Orientation of State Resource Groups (SRGs) on Development of eContent for DIKSHA

Immersive Technologies for Teaching-Learning and Assessment

Extended Reality (AR, VR and Virtual Labs)

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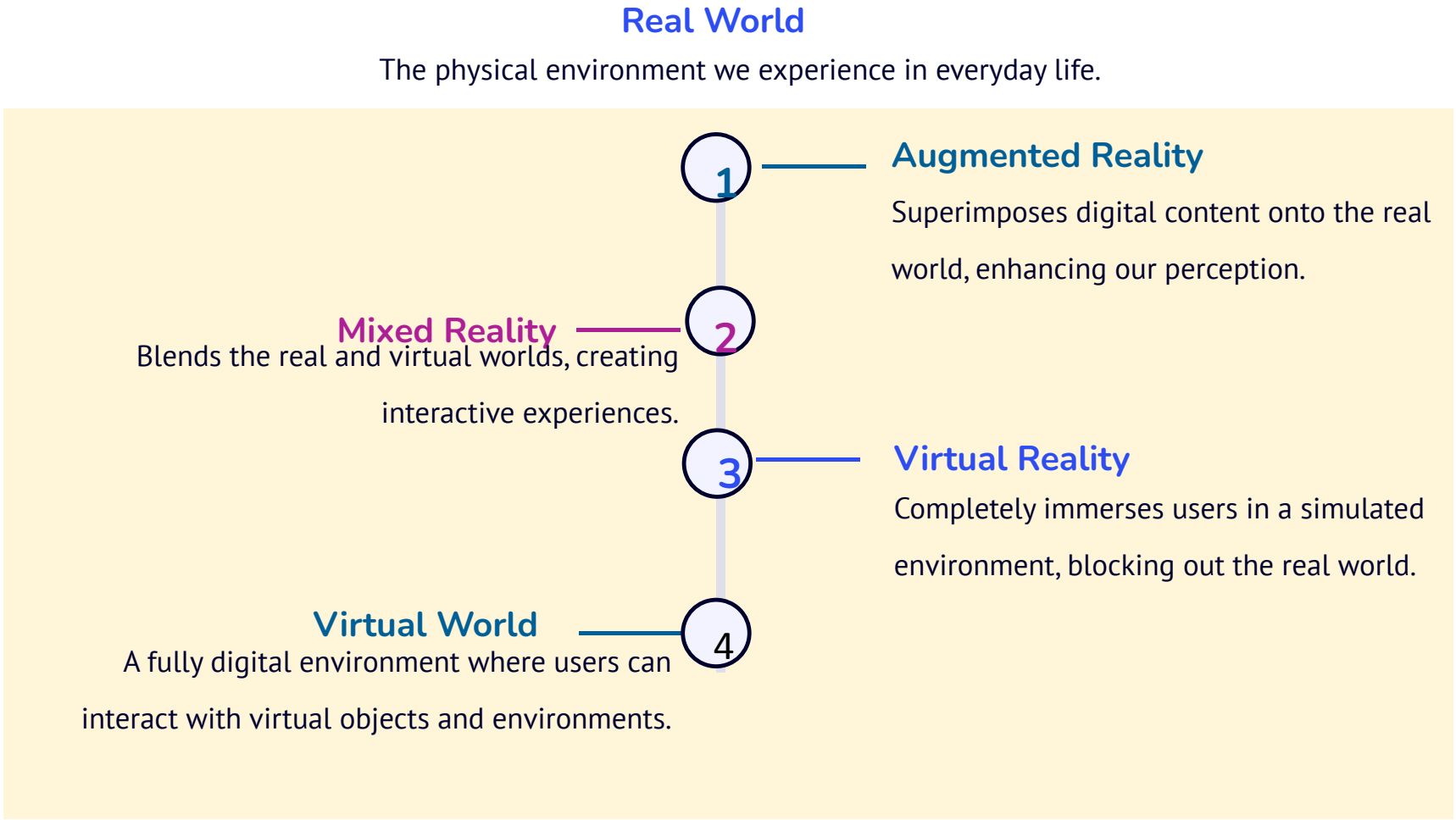
Session Outline

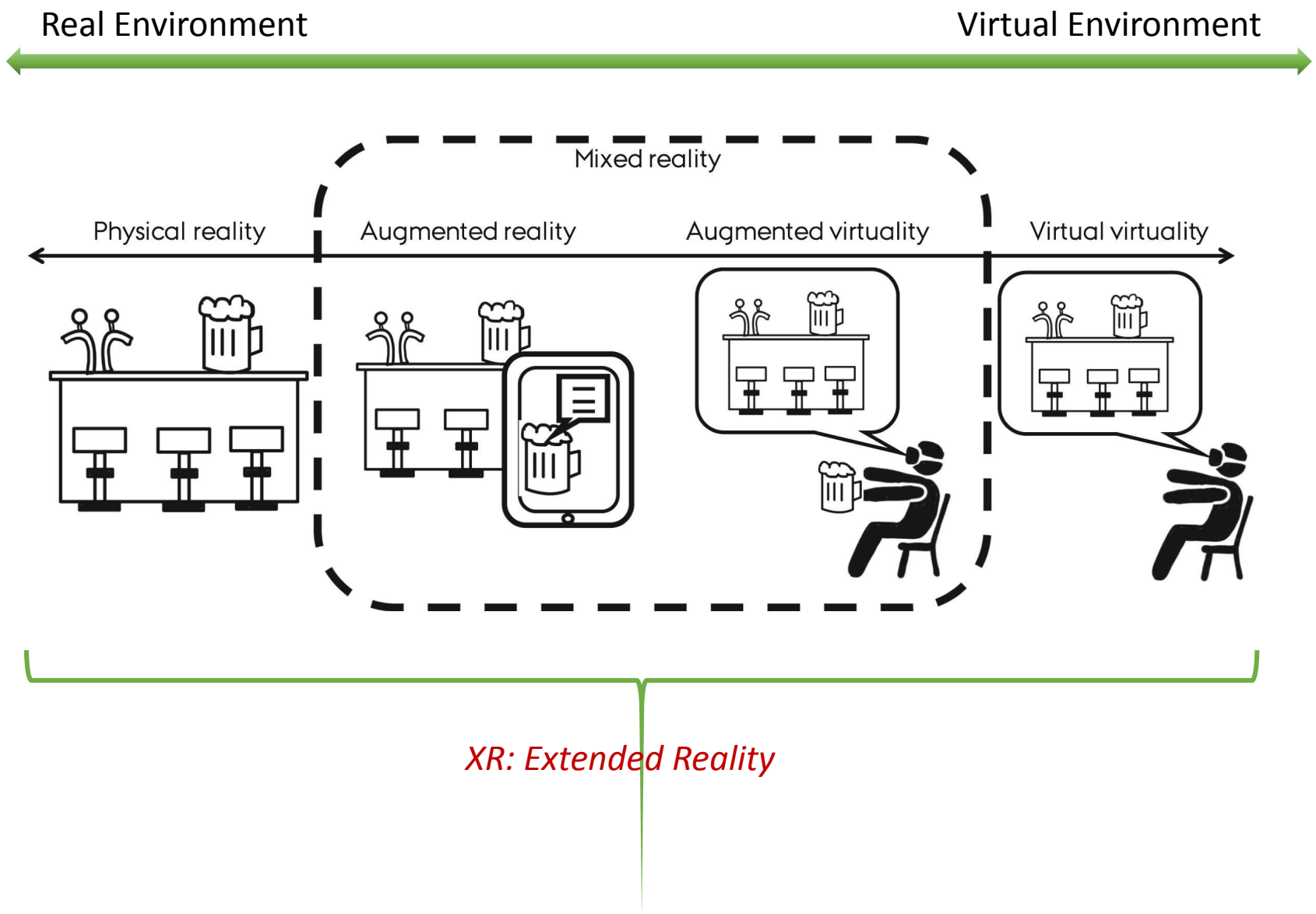
- Introduction: Concepts and Technologies
- The Spectrum of Reality-Virtuality Continuum

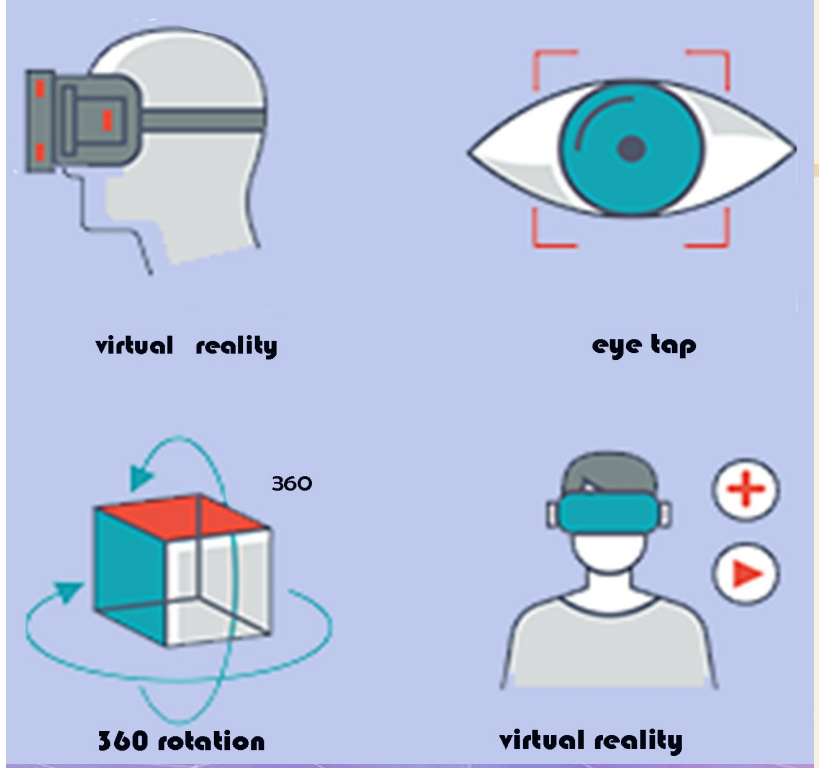
- Elements of Reality
- Immersive Technologies
  - Augmented Reality (AR)
  - Virtual Reality (VR)
  - Mixed Reality (MR)
  - 360 degrees Simulation
  - Virtual Labs
- Immersive Technologies and Assessment
- Challenges and Consideration

The Spectrum of Reality-Virtuality Continuum

The reality-virtuality continuum illustrates the range of technologies that blend the real and virtual worlds, from purely real to purely virtual.




Real Environment
Virtual Environment
Mixed reality
Physical reality
Augmented reality
Augmented virtuality
Virtual virtuality
XR: Extended Reality



Immersive Technologies

Extented Reality

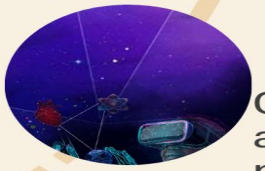
Umbrella term that encompasses all immersive technologies that blends physical and virtual worlds

Virtual Reality (VR

Uses headsets to create completely computer-generated environments

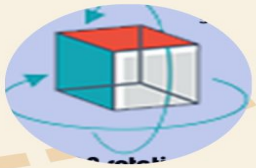
Augmented Reality (AR)

Overlays digital information onto the real world, often through smartphone cameras or special glasses



Mixed Reality (MR)

Combines elements of both VR and AR, allowing digital and physical objects to interact



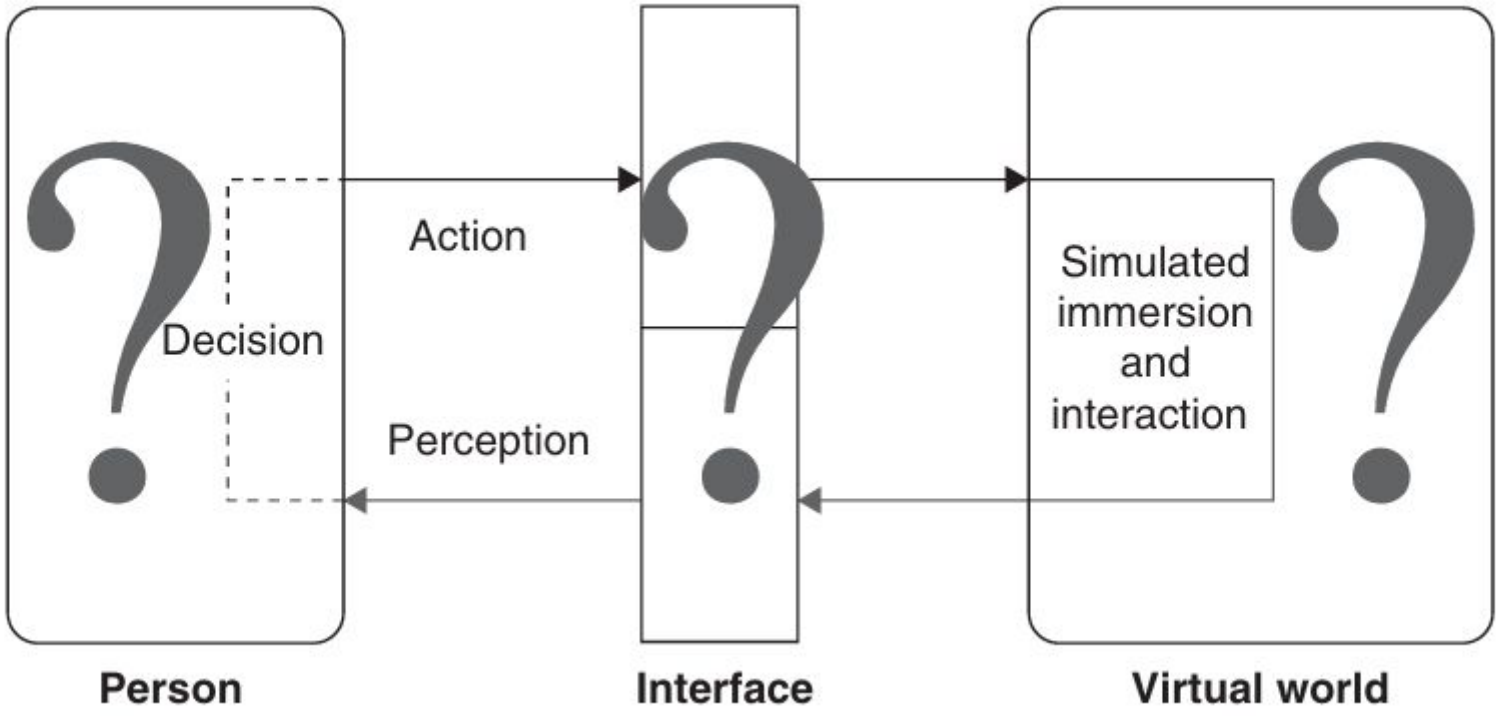
360-degree videos and Simulation

Immersive videos that allow viewers to look around in all directions

Basic Theoretical & Practical Concept in the Visual Aspect of Immersive Environment/Virtual Environment

- Immersive environments are digitally created spaces that replicate or extend reality, engaging multiple senses and enabling interaction.
- Foundational Theories: Rooted in psychology and cognitive science, immersion depends on
  - *Presence* – the psychological state of "being there."
  - *Immersion* – the degree of sensory involvement.
  - *Interactivity* – user ability to affect and receive feedback from the environment.
- Visual Aspects: Realism is achieved through lighting, shading, perspective, depth cues, and high-quality textures.
- Forms of Environments: 360° Videos and Images, AR, VR, MR, XR

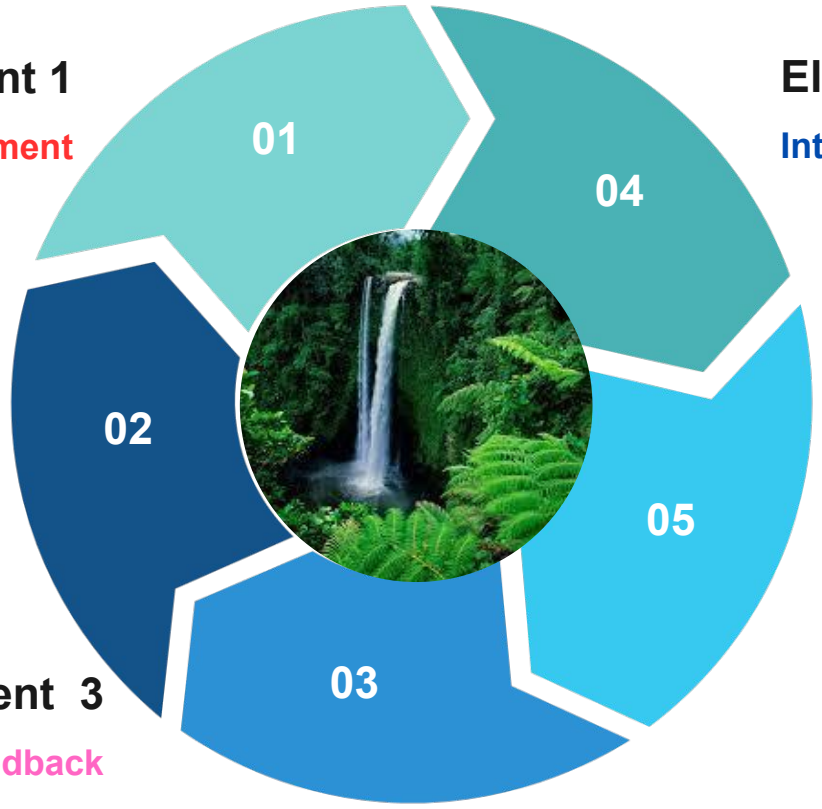
Introduction: Concepts and Technologies



Virtual Worlds & Characters/Actors

- **Computer Graphics** & Modelling– Enables the creation of lifelike visuals through 2D and 3D modeling, using mathematical algorithms to generate images.
- **Animation** – Bringing virtual characters and objects to life with motion and behavior.
- **Character:** designed with realistic movement and expressions.
- **Virtual World Creation;** Interactive ecosystems built with 3D software allowing users to explore, manipulate, and learn.
- **Interactivity** – Real-time rendering ensures objects and characters respond dynamically to user input, enhancing engagement and learning effectiveness

ELEMENTS OF REALITY



Elements of Reality

- The Virtual Environment:
  - description of objects within the simulation and the rules as well as relationships that govern these objects.
  - Determined by its content (Objects and Characters)
  - Displayed through various modalities (Visual, Aural and Haptic) perceived through vision, hearing and touch.
  - Like real objects, properties such as shape, weight, color, texture, density and temperature.
  - *VE grouped into four categories*
    - Environment Topology: Surface, shape, areas, and features.
    - Objects: 3 dimensional forms
    - Intermediaries: controlled vis interfaces or Avatars of User themselves.
    - User Interface elements: Virtual control such as virtual buttons, switches or sliders

Virtual Presence

- Feeling of actually being in an environment.
  - Completely psychological state or via some physical medium.

- Physical Virtual Presence (Sensory):
  - presenting the virtual world to a user with a synthesis of stimuli to one or more senses in response to user's position and actions.
  - Synthetic stimuli often drown out from real world to decrease mental presence in the real world.
  - User moves, the visual, audio and hepatic stimuli also change as the virtual scene also moves.
- Mental Presence
  - Depends upon the goal applications of virtual reality.
  - Varying degrees of intensity
  - Realistic display includes sight, sound and touch affect the level of mental virtual presence.

Sensory Feedback

- Reality system provides direct sensory feedback to users according to their physical location.
- Most feedback is provided vis visual information and hepatic information.
- Automatically measure the position and orientation of objects in the real environment.

Interactivity and Perspective

- Interactivity
  - Ability of the user to affect computer generated environments represents one form of interaction.
  - While working with same environment, it is necessary to follow activities like-pose, gesture, action, gaze, direction and speech.
- Perspective
  - Can use several options to change a user's perception of virtual environment.
  - It involves views through avatar's eyes, views from immediate vicinity of relevant activity, views involves looking from entirely independent location.

Human Perception, Motor and Cognitive Systems

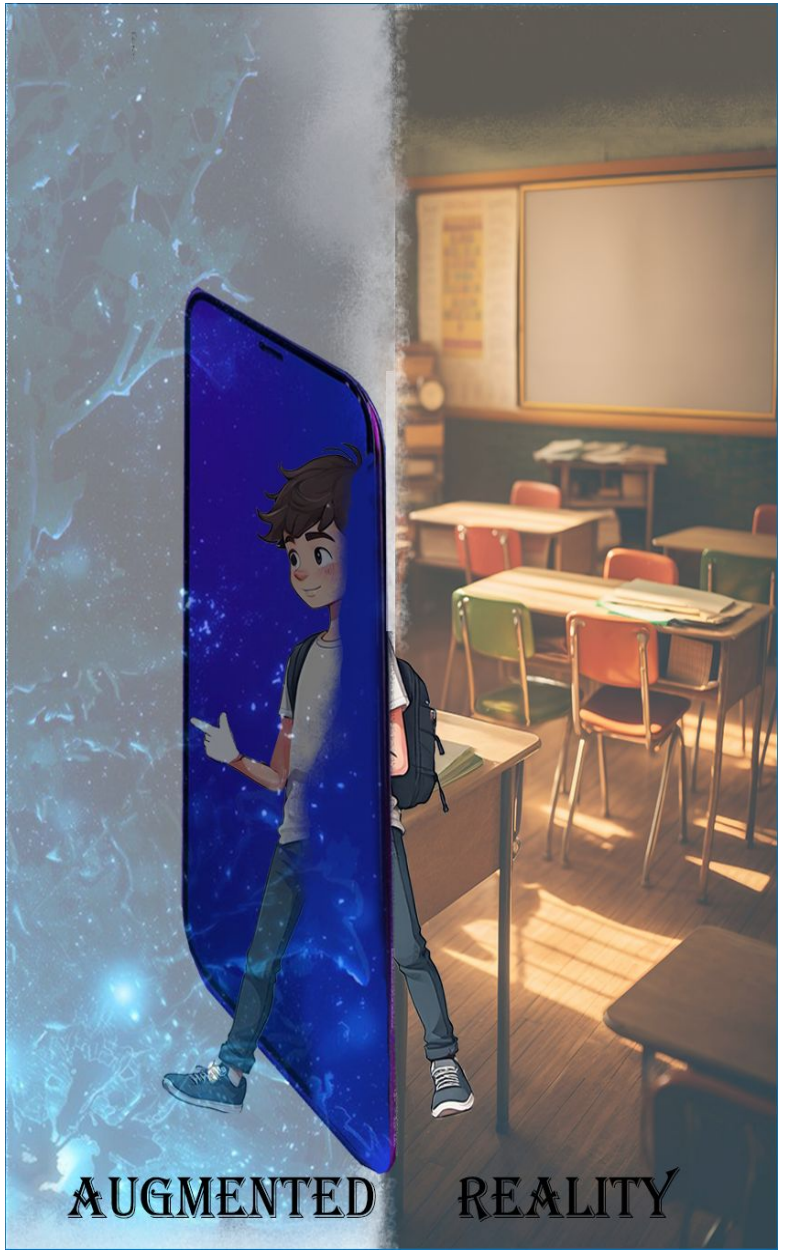
- Perception: allows information about the environment to be obtained
- Motor abilities (musculoskeletal system): allows movement through the environment, manipulation through touch, and positing of sensory organs for better perception;
- Cognitive abilities (Central nervous system): allows the analysis of information from the environment and action planning according to current task goals.

Display Technologies

- Display refers to any method of presenting information to human sense and in this context sight, hearing and touch frequently used to transmit synthetic stimuli in virtual reality.
- The experience of the virtual reality is based on
  - User's perception of virtual world
  - Physical perception of the virtual world is based on computer displays.
- The virtual reality system 'tricks' the senses by displaying computer generated stimuli that replace stimuli from the real world.

Augmented Reality (AR)

- A Superimposition of computer-generated perceptual information over the existing physical surroundings is called Augmented Reality (AR).
- Augmented Reality Devices
  - Smartphones and tablets are the most common AR devices.
  - Augmented Reality (AR) Glasses
  - Augmented Reality (AR) Headsets:
- Augmented Reality Apps
  - E-Pathshala AR (Augmented Reality)
  - SkyView
  - ARloopa



Collaborative Learning Experiences

1 **Shared Experiences**

AR can create shared experiences for students, allowing them to collaborate on projects, solve problems together, and learn from each other in a more engaging way.

2 **Interactive Games**

AR can be used to create interactive games that promote collaboration and teamwork. Students can work together to solve puzzles, complete challenges, and learn new concepts.

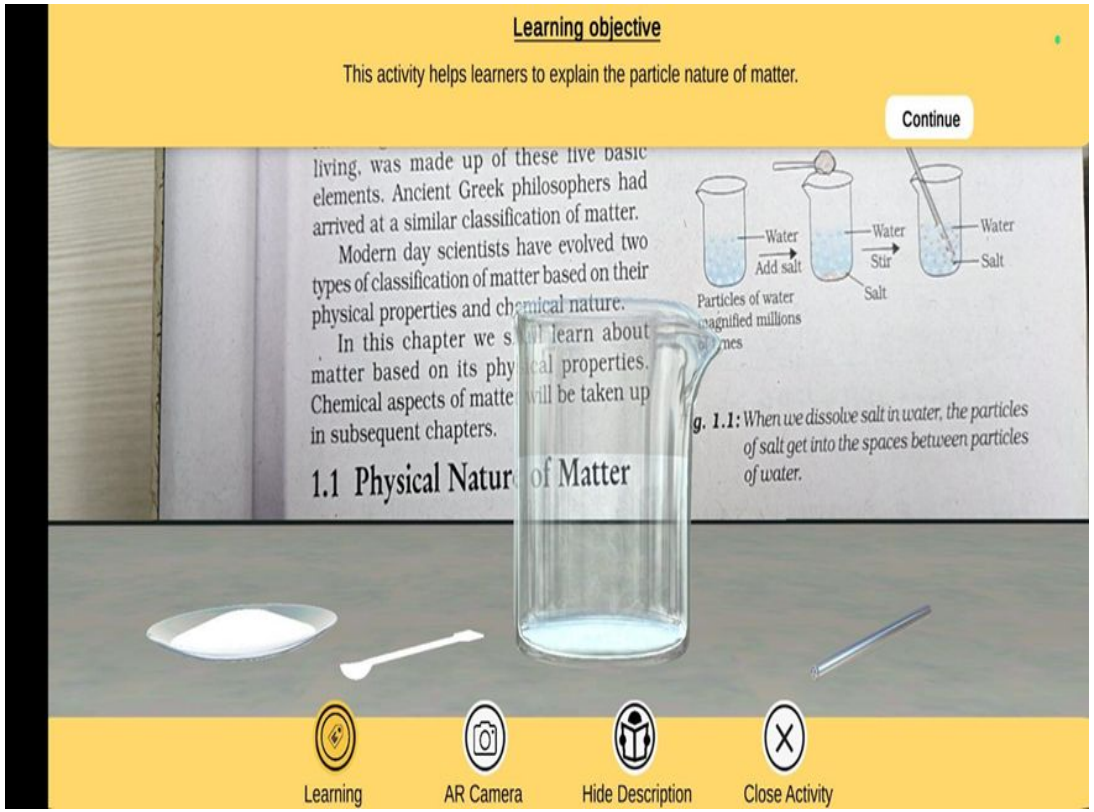
3 **Virtual Tours**

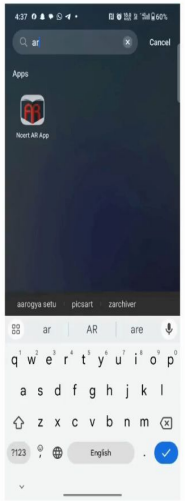
AR can be used to create virtual tours of museums, historical sites, or other locations. Students can explore these locations together and learn from each other's observations.

4 **Accessibility**

AR can make learning more accessible to students with disabilities by providing personalized and adaptive learning experiences.

NCERT epathshala AR app





Virtual Reality (VR)

- Virtual reality is a scientific and technical domain that
  - uses computer science behavioural interfaces to simulate in a virtual world

  the behaviour of 3D entities, which interact in real time with each other and with one or more users in pseudo-natural immersion via sensorimotor channels

Virtual Reality

Headsets

Headsets are the primary device for experiencing VR. They typically include a display, sensors, and input devices.

Controllers

Controllers allow users to interact with the virtual world, such as moving objects, selecting items, or performing actions.

Tracking Systems

Tracking systems use sensors to monitor the user's position and orientation in the virtual environment. This allows for more realistic and natural movement.

Features of Virtual Reality

Immersive

VR uses headsets and other devices to create a simulated environment that surrounds the user.

Interactive

Users can interact with the virtual world using controllers, sensors, or other input devices.

Multisensory

VR can engage multiple senses, including sight, sound, and touch.

Virtual Reality Headsets

1

High Resolution Displays

Headsets use high-resolution displays to create a clear and immersive visual experience.

2

Wide Field of View

Headsets provide a wide field of view, which helps to increase immersion and reduce feelings of claustrophobia.

3

Comfort and Ergonomics

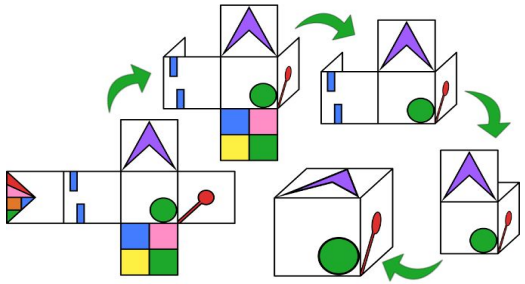
Headsets are designed to be comfortable and ergonomic for extended periods of use.

VR in Education: Enhancing Spatial Understanding

Visualizing Complex Concepts

visualize complex concepts and structures in three dimensions. For example, explore human anatomy, learn about the anatomy of plants.

Developing Spatial Reasoning



provides opportunities for students to develop spatial reasoning skills, which are crucial for success in fields like architecture, engineering, and design.

Improving Memory and Recall

VR's immersive nature can improve students' memory and recall of information. The ability to interact with objects and environments in a virtual world can create a more memorable learning experience.

What is Mixed Reality?

Mixed reality (MR) is a technology that blends the real and virtual worlds, creating interactive experiences where digital content seamlessly integrates with the physical environment.

Blending Reality

MR combines aspects of both augmented reality (AR) and virtual reality (VR), allowing users to interact with virtual objects and environments in real-time.

Interactive Experiences

MR enables users to manipulate digital objects, interact with virtual environments, and experience a sense of presence and immersion.

Characteristics of Mixed Reality

MR experiences are characterized by several key features that distinguish them from AR and VR.

1. **Real-Time Interaction**

   Users can interact with virtual objects and environments in real-time.

2. **Spatial Awareness**

   MR preserves the user's awareness of their physical surroundings while interacting with virtual content.

3. **Object Persistence**

   Virtual objects can persist in the physical environment, allowing for ongoing interaction.

4. **Collaboration**

   MR enables multiple users to interact with the same virtual environment simultaneously.

Mixed Reality in Education

1

Enhanced Engagement

MR technology creates immersive and interactive learning experiences that captivate students and foster a love of learning.

2

Experiential Learning

Students can explore different environments, interact with virtual objects, and participate in simulations, gaining valuable hands-on experience.

3

Personalized Learning

MR technology can adapt to individual learning styles and needs, providing personalized learning paths and customized experiences.

4

Accessibility

MR can provide equal opportunities for all learners, regardless of location, physical abilities, or learning styles.

360 degree Immersive Simulation: Creating Realistic and Interactive Experiences

Realistic Environments

Simulations replicate real-world scenarios, providing a safe and controlled environment for practice.

Interactive Experiences

Users can interact with virtual objects and environments, promoting active learning and skill development.

Engaging Content

Immersive simulations captivate users with engaging narratives and interactive challenges, enhancing motivation and retention.

Simulating Real-World Experiences

1. **Virtual Field Trips**

   VR can take students on virtual field trips to places that would be difficult or expensive to visit in person, such as historical sites, museums, or natural wonders.

2. **Career Exploration**

   VR can provide students with realistic simulations of different careers, allowing them to experience the challenges and rewards of different professions before making a career decision.

3. **Science and Laboratories Simulation**

   VR can be used to train students in safe and controlled environments, such as fire safety, emergency procedures, and first aid.

4. **Historical Re-enactments**

Pedagogical Benefits of Extended Reality

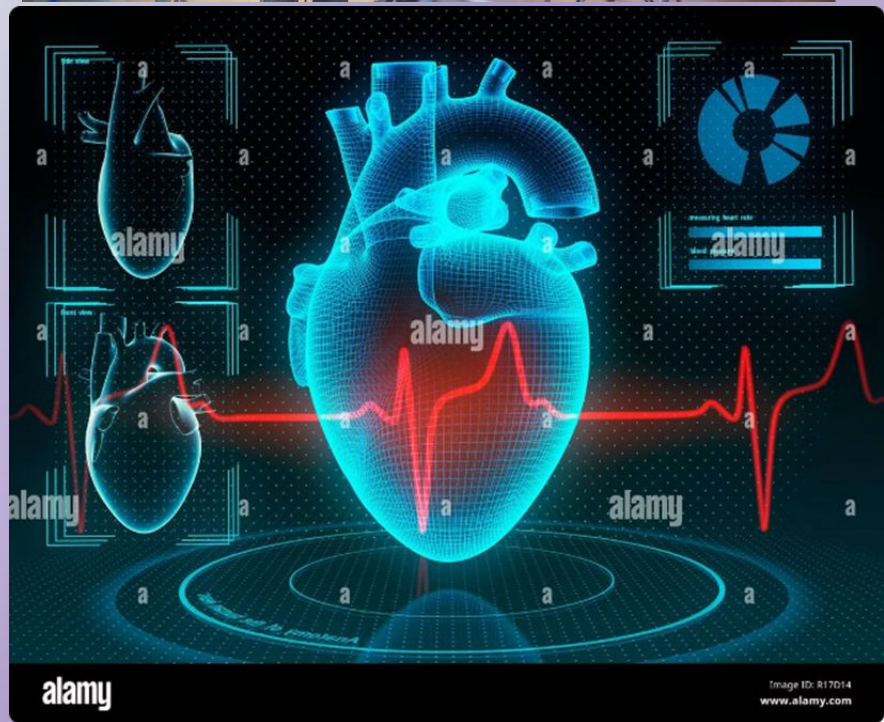
MR and immersive simulation enhance learning by providing engaging, interactive, and personalized experiences.

1. **Increased Engagement**
   Immersive experiences make learning more exciting and interactive, boosting student motivation and interest.

2. **Improved Retention**
   Hands-on experiences in virtual environments lead to deeper understanding and improved knowledge retention.

3. **Personalized Learning**
   Students can learn at their own pace and adapt the simulation to their individual needs and learning styles.

4. **Enhanced Collaboration**
   Virtual environments facilitate collaborative learning, allowing students to work together and learn from each other.



Virtual Labs

A virtual laboratory is a computer-based activity where students interact with an experimental apparatus or other activity via a computer interface.

- **Key Features of Virtual Labs**
- Collaboration Tools: Collaboration tools in virtual labs can enhance the learning experience by promoting teamwork, communication, and problem-solving skills.
- **Simple and Responsive Interface**:
- **Accessibility**: Virtual environments, or hands-on labs, are accessible from a computer with a primary web browser and fast internet connectivity.
- **Real-time Guidance**: This type of guidance is delivered in real-time, allowing students to receive feedback immediately.
- **Instructor control** authorizes teachers to electronically monitor their students' progress, as happens in physical classrooms

Pedagogical Integration of Virtual Lab

Pre-Lab Session,

students are introduced to the theoretical background and objectives of the lab activity. They might review instructional materials, watch demonstration videos, or complete preparatory assignments to familiarize themselves with the procedures and equipment they will be using.

Performance Session,

students actively engage in conducting the experiment. Utilizing the virtual lab platform, students perform the procedures, collect data, and make observations as they would in a physical lab setting.

Post-Lab Session

focuses on reflection, analysis, and consolidation of the learning experience. Students analyze the data they collected, draw conclusions, and compare their results with theoretical expectations.

Virtual Labs on DIKSHA

Activity

Step 1: Search https://diksha.gov.in/

Step 2: Scroll banners to find Virtual Labs vertical and click on its “Explore” icon.

Step 3: Scroll down on the landing page of Virtual labs to reach eContent of classes 11.

Step 4: Click on the “Explore” icon of the class 11, select the english medium, then choose a physics as subject.

Step 5: Click on the Explanation resource to reach the link for related resources

Immersive Technologies and Assessments

- **Simulation-Based Assessments**: Assess students' ability to apply knowledge in real-world scenarios through VR simulations, such as virtual labs or problem-solving tasks in simulated environments,
- **Skill-Based Assessment**: Evaluate practical skills in immersive settings, such as medical students performing surgeries in VR or engineers testing designs in AR.
- **Immersive Problem-Solving Tasks**: Use AR to create interactive tasks where students manipulate digital elements to solve problems, providing insight into their understanding and critical thinking.
- **Formative Feedback**: Provide continuous feedback in real-time as students engage with VR/AR tasks, allowing for ongoing assessment of their progress and areas for improvement.
- **Creativity and Design**: Assess students' creativity through tasks that involve designing virtual models, environments, or systems using immersive tools, like creating a virtual city in VR.
- **Gamified Assessments**: Turn assessments into engaging, gamified experiences in immersive environments,
- **Collaboration and Teamwork**: Use immersive technologies to assess collaboration skills by having students work together in virtual spaces to complete group projects or challenges. where students earn rewards or achieve goals based on their performance.

Challenges and Considerations

Cost of Hardware and **Software**	The initial investment in virtual reality and augmented reality technology can be significant.
Teacher Training	Teachers require training to effectively integrate immersive technologies into their curriculum and leverage their potential.
Technical Support	Maintaining and troubleshooting virtual reality and augmented reality equipment can be challenging.

Learning Won’t Change

Until Professional Learning Changes

Thank You

Any Query