology are key factors driving the adoption of AR and VR in education industry.

Market size of AR and VR in Education industry (2022-2032)



Source: Precedence Research

Educators have started utilizing VR and AR technologies to provide an immersive learning experience during eLearning. Learners could interact with their environment with the help of VR headsets. The interactive experiences offer students new ways to learn and engage with their peers and trainers and absorb knowledge in a way that traditional instruction methods would find hard to replicate.

AR and VR – Revolutionizing e-learning

Areas of implementation




Value addition through AR and VR

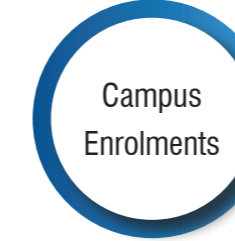
By leveraging AR and VR in institutions, students from across the world could participate in the lectures, while also giving an immersive classroom environment. The technologies help universities save costs related to infrastructure. Universities have started providing 3D lectures to students by harnessing VR technology.

Example

- For instance, Harvard University offers an introductory computer science course, Computer Science 50 (cs50), in VR. Students wear their VR headsets and appear to be sitting amidst their course mates in the middle of the lecture hall, although they are participating at home.
- 3D Bear AR app allows students to create and experience their own virtual worlds. Teachers can access lesson plans, assign tasks to students, and track them using this AR app.
- Human Anatomy Atlas 2023 + is a cross-platform (web & mobile) AR app that offers full female and male 3D interactive visual content and models to study gross anatomy.

3D Lectures at learning institutions

Areas of implementation	Value addition through AR and VR
 <p>Learning scenarios in schools</p>	<p>Instead of the typical e-Learning experience, VR and AR provide an intensive and immersive educational experience. This experience involves fun elements as virtual school field trips, hazard-free experimentation, and other useful applications.</p> <p>Example</p> <ul style="list-style-type: none"> Octagon Studio's Dinosaur 4D+ AR flashcards allow teachers to explain the origin and physiology of dinosaurs, during which the students discern the animated reptiles. AssemblerEDU AR app allows teachers to teach complex concepts in 3D. Through its AR editors, 3D library, and importing options, Assembler helps create an accessible learning experience at school.
 <p>Experimental learning</p>	<p>AR and VR allow individuals to see the results of their actions first-hand and facilitate experimental learning in technical topics. This type of learning is useful because it helps in better grasping of concepts, improves creativity, and increases chances for reflective learning. Experiential learning with VR enhances student's practical understanding of complex concepts.</p> <p>Example</p> <ul style="list-style-type: none"> Quiver Masks, an AR coloring app combines AR coloring pages with face-tracking. The app offers an educational platform that enables educators and students to visualize and understand learning subjects. Catchy Words AR is a fun AR app for students to practice their spelling skills. Students will be able to see letters floating all around them, when using the app. By moving their phones and adjusting positions, students have to catch the letters and solve the word.
 <p>Safety education</p>	<p>AR and VR technologies are deployed to impart experience-based safety education to children to enhance their self-awareness.</p> <p>Example</p> <ul style="list-style-type: none"> More than 80 kindergartens in China make use of AR technology in an elementary education program to teach children from an early age all the basic safety rules and develop self-awareness.

Areas of implementation	Value addition through AR and VR
 <p>Campus Enrolments</p>	<p>AR and VR technologies have made campus enrolments easier and smooth with less human interaction. The technologies have also facilitated better understanding of the courses and programs to the prospective students.</p> <p>Example</p> <ul style="list-style-type: none"> The University of Scranton, Pennsylvania has leveraged AR in their admissions marketing campaign from 2014. Visitors at the university were asked to download a free AR app called Layar, and then point their phone towards the university logo on the marketing poster. The logo was transformed into a video that appeared to be playing on the poster. The Savannah College of Arts and Science has introduced an AR catalog detailing various courses and programs for students. The AR-driven catalog enables prospective students to learn more about the institution before enrolling.

Source: eLearning Industry, Fingent

The demand for innovative learning solutions, smart education, and distance learning, rising adoption of VR technology in corporate training programs coupled with government initiatives to increase tech adoption are likely to boost the demand for AR and VR devices in the near-term.



Benefits in adoption of AR and VR

01 Real-World Simulations

Fields such as medicine, engineering, and aviation benefit from VR and AR simulations as they provide a safe environment for practicing complex procedures. This hands-on experience enhances skill development and confidence.

02 Enhanced Learning Engagement

VR and AR provide students with immersive experiences that capture their attention and foster active participation. Complex concepts become tangible, leading to a deeper understanding and improved retention.

03 Personalized Learning Paths

VR and AR enable educators to tailor and customise content to individual learning styles. Students can progress at their own pace and revisit materials as needed, promoting personalized learning.

04 Interactive Learning

These technologies allow learners to interact with 3D objects and scenarios, making abstract subjects more concrete. Students can dissect virtual organisms, explore historical sites and conduct scientific experiments without leaving the classroom.

05 Global Learning

VR and AR bridge geographical gaps, allowing students to virtually travel to different parts of the world and experience diverse cultures.

06 Enhanced Collaboration & Teamwork

AR and VR both allow for hyper-collaboration since activities, games and explorations are organised in a way to mimic real life engagement.

Source: Analytics Insight

However, the absence of standardised regulatory framework and guidelines for AR and VR development remains a key challenge for integration of the technology across platforms, devices and software application. The absence of industry standards leading to fragmentation and inconsistency in the quality, functionality, and user experience of AR and VR applications is likely to weigh down on the adoption of AR and VR technologies in the education industry. Establishing industry standards and promoting interoperability would foster flexibility and scalability in the implementation of AR and VR technologies. Additionally, industry standards would facilitate collaboration, content sharing, and the development of a sound ecosystem of AR and VR resources.

Challenges in the adoption of AR and VR technologies



High costs

- Implementing VR and AR technologies can be expensive due to the need for specialized equipment and software. Institutions need to invest in devices and training to ensure effective use.
- VR headsets and other equipment can be expensive, making it difficult for some institutions to implement these technologies on a large scale. However, as the technology becomes more common, costs are expected to decrease.



Content Development

- Creating high-quality VR and AR educational content demands expertise and resources. Developing engaging and curriculum-aligned materials can be time-consuming.
- Instructional designers and educators must understand the technology and its potential applications to create engaging learning experiences.



Technical challenges

- Technical glitches and compatibility issues can disrupt the learning experience. Teachers need to be proficient in troubleshooting and maintaining the technology.
- VR and AR technologies require significant bandwidth and processing power, which can strain institutional networks and systems.



Accessibility

- There is a risk that VR and AR technologies may not be accessible to all students, particularly those with special educational needs.
- For example, students with visual impairments may be unable to use VR headsets effectively, while students with hearing impairments may find it difficult to use AR technologies that rely on audio cues.
- Institutions must ensure that they are providing accessible options for all students and are not creating a barrier to learning.

Source: eLearning Industry

Global Market for AR and VR in Education



The VR market is projected to grow from USD 6.1 billion in 2020 to USD 20.9 billion by 2025 and record a CAGR of 27.9%, according to Markets and Markets. China, U.S, UAE and France are among the top countries investing in VR. While VR and AR technologies are still heavily embedded in gaming, the EdTech industry comes next as governments and institutions are emphasizing the use of technology in education. China's application of AR and VR technology in education is widespread. Today, VR headsets have become a common sight in Chinese

classrooms and at learning centres. AR and VR headsets shipments crossed 1.1 million units in China in 2022, according to Counterpoint Research's XR Model Tracker. VR remains the primary segment within XR (Extended reality), contributing more than 95% to overall shipments in 2022.

Adoption of AR and VR across countries



China

- China rolled out its masterplan for VR development in 2019 and is taking efforts to become a world leader in the industry.
- The technology has already been introduced to schools in China, where children can sit in pods and be educated by virtual tutors.
- Moving forward, China plans to create and introduce headsets into every classroom in the country.



United States

- VR has already gained momentum and is widespread in the U.S, with almost half of U.S colleges already using it.
- U.S is expected to witness the launch of ten 'metaversities', where a digital version of an actual campus will be created for students, whether on-site or remote.
- Each student in the 'metaversities' is set to receive a Meta Quest 2 headset, which will allow them to experience courses as if they were actually on campus.



France

- France has recently implemented the VirtualiTeach program in its classrooms. The program allows science and technology students to observe and feel the materials.
- It is expected to help students better understand theoretical concepts.



UAE

- In the UAE, schools are experimenting the implementation of VR and are interested in AR. This negates the need for headsets.

Source: XpertVR

Although the adoption of AR and VR technologies are yet to gain traction in the developing countries and sectors, the upcoming trends in the technology are expected to have transformative effect and create a digitally augmented space in every field.

Future trends in AR and VR

Introduction of AI in AR/VR space

- The AI, AR and VR technologies have proved their potential individually. In the future, VR and AR developers are likely to consider the potential of their collaboration.
- The developers will look into getting a clear idea of how advanced machine learning algorithms and other AI methodologies can aid computers and other devices in visualizing things and understanding them effectively.
- This will further lead to the emergence of highly interactive image recognition facilities.

WebAR

- The advent of WebAR will facilitate users to interact with augmented reality in the web space. It will enable them to get exposure to AR on Google Chrome, Mozilla Firefox and other browsers regardless of which device they run upon, resulting in lower barriers to its usage and higher overall experience.

Remote assistance via AR/VR

- AR and VR technologies are likely to enable users to see on site situations in real-time via their mobile phones or laptop.
- They will be able to assess everything and send the files (images, videos, or PDFs) with proper comments/notes to remote locations which will remain locked on the shared scene.

Metaverse with AR/VR

- Augmented reality appears to be the more durable and reliable technology that is often associated with metaverse case studies. For instance, Apple's Vision Pro headset is a testament to the potential on the horizon for AR technology.

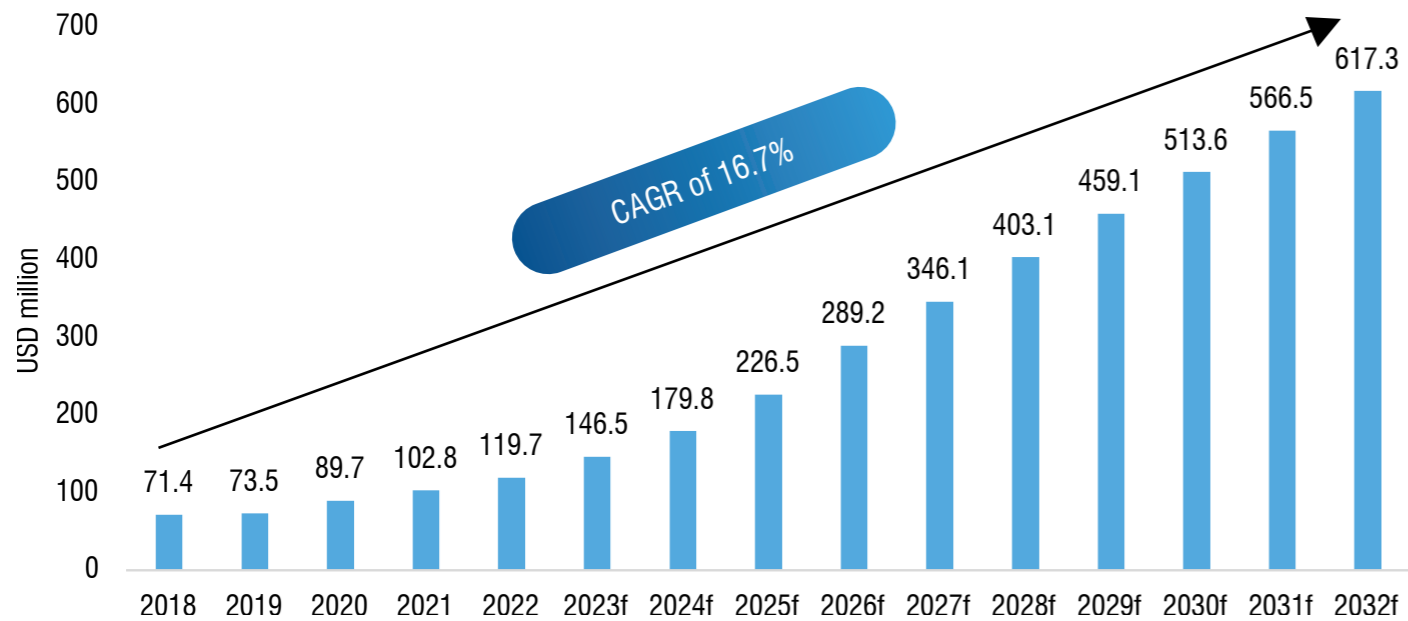
Source: Appinventiv

Adoption of AR and VR in GCC region

The GCC AR and VR technology market is projected to grow owing to the increased usage of the technologies across a variety of sectors, including healthcare, education, retail, and entertainment. After the impact of the COVID-19 pandemic, the adoption of these technologies grew as businesses explored innovative ways to interact with stakeholders online. The technical developments, rising investments, and the mounting demand for immersive and interactive experiences across various industries is expected to fuel the market’s growth trajectory in the future.



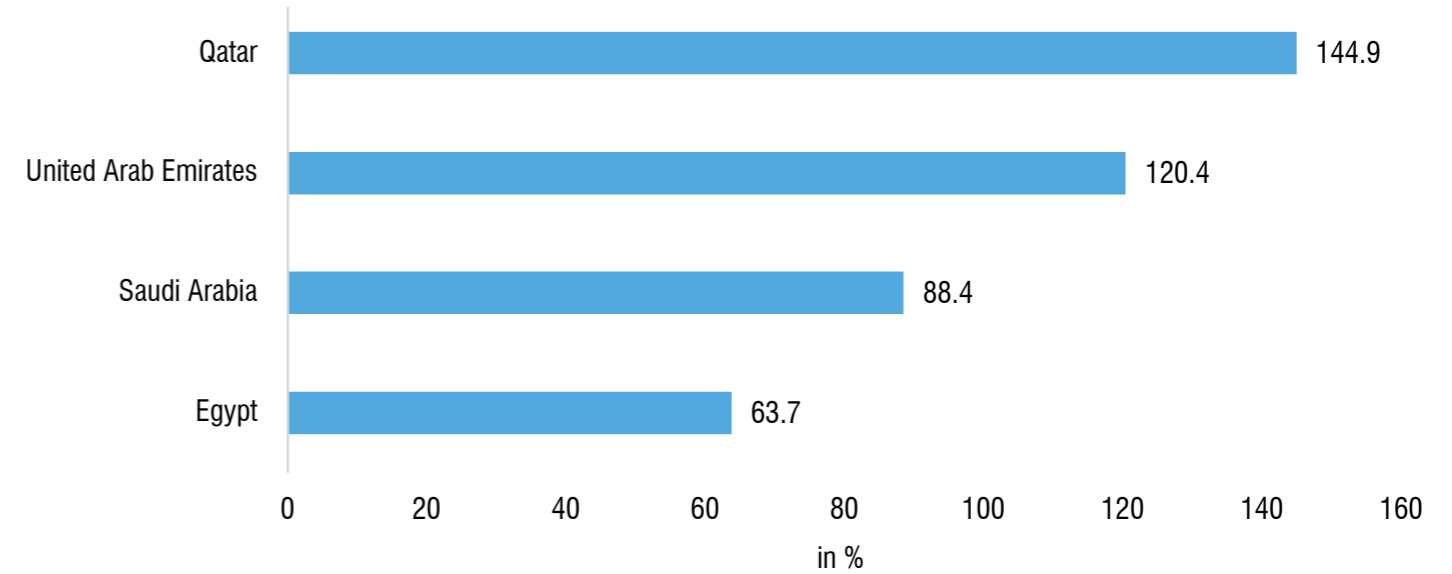
AR and VR Market size in the GCC region



Source: Wantstats

The educational institutions in the GCC region are becoming increasingly aware of how AR & VR can improve student’s learning experiences. These technologies have been helping students visualize arduous concepts, increase engagement and retention, and create individualized learning environments by offering interactive experiences. For instance, The American University of Sharjah has adopted VR to instruct civil engineering students about building design and construction methods since 2021.

AR and VR penetration rates across countries (2022)



Source: Statista

The AR and VR startups are well-established in UAE and gaining traction in the other GCC regions. The use of AR and VR technologies have been widely deployed in the construction and healthcare sectors of the region. In 2022, Thumbay Group announced the opening of the world’s first metaverse hospital in the UAE, which would be a fully virtual hospital where patients can consult with a doctor and connect with them before even moving to further procedures.

AR and VR startups in GCC region

Year	Location	Description
2006	Dubai (UAE)	Mersive provides an AR and VR based solution for patient education. The platform provides education and experiences for patients and engages patients across their journey in an interactive virtual & superimposed environment. Allows healthcare organizations to engage, educate, and entertain the patients, visitors, and families during their healthcare journey.
2018	Dubai (UAE)	ScaleVR Technologies offers a cloud-based platform for enterprises to create virtual reality experiences without technical know-how. It allows users to add videos or interactive elements into 3D and convert the same to a VR app. Its collaboration module allows users to view VR with other users over the internet or LAN, thereby enabling businesses to engage their customers. Use cases are in the areas of education, real estate, among others.

2019	Dubai (UAE)	PharmaVgate Academy is a provider of a virtual reality-based healthcare applications. The immersive learning platform allows pharma learners to access realistic 3D spaces and objects to learn, practice and apply skills in a virtual environment.
2020	Dammam (KSA)	VRwecare is a provider of a SaaS-based virtual reality platform for pain and anxiety management in hospitals. The company has developed a hardware and software system that helps medical professionals to handle patients in pain during medical procedures. The VR application headset has been developed to reduce the patient's anxiety in order to provide relaxed and stressful medical procedures.
2021	Dubai (UAE)	Everdome is a developer of a blockchain-based metaverse platform. It develops a platform where users can access virtual worlds for buying and selling virtual lands, engage in professional activities, socialize, and do branding for their business. It also provides VR games and AR features and allows facilitates virtual medical consultations.

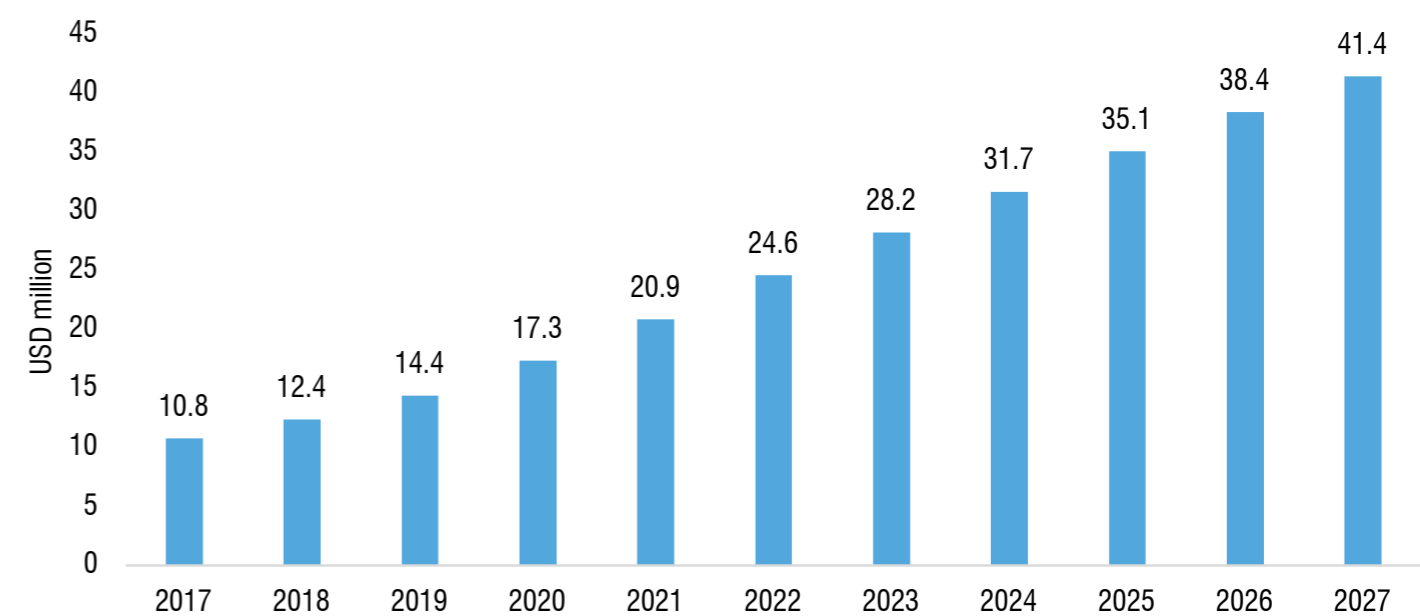
Source: Tracxn



AR and VR market in Saudi Arabia

Saudi Arabia AR and VR technology market size is projected to grow at a CAGR of 24.8% during the period between 2022 and 2028.⁴ Growing potential of AR and VR in the gaming industry is one of the key drivers of the Saudi Arabian AR and VR market. The entertainment, media, aerospace, and defence companies are expected to fuel the growth of the AR and VR market in Saudi Arabia. The education sector is expected to undergo significant change, positively impacting the AR and VR market expansion in the coming years.

Forecasted revenue of AR and VR market in Saudi Arabia (2017-2027)



Source: Statista

The Saudi Ministry of Education integrated technology into its educational system by building an educational portal called National Education portal platform (iEN), which offers many technologies that support education such as AR experiments, e-textbooks, learning games, video clips, and TV channels. This initiative made Saudi Arabia better equipped to facilitate the shifting of the education system during the COVID-19 pandemic. According to Tatweer (a company setup by Saudi government to improve education), most Saudi schools have received AR materials including textbooks and apps and have access to the support resources on the IEN platform.

⁴ Bluewave Consulting

AR Implementation in Saudi schools

1

Integration in curricula

In September 2018, the Saudi Ministry of Education (MoE) began to apply AR technology in its schools and curricula. AR apps and textbooks designed for educational purposes were sent to schools with the link to the National education portal IEN platform, which contains AR materials for both teachers and students.

2

Textbook learning

The MoE with Tatweer designed AR apps to allow users to scan targeted marks and pictures in textbooks to see the associated digital content. For example, most of science textbooks became enhanced by AR codes and have a list of contents that contains AR photos or marks.

3

Teaching materials for tutors

On the National education portal platform (IEN), there are many resources available to support the usage of AR technology in teaching and learning. Teachers can download additional content to use in classroom. There is also an illustration video to explain how to use AR apps to exploit the marks in textbooks.

4

Topics supported by AR technology

Sponges, Solar eclipse, Constellations, Photosynthesis, Voltage and resistance, Center of mass, Modern Periodic Table, Convex mirrors, Electrical voltage, Intermolecular forces, Gas pressure, Magnetic fields, galvanometer Gases are few topics that were enhanced with the application of AR technology.

Recently, Saudi Arabia has been working to raise awareness of the importance of investing in technology in the education sector to improve the country's teaching and learning processes. The MOE introduced the Madrasati platform to facilitate e-learning and distance education, which enable students and teachers to acquire knowledge and skills efficiently. The MOE is also working on a project using Blockchain technology for the Ministry and Saudi universities to create a single source for certificates through a reliable certificate system that preserves all actions that are taken on the certificate.

Spotlight: LamsaWorld

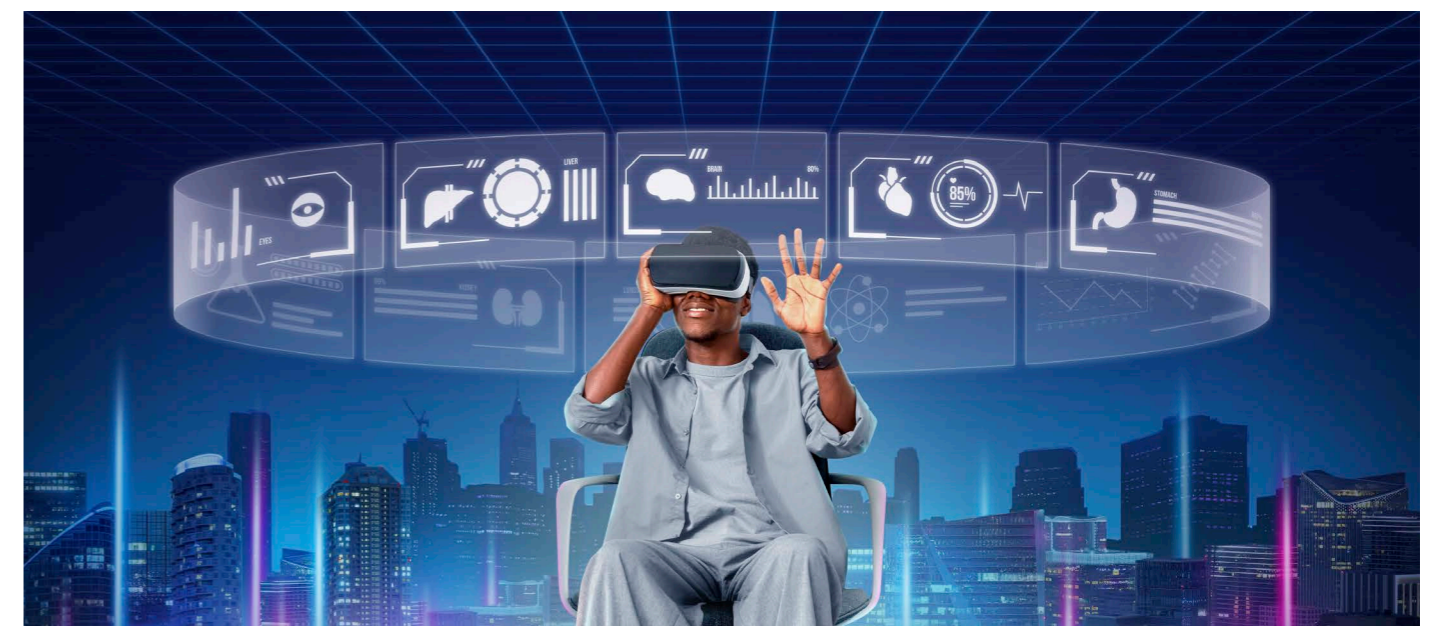
LamsaWorld is one of Riyadh Valley Company's indirect investments from the Oryx fund investments (Hambro Perks). Founded in 2011, it is based out of Abu Dhabi, UAE. LamsaWorld's app provides children an educational journey, starting from early childhood to develop educational, language, and creative thinking skills. This journey also stresses on self-confidence, providing the child with the necessary tools to prepare themselves for entering the school years. They have their monthly subscription costing USD 14.99 and the yearly plan is priced at USD 180.

In addition to its core educational offerings, LamsaWorld company has also ventured into the realm of virtual reality (VR) in education. By leveraging VR technology, LamsaWorld aims to enhance the learning experience for children. Through their app, children can engage in immersive educational experiences that go beyond traditional methods.

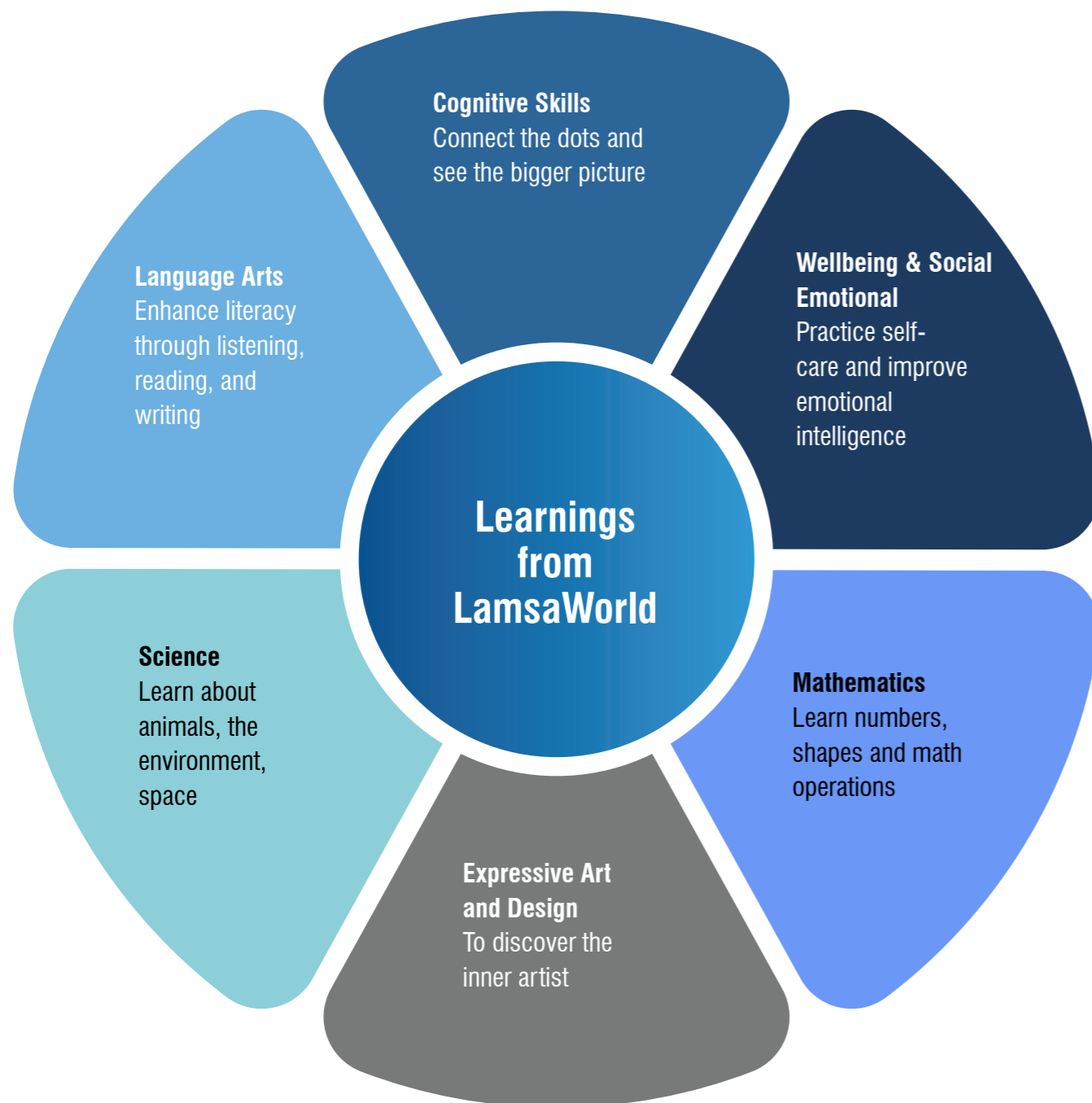
With VR, LamsaWorld creates interactive and visually stimulating environments that allow children to explore various subjects and concepts in a more engaging and memorable way. They can visit historical landmarks, dive into the depths of the ocean, or even travel to outer space, all from the comfort of their own homes.

By incorporating VR into their educational journey, LamsaWorld provides children with a multi-sensory learning experience. This technology allows for a deeper understanding of complex topics by enabling children to visualize and interact with content in three-dimensional space.

Lamsa's content is designed based on research by experts in the ECD (Early Childhood Development) field. They consider children as curious individuals with interest to learn new things through exploration, play, repetition, and practice. Interactive activities and stories, memory and observation games, songs and videos are intended to develop the child's intelligence, learning skills and problem-solving skills. They also tend to improve the child's social and emotional skills to better interact with their surroundings.



Learnings from LamsaWorld



Source: LamsaWorld Website

Unique Selling Proposition of LamsaWorld

Educational framework

- Lamsa's learning framework focus on learners' development across various domains, including physical, cognitive, social and emotional, sensory, and speech.
- With the support of curriculum experts and seasoned educators, Lamsa aims to incorporate the latest developmental research into its framework.

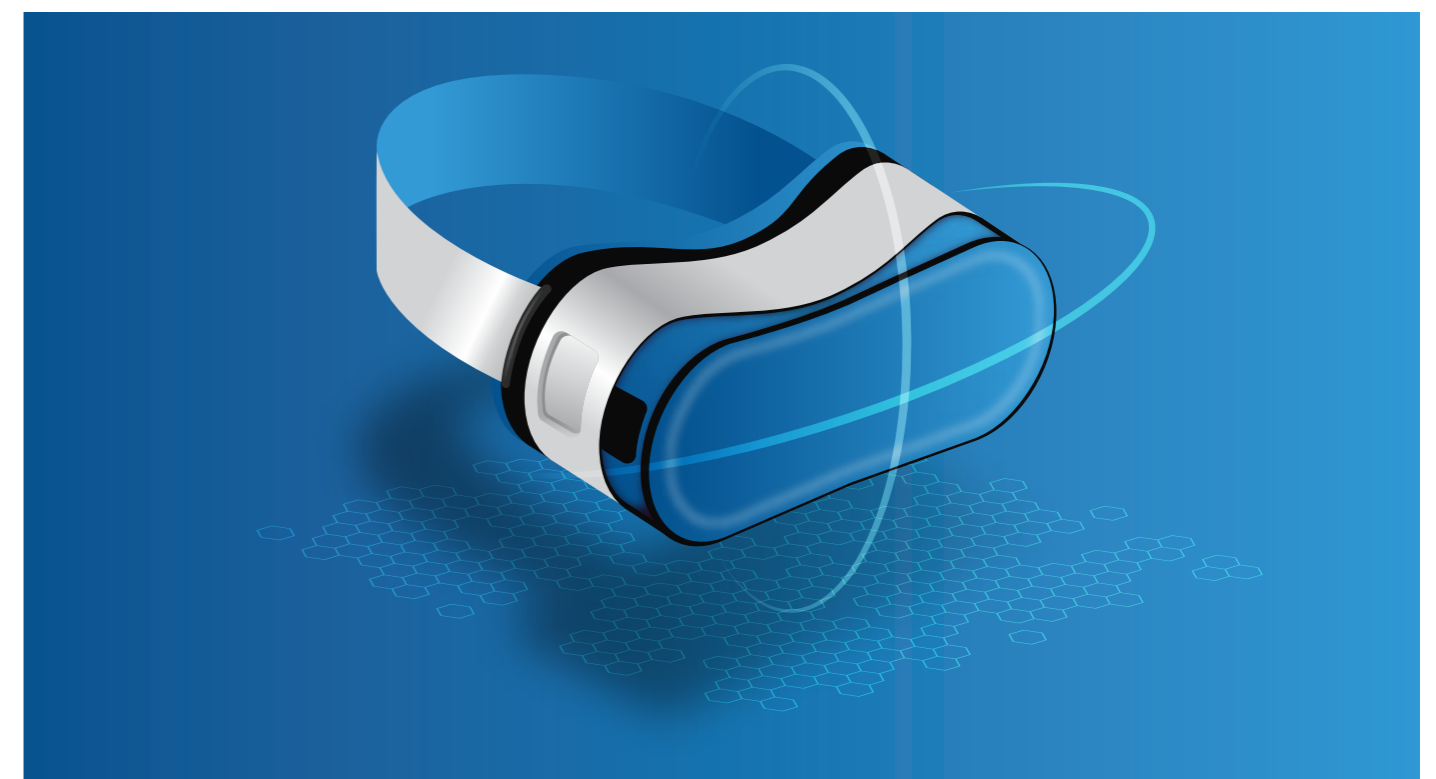
Personalized Learning Experiences

- Lamsa offers children an integrated learning journey that fuels their development across various academic and developmental domains.
- It provides personalized, interest-based experiences for children.

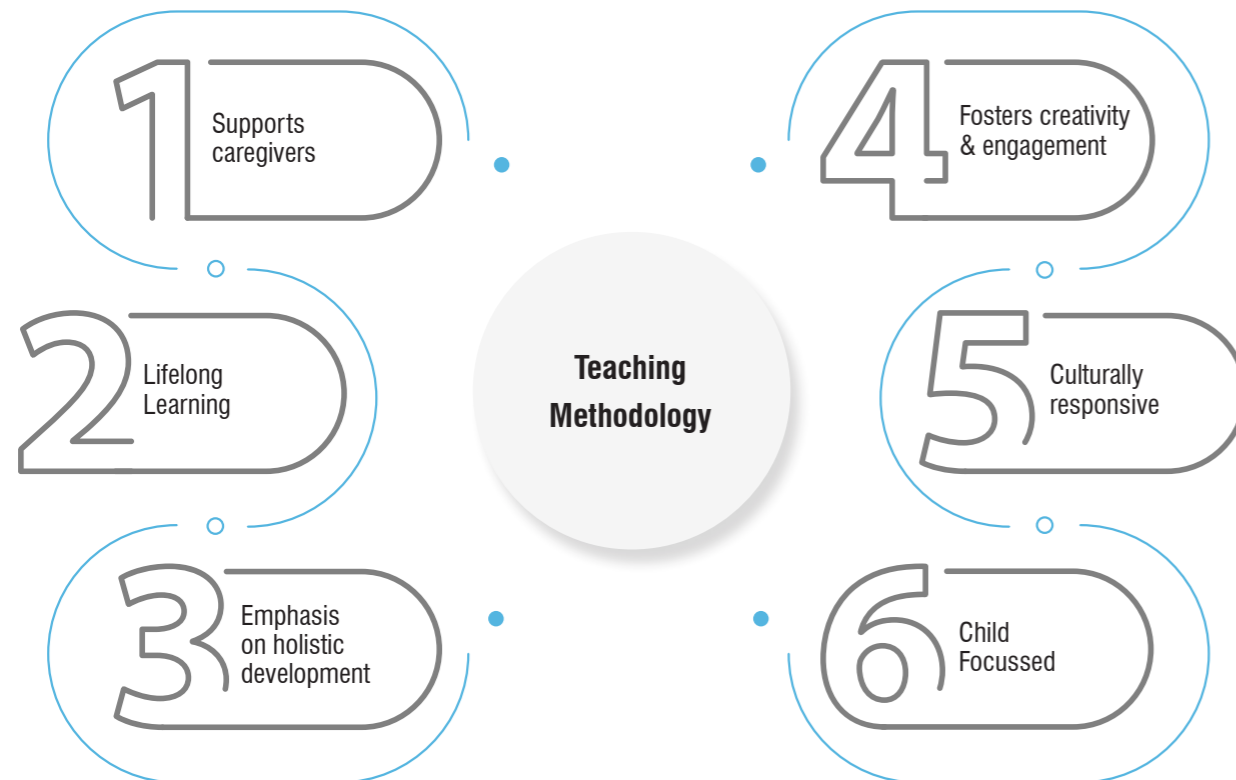
Keeps Track of Progression

- Lamsa's Parent Report Feature helps parents to continuously monitor child's progress.
- Lamsa provides guidance and tools for encouraging the child's learning based on their developmental profile, interests, needs, and behavior.

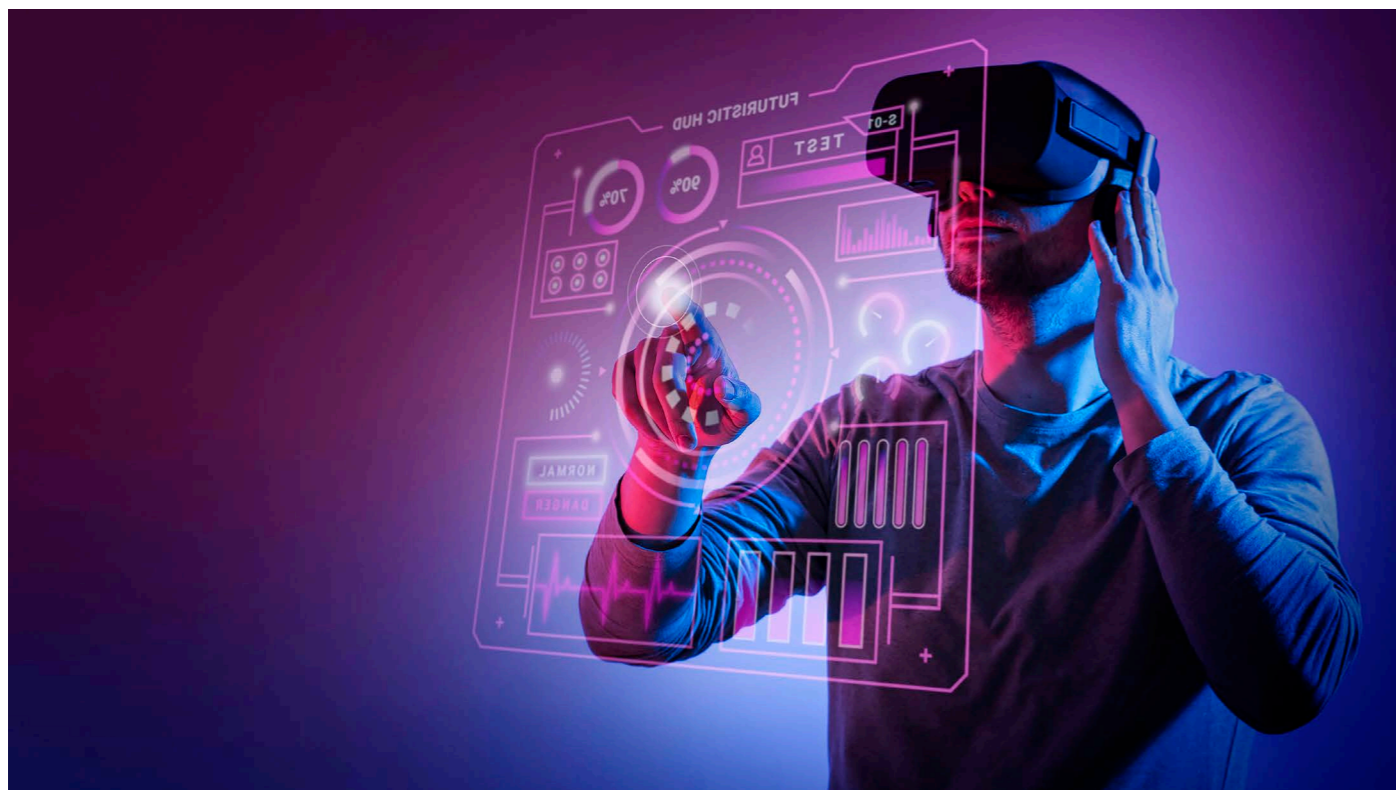
Source: LamsaWorld Website



LamsaWorld's Teaching methodology



Source: LamsaWorld Website



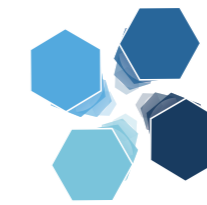
Conclusion

VR and AR technologies have transformed learning methods and traditional teaching practices. Today, these technologies have reinforced the transition from in-site education based on printed books to interactive educational approaches providing immersive learning experience and better understanding of concepts. The use of VR and AR technologies in higher education offers significant benefits to both students and instructors. These technologies provide interactive learning experiences, personalized instruction, and access to experiences that may not be possible in traditional classroom settings. With the use of VR, a supervisor in a factory may also lead a pseudo hands-on training sessions for the employees.

While the adoption of AR and VR being widespread in countries like U.S and China, the use of these technologies is still relatively new in the GCC region. It is expected to be a fast-growing technology in the GCC region, as there are many benefits associated with them, especially in the application of EdTech. However, the implementation of these technologies is costly. While there are challenges to implementing these AR and VR institutions might consider the benefits and explore ways to incorporate VR and AR into their teaching practices. As technology continues to evolve, VR and AR will likely become significant tools in the future of higher education.

Within the GCC region, although AR technology is prominent in several industries, UAE is taking efforts to use AR and VR gadgets in the field of education. In 2022, Thumbay Group announced the opening of the world's first metaverse hospital in the UAE, where patients can consult with a doctor and connect with them before even moving to further procedures. In Saudi Arabia, the implementation of AR and VR technologies in the education industry is widespread since the onset of pandemic. According to research by the University of Leeds, most Saudi schools have received AR materials including textbooks and apps and have access to the support resources on the IEN platform.

The rise of immersive digital knowledge and practical experience is anticipated to contribute to the growth of AR and VR technologies in the education market by embedding digital information such as video, audio, and news. The market has the potential for vast expansion in all regions as a critical element for the personalized education market. In the future, the AR and VR gadgets is expected to give customized and well-designed experiences. With this constant pace, AR glasses with Long-term evolution (LTE) abilities is likely to turn into an option to the smartphone.



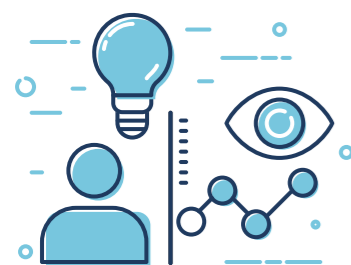
شركة وادي الرياض
Riyadh Valley Co

Riyadh Valley Company

Riyadh Valley Company established in 2010 by Royal Decree No.116 dated 13/4/1431 AH to be the investment arm of King Saud University in the fields of Knowledge Economy and the university strategic projects.



شركة وادي الرياض
riyadh valley co



Vision

To be the regional leader in knowledge-based investment and technology.



Mission

Riyadh Valley Company is a strategic investor, focused on leveraging the local capabilities, investing locally and globally in growth - stage businesses to create financial and strategic returns that will support the future of economic development in the Kingdom.

Investment Sectors:

Venture Capital Investments



Healthcare Investment



Renewable energy & Sustainable Resources



Information & Communication Technology



FinTech



Education



Logistics and Transportation

Strategic Investments



Innovation and R&D Projects



Educational Projects



Healthcare Projects



Commercial Projects



Residential Projects



Mixed-use Projects

Knowledge Investment Portfolio



Strategic Investment Portfolio



Sudair Pharma Company Project

Research center and offices



ELM Information Security Company Project

Research & Innovation center



Four Directions Company Project

Office project



Majd Real Estate Company Project

Offices project



Derma Clinic Company Project

Residential project



City Lights Real Estate Company Project

Mixed-use project



Qasr Alaaredh Company Project

Building



Sahat Al-Ardh Company Project

Mixed-use project



NMR Real Estate Company Project

Mixed-use project



Takween Altanmia Company Project

Offices project



Al-sorooth Al-Mubarakah Company Project

Offices project



Obeikan Company Project

Commercial project



Derma Clinic Company Project

Healthcare project



Dur Alkuttab Company Project

Educational project



Four Directions Company Project

Commercial project



U WALK Project

Commercial project



The Esplanade Project

Commercial project



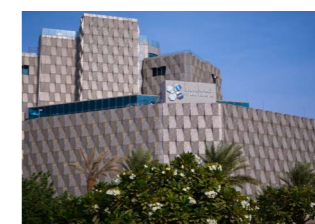
Almaarefa University Project

Building project



Arrowad Education Company Project

Educational project



Innovation Tower Project

Office building project