Level 1

AR/VR

Teacher Handbook

CONTENTS

Lesson 1

Demystifying eXtended Reality

01. OVERVIEW

Ask students to introduce themselves. Ask them why they chose to take this course and what they hope to learn by taking the class. Excite them by providing them the lesson overview.

This course is to help the students recognize the concept of eXtended Reality (XR). They will explore what it feels like to augment and imagine something closest to reality as we navigate into the fourth industrial revolution in this digitised world. In this lesson, we will also discuss the need for XR and find more opportunities to apply it in our daily life.

The students will learn about the important factors that shape the digital world and understand how it differs from and complements our physical world. At the end of each section in a unit, they will experience the utility of XR by applying its fundamental idea in our own world through activities and practical learning.

Slide 02

1.1. LEARNING OBJECTIVES

By the end of this lesson, students will be able to:

- Understand the concept of XR
- Take a sneak peek into the Information Age
- Acknowledge the need for XR in this interplay of the physical and the digital
- Appreciate the unique opportunities presented by XR
- Students will be introduced to the metaverse and its elements
- Students will be able to create their own metaverse avatar

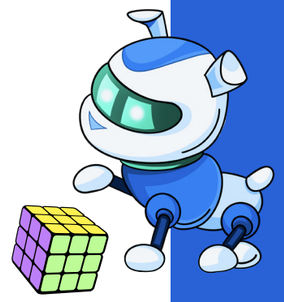
1.2. PRIOR KNOWLEDGE

Enquire if the students meet the prerequisites.

The students should know:

- Basic awareness about digital devices
- Access to a computer, mobile phone, and internet

02. THE INFORMATION AGE



ACTIVITY

Slide 03

ACTIVITY:

BACK TO THE FUTURE!

This activity emphasises the increasing digitalisation of our lives. Implore the students to think about the past when digital devices were not so ubiquitous.

DURATION: **10 MIN**

Close your eyes for a moment and think about everything you did last evening after reaching home. Maybe you sent your cousin a message, had a video call with your friend, bought your favourite dress from an e-commerce store, or played a multiplayer game online! Now try to imagine how your parents might have done the same things when they were kids. Does it look any different?

Discuss these differences with your class.

Moderate a classroom discussion and share relevant examples from your experience.

Below mentioned are some examples for your reference:

Now	Then
Send your cousin a message	Posting letters
Video call with your friend	Travel all the way to their place to talk with them
Buy your favourite dress from an e-commerce store	Visit the store and buy a dress with the help of the store attendant
Play a multiplayer game online	Gather your friends in the playground for an in-person game

You must have realised that our world has not always been like it is today. It is easy to take for granted how digitised our lives have become. But our computers, laptops, smartphones, and virtual reality headsets are more than mere convenient tools for streaming movies and playing games. They are the products behind the Fourth Industrial Revolution that is transforming the way we live, work, learn, and play. Just one generation ago, the gadgets and digital devices which populate our homes today existed only in the imaginations of people who grew up watching Dexter's Laboratory or The Jetsons.

Talk about the four industrial revolutions. Discuss with students about their favourite sci-fi cartoon or film.

Slide 04

Can you name 5 digital devices that you use at your home?

1. Mobile Phone
2. Laptops
3. Fitness Band
4. Camera/CCTV Camera
5. Tablet

Our digital devices connect us to people around the world and give us access to all-important data. The heart of our digital lives is the internet, which now connects 65 percent of the population on the planet, and almost everyone living in developed countries. Digital sensors are being widely adopted in our homes, offices, and public places.

This has resulted in an interconnected world like never before. At the same time, advancements in the internet and computers are allowing us to experience fascinating virtual worlds, as well as an augmented reality, through our digital devices.

Slide 05

Play the video. After the video, ask the students if they have experienced any other virtual universe.

Check out the fascinating virtual universe of Roblox created by kids like you!

Slide 06

All told, we generate 2.5 quintillion (25,00,00,00,00,00,00,00,000) bytes of data every day. 90 percent of all the data in existence was created in just the last two years. Organisations use this data for day-to-day things such as weather forecasting, movies and songs recommendations, fixing your cab fare during surge pricing, and also for more critical uses such as medical diagnosis, reducing gender discrimination, identifying illiteracy in the vulnerable population, and estimating the global temperature increase in the coming years.

But, as we will read in the next section, there is a gap between our digital and physical world, and by bridging this, we can unleash new abilities and possibilities for ourselves.

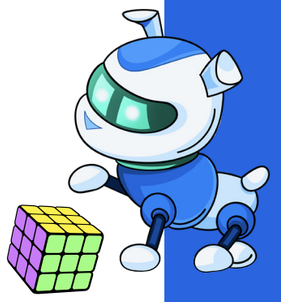
Slide 07

ACTIVITY:

MY DIGITAL WORLD

This activity encourages students to identify the use of digital devices in their daily lives. You are encouraged to prompt students to come up with a variety of answers.

DURATION: 5 MIN



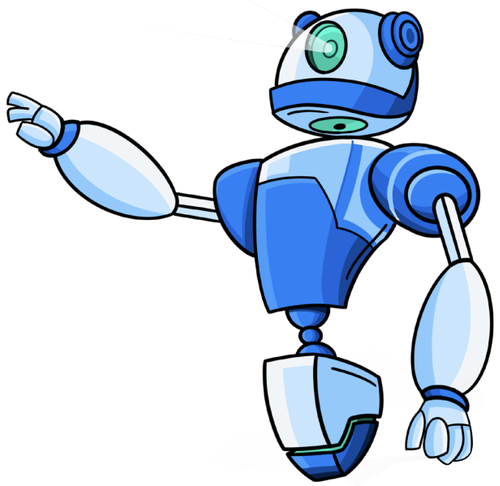
Write down 5 use cases of digital devices in which you see around yourself. Get creative!

One has been given as an example for you.

Example – Using Google maps for navigation.

1. Taking photos
2. Reading news
3. Playing games
4. Monitoring pulse rate and sleep pattern
5. Making digital payments

Accept any other answers as well.



ACTIVITY

Slide 08

03. THE NEED FOR EXTENDED REALITY

ACTIVITY: SAY HELLO

Teacher's Note: This activity provides an AR solution experience to the students.

Take a look at the picture below.

What do you think these different bubbles say? Do you know what the different languages written here are? Try to search them on the internet.

Do not worry if you are a little confused, for technology is here to help us! We can check what the bubbles actually say by using an application called Google Lens.

After you have downloaded it on your phone, point your camera at the above photo, select the 'Translate' option in the lens, and see the magic happen! As a bonus activity, try to find out what the different languages written here are, and greet your friends.

You might have guessed that all the bubbles in the activity image say ‘Hello’ in various languages. But did you have some doubt? Did you struggle in searching the languages on the internet? Do you agree that technology made our task of translating these words into our preferred language extremely easy and quick? Discuss with your class.

Moderate a classroom discussion. Ask the students to share their experience of using the Google Lens app. Did they face any challenges? Can they think of improvements in this application?

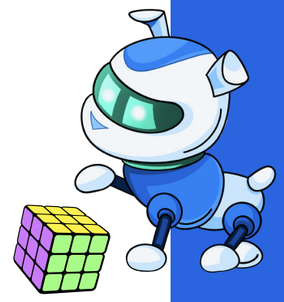
Slide 09

Now, we should be able to conclude that even though there is a tremendous amount of digital data available in the world, there is a fundamental disconnect between the data and the physical world in which we apply it. Our world is three-dimensional, but the rich data and the abundantly liberating virtual worlds remain trapped on two-dimensional pages and screens. This gap between the real world, the digital world, and the virtual world limits us to take full advantage of the billions of smart and interconnected digital devices worldwide and keeps us from exploring the possibilities in the virtual universe.

You may ask the students or share on your own, other cases where they might have experienced this gap between the physical and digital worlds.

An exciting set of technologies clubbed under eXtended Reality (XR) promises to bridge this gap and release untapped and unique human capabilities – similar to how Google Lens allows you to understand so many different languages! XR is rapidly becoming a part of our world and is beginning to impact every area of our lives. Soon, it will transform how we learn, make decisions, and interact with our physical worlds. In the next section, we will describe what exactly XR is, its evolving technologies, and how it helps us. Are you as excited as we are?

Slide 10,11



ACTIVITY

ACTIVITY:

LAY IT OVER

This activity depicts the benefits of merging digital data with the real world. Ask the students to match the images in column A with the most appropriate data point in column B.

Match the images in column A with the appropriate data in column B.

One has been done as an example, and a pictorial representation of the same is provided for your understanding.

Column A	Column B
Example: 	**Example:** **Example: 10% discount on combo meals!**
i) 	 **1. Ball trajectory**
ii) 	**2. Engineer, 5 years of experience in IT sector**
iii) 	**3. INR 57/dozen**
iv) 	**4. 83 miles per hour**
v) 	**5. 47°C**

Correct answers:

i) - 3 ii) - 5 iii) - 4 iv) - 2 v) - 1

Slide 12

04. WHAT IS XR?

ACTIVITY

VIRTUAL TRIAL

This activity provides an XR experience to the students.

I need new sunglasses!

Do you wear spectacles, and have been wondering to try out some latest designs?

Have you been wanting to buy trendy sunglasses but not sure how you will look in them?

Check out this amazing feature from Lenskart, India's leading optical retail chain, which lets you try out cool eyewear designs on their website, just like you would do in a physical store, before buying one for yourself!

What you just experienced is an example of XR!
Can you think of more similar experiences and share them with the whole class?

A few similar examples:

1. Image filters on social media platforms
2. Pokemon Go game
3. Weather effects on news channels

Slide 13

Imagine what it might be like to live in the year 2050 and beyond! Perhaps, thanks to advancements in XR, you might be able to buy a new home anywhere in the world as if you were actually on-site, or have lunch with your dear ones in a faraway land. This essentially means that the tremendous changes lined up for us might be beyond our imagination's ability to grasp.

But what we surely know is that XR is going to be crucial in bringing about this change.

XR is a term used for "extending" our reality with the help of technology. It is essentially an umbrella term for all the immersive technologies, the ones we already have today – Augmented Reality (AR), Virtual Reality (VR), and Mixed Reality (MR) – plus the ones still to be created (we will study AR, VR, and MR in detail in the next lesson). These immersive technologies transform the reality we experience by either blending the real, digital, and virtual worlds or by creating a new world altogether. The 3D Pokémon we catch through our smartphone camera, image filters on different platforms, or even the enthralling multiplayer gaming environments are all examples of XR!

The idea of XR is actually older than most people realise - since the early 1960s. Of course, it's only recently that we have started to unlock the potential of the XR landscape, thanks to the evolving technology and the torrent of data we have access to. This has also paved the way for the discovery of new concepts, like the

Slide 14

Here are some exciting use cases!

Shopping **Training** **Entertainment** **Gaming**

Play the videos associated with each use case. You may encourage the students to imagine and share other use cases for each area.

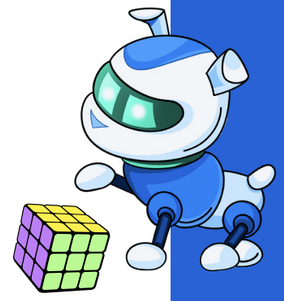
- **Shopping**: XR gives you the ability to try before you buy. IKEA Place lets you place their furniture in your home via your smartphone.

- **Training**: In life-and-death circumstances, XR can provide training tools that are hyper-realistic to help us figure out solutions to problems and their responses to critical situations without putting their lives at risk. AVEVA group provides engineers with one such training module.

- **Entertainment**: One of the most benefited fields from XR, the entertainment industry continues to find new ways of utilising immersive tech. Take a look at this XR studio in London.

- **Gaming**: Computer games ought to be more fun if you can be in them and XR allows you to do just that. Numerous game companies are coming up with XR games, and for the Marvel fans out there, here is a review of one such Spider-Man game.

Hope these examples have got you excited about XR and what we can achieve with it. After you do the activity below, and get a feel of being in a virtual world, we will talk about metaverse, a concept that is becoming more and more popular every day!



ACTIVITY

Slide 15

ACTIVITY:

AUGMENT YOUR WORLD WITH DATA

This activity engages the students with XR.

DURATION: **15 MIN**

Project and play the video.

Watch this video below and imagine yourself to be the main lead of the video as you enact the scenes and situations imagining it to be real.

It helps to understand and observe the elements that aid us to augment reality - sound, movements, visual graphics.

Slide 16

05. INTRODUCTION TO METAVERSE

Teacher's Note: Discuss the students' perception of 'metaverse'. Have they heard this word before? What does it mean? Has it become popular recently?

Imagine attending a mega-concert of your favourite music star, this is a video of Daler Mehndi's virtual concert.

Slide 17

What is Metaverse?

A metaverse, considered to be the next generation of the internet, is a virtual environment where users can interact with each other in a digital space, similar to the real world. It defines a collective sharing space by combining physical reality, gaming, social interactions, and digital currencies to enable users to live virtually.

For a better understanding of the idea of metaverse, check out this intriguing introduction scene from the movie Ready Player One which is set in one such metaverse – 'The Oasis'.

Slide 18

Just imagine how cool it would be to walk into a supermarket in the metaverse and buy the items you are looking for. How fun would it be to meet up with your friends in the metaverse and go watch a movie together? And how about buying virtual sneakers from Nike or Samsung mobile phones from their virtual showrooms, or going to watch your favourite sports team in their virtual stadium?

Can you think of different things you would like to do in the metaverse? Discuss with your class.

Some sample answers are given below for your reference:

1. Throw a virtual birthday party
2. Visit a wildlife sanctuary with extinct animals
3. Organize an art exhibition of my paintings
4. Build my own floating house
5. Conquer my fears!

Slide 19

The metaverse is a massively scalable, persistent network of interconnected virtual worlds focused on real-time interaction where people can work, socially interact, transact, play and even create. Unlike our universe, we can have more than one metaverse.

Here are a few things that we can do in a metaverse:	
Interact with other people through chat or voice	
Explore stores, museums, games, houses, etc.	
Play single-player and multiplayer games	
Listen to music and experience art created by other users	
Change your virtual appearances	
Build your own world, like in Minecraft	
and much more!!!	...

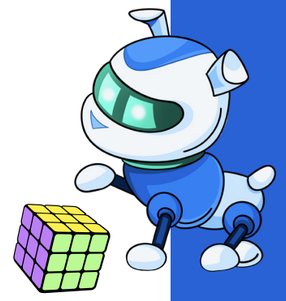
Slide 20

06. ELEMENTS OF METAVERSE

Amid all the exhilaration around metaverse, let us now take a look at some of the elements which make metaverse a functional and liveable space. While you read about some of these elements, try to relate them to the real world to grasp them better.

- **Online Shopping**: Shopping in metaverse will offer unprecedented convenience, speed, and access to redefine the e-commerce experience. The metaverse will be a seamless experience that makes it easier for shoppers to find exactly what they want, exactly when they want it.
- **Digital Currencies**: These currencies can only be accessed with a digital device because they are electronic, like Bitcoins or other cryptocurrencies. They are also called metaverse tokens and can be used by people within the metaverse to create, buy, and sell goods.
- **Non-Fungible Tokens**: NFTs represent ownership of digital assets such as social media posts, digital art, paintings, products, and so on. In the metaverse, they can represent ownership, allowing us to choose the product of our choice from the digital markets.
- **Gaming**: In-game universes appear as 3D virtual worlds in the metaverse which you can view in 360-degrees and even “touch and feel” through sensors.
- **Concerts, Social, and Entertainment Events**: Virtual concerts taking place within the metaverse are the next step in the evolution of the music industry. In the metaverse, virtual humans are no longer bound by physical limitations. An artist can instantly change outfits in a virtual concert or transform the stage from an outer space realm to an underwater world.
- **Workplace**: Metaverse can transform the way we work and socialise on a fundamental scale. Video conversations are already being replaced with the option to sit next to an avatar of the person you want to meet.
- **Digital Humans**: Digital humans are 3D versions of chatbots that exist in the metaverse. They are like AI-enabled non-playing characters in a video game that can react and respond to your actions and support your digital avatars in the metaverse.

Slide 21



ACTIVITY

CREATE YOUR METAVERSE AVATAR

This activity allows the students to create their virtual avatar - their representation of the metaverse.

Kindly make sure that all the students are respectful of their own selves and their peers.

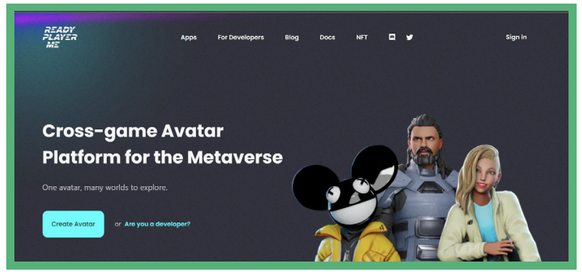
Duration: 20 min

Most of us look at ourselves in the mirror every day. We style our hair, dress ourselves, maybe put on the sunglasses and the new pair of shoes that we bought recently! This is what makes us look like ourselves and helps others recognize us. But what do you think people look like in the metaverse?

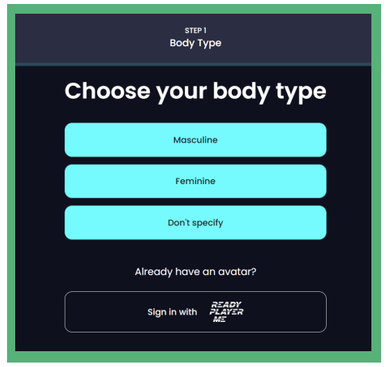
We can use digital avatars to represent ourselves in the virtual worlds. Our profile photos are our 2-D Avatars for social media platforms. Similarly, we can create 3-D Avatars for the metaverse.

Do you want to create your own digital avatar? Let's get started then!

1. Go to “Ready Player Me” and click on ‘Create Avatar’.

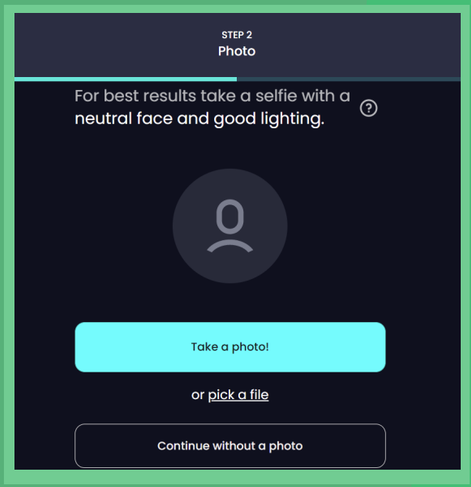


2. Choose your body type by clicking on the appropriate option

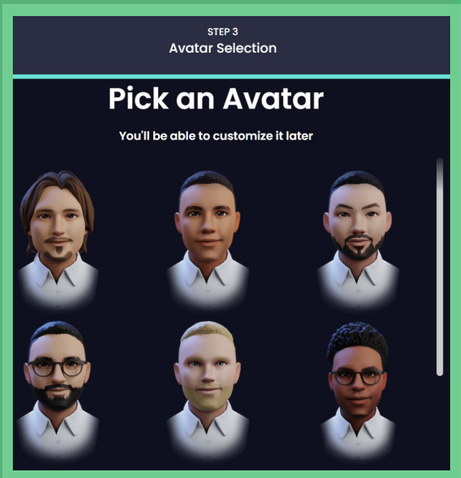


ACTIVITY

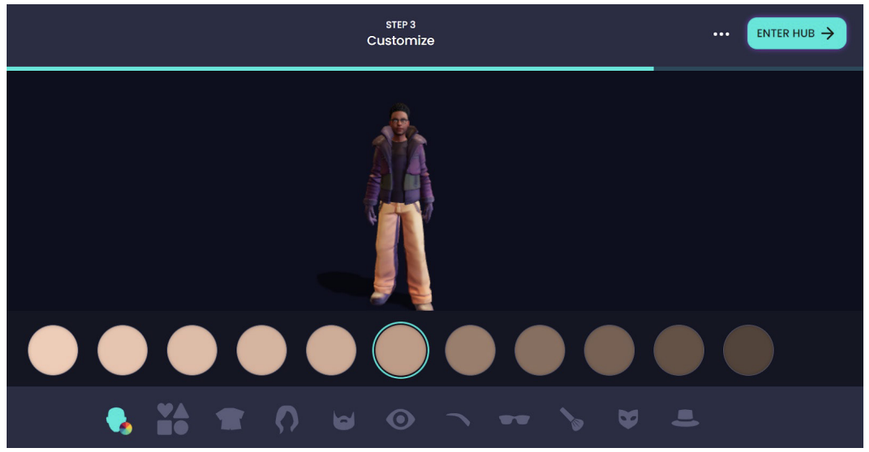
3. In this step, we recommend that you '***Continue without a photo***'. You may choose other options after taking permission from your teacher/parents.



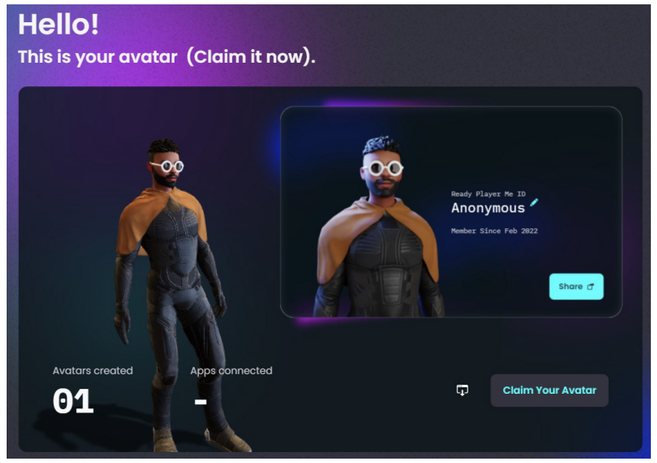
4. Pick an avatar to get started. You can customise it later on.



5. Explore the various options to customise your avatar using the available features. Change your hairstyle, your dress, try on a headgear, and more to come up with an avatar you like! You can also move your avatar around using the mouse button. Once you are done, click on '***ENTER HUB***'



6. Congratulations, your avatar is ready! Click on '***Share***' to download the avatar image and share it with your class, and check out how your classmates will look in the digital world!



7. **Bonus step**: You can also download the 3D model of your avatar by clicking and downloading it on your computer. Use '**3D Viewer**' or '**Paint 3D**' or any other similar application to open it in 3D.

ACTIVITY

NOTES

NOTES

GLOSSARY

- **Virtual reality headsets:** A device worn on the head that completely covers the eyes for an immersive 3D virtual experience.
- **Fourth Industrial Revolution:** It creates a world in which virtual and physical systems cooperate with each other, driven by the internet and advancement in intelligent and connected electronic devices. Watch this video to learn more.

- **Digital device**: It is an electronic device that can create, generate, send, share, communicate, receive, store, display, or process data. Some examples are desktops, laptops, tablets, smartphones, fitness bands, earbuds, etc.
- **Data**: It is information processed or stored by a computer. This information may be in the form of number, text, image, audio, video, etc.
- **Internet**: It is a vast network that connects computers all over the world. Through the internet, people can share information and communicate from anywhere with an internet connection.
- **Sensor**: It is an input device that records data about the physical environment around it. Sensors send data to a computer for storage and processing.
- **Real world**: It is the physical and natural world that we see around ourselves. This is where we live.
- **Digital world**: It is the world of computers and digital devices and where they collect and store information. This is where our data lives and we need access to the digital world to analyse our data.
- **Virtual world**: It is a simulated world designed in and operated by a computer. This is not physically present, and there can be more than one virtual world. Your favourite cartoon characters and game heroes live in their own virtual worlds. Here is an example of a virtual world we can inhibit soon.

- **Umbrella term**: A term used to cover a wide-ranging subject rather than one specific item.
- **Immersive technologies**: Immersive technologies create distinct experiences by merging the physical world with a digital or simulated reality. They are called as such because interacting with them completely immerses the user in the experience.
- **Digital avatar**: Digital avatar is a graphical illustration of a user in the digital world. It can be a 2D icon, as we see across social media platforms, or a 3D figure, as we see in games or virtual worlds.
- **Scalable**: It is a feature of a system to increase or decrease in performance and cost in response to the demand.
- **Cryptocurrency**: It is a digital asset and all of its transactions are highly encrypted, making the exchanges highly secure.

Lesson 2

Understanding eXtended Reality

01. OVERVIEW

Recap the previous lesson. In this lesson, the students will learn about technologies under XR with relevant examples.

In the previous lesson, the students were introduced to the concept of eXtended Reality (XR), its need and importance, and the exciting idea of a metaverse. Through our 5 sense organs, we experience the real world - a world made of our environment and shaped by science and engineering technology. But what are the technologies that make up this new reality? And what allows us to experience it?

While defining XR in the last lesson, the students learnt that it is essentially an umbrella term for all the technologies - Augmented Reality (AR), Virtual Reality (VR), and Mixed Reality (MR) - which allow us to extend our real world. Here, we will take a look at these three technologies, one by one. We will also discuss the various tools which can empower us to interact with these technologies.

Slide 02

1.1. LEARNING OBJECTIVES

By the end of this lesson, students will be able to:

- Understand augmented, virtual, and mixed realities
- Differentiate between 3 types of XRs
- Identify common XR hardware devices
- Identify common XR software devices

1.2. PRIOR KNOWLEDGE

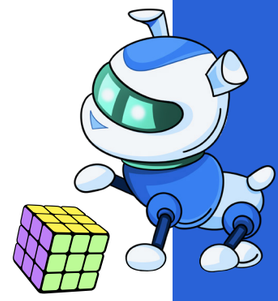
Students should already know:

- The concept of XR
- How to interact with digital devices - computers, smartphones, tablets, etc.
- What is hardware and software

02. AUGMENTED REALITY

Slide 03

ACTIVITY: WORLD IN MY PHONE



This activity provides an AR experience to the students. Encourage them to search for things that interest them.

DURATION: 10 MIN

Now you can use Google Search to place 3D digital objects right in your own space directly from search or from websites on Chrome. Learn more about everything from NASA's Curiosity Rover to human anatomy to animals like hedgehogs, penguins, and sharks.

1. On your Android phone, go to google.com or open the Google app
2. Search for an animal, object, or place
3. If a 3D result is available, tap 'View in 3D'
4. To interact with the 3D result in AR, tap 'View in your space'
5. Follow the on-screen instructions
6. Here are some other things you can search for - Lion, Curiosity Rover, nervous system, Gateway of India

Slide 04

Augmented Reality (AR) overlays digital content and information on our physical world - as if it is actually there with you, in your space. It opens up new ways for our digital devices to assist us throughout the day by letting us experience digital content in a similar way we experience the world. We can now search for things visually, simply by pointing our cameras at them. AR can put answers to your questions in front of you by displaying visual and immersive content on top of your real world.

Ask students if they have played the AR game Pokémon Go. What did they like most about that game? Then, play the video.

Watch this video about the sensational game Pokemon Go as an example of !

ACTIVITY

Slide 05

Some of the common examples of AR around us are:

Snapchat and Instagram: These and similar other social media platforms are full of trendy and catchy image filters which use AR to be overlayed on our images. Watch this video of AR filters created on Snapchat for an SBI campaign.
Ask the students if they have ever used image filters on social media platforms. Which one is their favourite filter?

Google Maps: Google Maps AR or Live View is designed to let you use augmented reality to help you navigate when walking. Watch this video to understand more about Google Maps AR.
Ask the students if they use Google Maps for navigation. Do they use it in their own city or only when they go to a new place? How is it helpful?

Online Conference and Meetings: Various filters and virtual backgrounds can use AR to change our appearance and make it appear that people are at the beach, a famous landmark, or even outer space. Look at this video to understand how Zoom does it.
Ask the students if they use virtual backgrounds during online classes. Which one do they like? What was the use of the virtual background?

Sports: AR is being used in sports for a better understanding and clear analysis. Watch how cricket has already been using this technology.

Slide 06

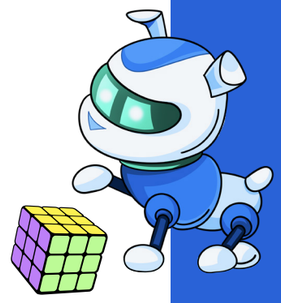
03. VIRTUAL REALITY

ACTIVITY:
VIRTUAL HORROR!!!

This activity provides a VR experience to the students. Ask the students to navigate around the video by using the mouse or sliding their finger across the device screen.

DURATION: 5 MIN

Do you believe in ghosts? Are you ready to get spooked? Here is your part to become a part of paranormal mischief, in a virtual reality. Prepare to get scared, but don't be afraid, because it is only virtual.



As you watch the video, navigate yourself. Look around, try to walk by zooming in and out, and have fun inside this haunted mansion!

Slide 07

Virtual Reality (VR) is the use of computer technology to create a completely simulated environment which can be explored in 360 degrees. Unlike traditional interfaces, VR places the user inside the virtual environment to give an immersive experience. We can tour various places and experience changing viewpoints and perspectives through the means of different controls

This is a repository of many interesting VR videos which students can watch whenever convenient.

You can access numerous immersive VR videos here.

ACTIVITY

Slide 08

Ask the students to navigate around the video by using the mouse or sliding their finger across the device screen.

Some of the common examples of VR around us are:

Marketing: In 2016, Oreo ran a fun VR marketing campaign that transported viewers into the magical land of milk rivers and filled cupcake-flavored Oreo biscuits.

Gaming: VR is already transforming gaming by providing players with an immersive experience which takes them inside the game universe.

Travel: We can travel almost anywhere in the virtual world. You don't need a ticket but only an internet connection and a mobile phone, a computer, or a headset.

Slide 09

04. MIXED REALITY

Mixed Reality (MR) merges the real world and digital elements, so that you are able to interact with both worlds. In MR, you interact with both physical and virtual items and environments, using advanced sensors and technologies. It provides the ability to have one foot (or hand) in the real world and the other in an imaginary place, offering an experience that can change the way you game and work today.

Here is an example to make you more familiar with the idea of MR

Watch this video about Microsoft's mixed reality HoloLens and how it is expanding the Windows ecosystem far beyond the PC.

Summarize the above 3 technologies with the help of the below graphic.

The below graphic summarizes the three technologies which allow us to extend our realities.

VR	VIRTUAL REALITY	AR	AUGMENTED REALITY	VR	MIXED REALITY
Fully artificial environment 		Virtual objects overlaid on real-world environment 		Virtual environment combined with real world 	
Full immersion in virtual environment 		The real world enhanced with digital objects 		Interact with both the real world and the virutal environment 	

Slide 10

05. TOOLS

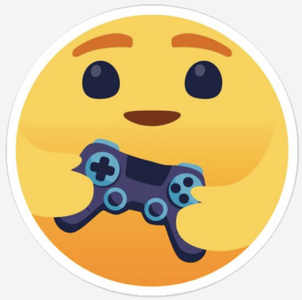
Now that we understand what AR, VR, and MR are, let us take a look at the tools to use these exciting technologies. But before we do that, let's play an exciting game!

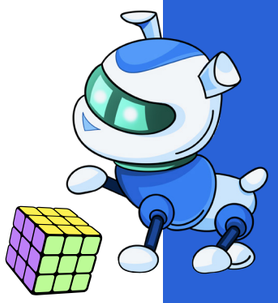
ACTIVITY

EMOJI SCAVENGER HUNT

This activity lets students interact with Computer Vision - an important technology used in extended reality.

This is a game based on Computer Vision where the machine initiates the game by showing an emoji. The participant is expected to show a similar object in front of the camera while the machine keeps on guessing what is being shown to it. This game is best experienced on a mobile phone.





Start playing the game!

Sophisticated XR requires advanced hardware and software - we need hardware to simulate, track, measure and map our environment, and we need software to allow our devices to understand the incoming data and to display it properly.

ACTIVITY

Slide 11

5.1. HARDWARE

- **Display**: Various technologies are used to display XR. It includes projectors, monitors/computers, handheld devices such as smartphones and tablets. Another way to realistically display the virtual world in 3D is using Head-Mounted Displays (HMD), worn on the head as glasses or as a part of a helmet. Here are some of the popular HMDs:
- **Cameras**: Cameras act as an interface between the physical world and the virtual elements, in AR and MR. 360-degree cameras are used to record videos for an immersive experience in VR.
- **Motion trackers**: These devices are used to track the movements of our head, eyes, hands, and the rest of the body, which is then converted into a similar movement in the virtual world. They include optical sensors, handheld remotes, gloves, wands, and other body wear.

Watch this video to understand how motion trackers work.

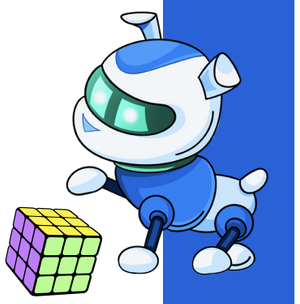
Slide 12

5.2. SOFTWARE

- **3D Modeling and Graphics Designing**: 3D modeling and design software are used for creating visualisation and interactive content. We can use these tools to create models, animations, and effects for the virtual world.

- **Computer Vision**: The emoji scavenger hunt game we played at the beginning of this section is based on Computer Vision technology. This piece of software allows our digital devices to see and make sense of images and videos. This is how social media platforms recognise your friends through photo tags, and how you can get yourself a flower crown by using image filters.
- **Software Development Kits**: Think about putting together a model car or plane. When constructing this model, a whole kit of items is needed, including the kit pieces themselves, the tools needed to put them together, assembly instructions, and so forth. A software development kit functions in much the same way, providing a set of tools and guides that allow us to create software applications for specific hardware.
- **Computer Programming**: Different computer programming languages can be used to write the software. C#, C/C++, and Java are the most popular programming languages among XR developers.

Slide 13-15



ACTIVITY

ACTIVITY
THROUGH THE EYES OF COMPUTER

This activity provides an understanding of how machines see the images by encoding them into numbers. The students may perform this activity in pairs. You may choose the same 5 images to be used by every group for the activity.

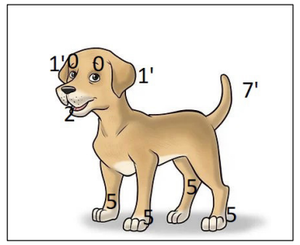
DURATION: 30 MIN

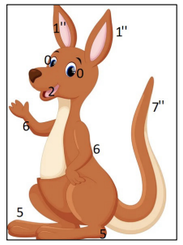
Do you know how computers see images? Let's do this simple activity to understand how computers convert images to numbers and see our real world!

Encoding key:

A. Eye - 0
B. Short Ear/Long Ear - 1'/1''
C. Mouth - 2
D. Short Beak/Long Beak - 3'/3''
E. Wing - 4
F. Leg - 5
G. Arm - 6
H. Short Tail/Long Tail - 7'/7''
I. Sting - 8
J. Gills - 9

You can use the encoding key to convert images into a set of numbers. See an example given below:





This image of a dog can also be represented by the code - 1'001'27'5555.

The image of a kangaroo can be represented by the code - 1''1''0027''6655.

Steps to do the activity:

1. Choose a partner to perform the activity with you. One partner will become A and the other will be B.
2. Choose 5 images - one each of an animal, a bird, a fish, a reptile, and an insect.
3. Partner A will:
   a. Label images randomly as Image (i), Image (ii), Image (iii), Image (iv), Image(v)
   b. Encode them into numbers using the encoding key
   c. Share the codes for 5 images with partner B
4. Partner B will:
   a. Decode the codes received from partner A using the encoding key
   b. Try to identify which photo from Image (i) to Image (v) is of an animal, a bird, a fish, a reptile, and an insect
   c. Write your answers on a piece of paper
5. The team with the most correct answers wins!

In a similar way, our computers also convert the images and videos into codes containing numbers to see and understand our world!

NOTES

GLOSSARY

- **Overlay**: To lay or place (one thing) over or upon another.
- **Immersive**: It provides complete absorption in something.
- **Simulation**: Using a computer to create a replica of something.
- **Sensor**: It is used by a computer to interact with the real world - to measure temperature, gauge distance, detect smoke, regulate pressure, etc.
- **Hardware**: It includes the physical part of a digital device.
- **Software**: It is a set of instructions which allow a computer to perform certain tasks.

Lesson 3

Experience XR

Slide 02

01. OVERVIEW

Get the students excited by sharing an overview of a few XR applications from this chapter.

By now, the students should be familiar with the concept of extended reality. In the last lesson, they were taught about Augmented Reality (AR), Virtual Reality (VR), and Mixed Reality (MR), and a few examples of each of these. We will use this lesson to try our hands on some applications to understand how to interact with eXtended Reality (XR).

1.1. LEARNING OBJECTIVES

At the end of this unit, students will:

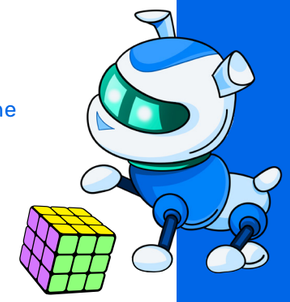
- Learn about XR Devices
- Understand the Do's and Don'ts of XR
- Use XR applications
- Be a part of an immersive metaverse

Slide 03,04

02. XR DEVICES

ACTIVITY

3D PHOTOS



This activity provides a 3D experience of the photographs. Please ensure that the students do not strain their eyes while trying out the stereograms.

Have you ever come across photos which reveal themselves when your eyes are unfocused? Well, there is nothing in the photo that changes over time. Stereograms allow you to see a three-dimensional shape while looking at a two-dimensional image. Take a look at the image below:

3D Object Array Stereogram

3000 x 2400 pixels
10" x 8" @ 300ppi

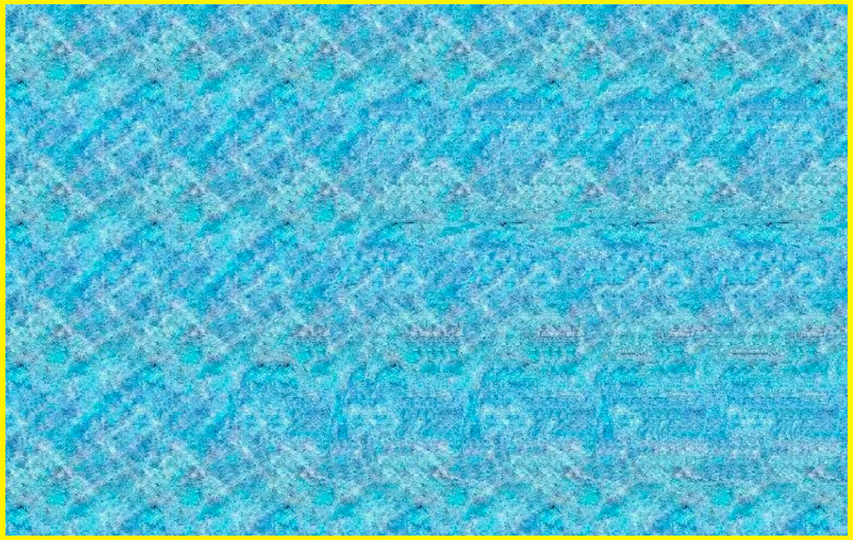
The hidden image

If you hold the image close to your eyes and keep your eyes unfocused, the rows should appear at three different depths. This type of stereogram is made simply by repeating images of different widths and it converts your 2D phone to a 3D device (with a little help of our eyes and brains).

ACTIVITY

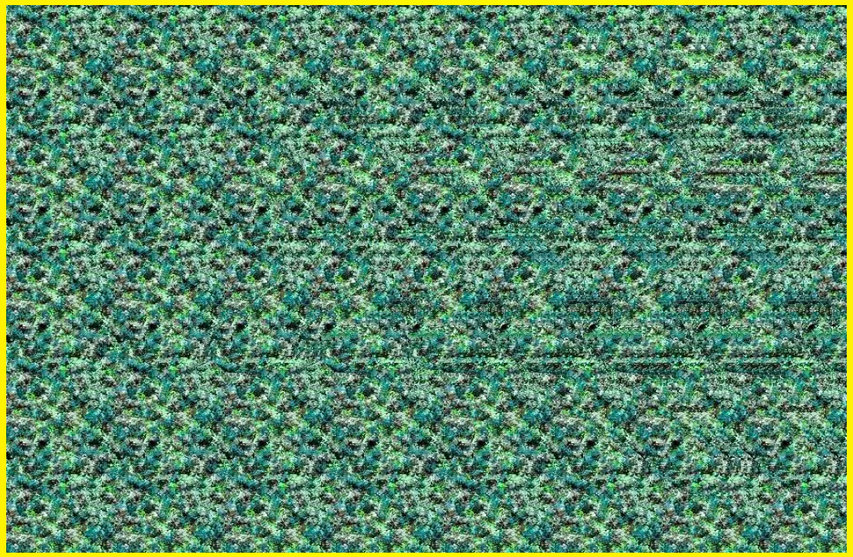
ACTIVITY

Here are a few more stereograms! Try them out but make sure to not strain your eyes a lot.



Did you see a tricycle?

Move your head slightly to see the 3D image.



How about this?

It's an aeroplane!

Slide 05-07

There are multiple devices present in the market for using XR applications. Whereas VR is mainly being used with headsets, AR, and MR are being tested everywhere you can imagine from phones to **wearables**, and even on projectors. Let's take a look at some popular means of accessing XR.

- **HTC Vive**
  - Tethered to a computer
  - Excellent room tracking
  - Ideal for large scale experience
- **Oculus Rift**
  - Built-in sound
  - Room tracking and hand controllers
  - Sleek comfort
- **Google Cardboard**
  - Affordable and easy to use
  - Hand-held with limited interaction
  - Ideal for 3-5 minutes long experiences
- **Microsoft Hololens**
  - Untethered and powerful
  - Cameras and sensors in the headset track your position in space as you move around digital objects
  - Hailed to be the future of computing
  - Ideal for AR and MR applications
- **Mobile AR**
  - Highly accessible
  - 3D virtual worlds at our fingertips
  - Ideal for product demos, sales & marketing, education, and tourism

Some other popular devices are Google Daydream View, Google Lens, and Samsung Gear VR.

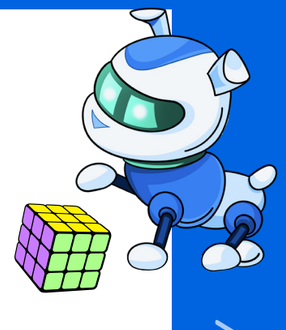
Ask the students if they have ever used any of the above mentioned or any other headsets. Where did they use it? How was their experience?

Slide 08

03. GETTING STARTED WITH XR APPLICATIONS

With so many exciting XR applications, let us try our hands on a few of the AR and VR applications which allow us to interact with the extended reality.

3.1. AUGMENTED REALITY



ACTIVITY

REFLECTION

What is Augmented Reality?

Ask the students to recall the meaning of Augmented Reality from the last lesson.

Answer: Augmented Reality (AR) overlays digital content and information on our physical world - as if it is actually there in the space around us.

AR starts with a device equipped with a camera - a smartphone, a tablet, or smart glasses - loaded with AR software. When a user points the device camera at an object, the software recognizes the object through the Computer Vision technology, and the device starts displaying the digital content.

Slide 09

Experience 1

For instance, this web-based AR experience makes a Charlie Chaplin poster come to life.

1. Go to www.onirix.com/try-webar-experience-marker/
2. Scan the given QR code through your smartphone. You can also use the link given above to use the AR application.
3. Point your device camera to the poster and see it come to life! t

Experience 2

You can also try out the virtual face masks introduced by Kellogg's in one of their marketing campaigns.

Search for Kelloggs CocoPops Adventures
on your smartphone and select Coco's face masks!
Click on your photos and share with your friends!

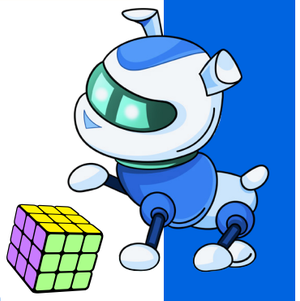
Experience 3

In another fascinating AR experience, Nestle KitKat came out with an AR experience for their Ocean Salt flavour. Users would enter into a deep-sea adventure transporting them deep beneath the ocean surface. By collecting and removing plastic waste, they would learn about the devastating impact this is having on our marine life (the application is in Japanese).

Scan the QR code with your smartphone to join the experience

Slide 10

3.2. VIRTUAL REALITY



ACTIVITY
REFLECTION

What is VR?

Ask the students to recall the meaning of Augmented Reality from the last lesson.

Answer: Virtual Reality, or VR, is the use of computer technology to create a completely simulated environment which can be explored in 360 degrees.

.....
.....
.....

Even though the VR headsets provide a complete immersion and life-like experience, it is possible to experience virtual reality without the funky headsets too - using your smartphones. In VR, the 3D environment is controlled by the user who is experiencing it by moving their devices around, pretty much how they move around to interact with their real world.

ACTIVITY

Slide 11

Ask the students to navigate around the experience by moving around their mobile device.

Experience 1

Visit this virtual world created by Timberland, for Green Stride shoes virtual launch. Here, you can interact with the products and click through the experience to purchase, all in the unique underground setting created virtually.

Experience 2

Have you heard about the Winter Olympics? The General Mills company enabled Canadians to digitally cheer for their Winter Olympics team! Enter this experience to submit digital cheers to inspire athletes, play interactive games, and learn more about Team Canada.

Experience 3

The Taj Mahal is one of the great artistic treasures of the world, an instantly-recognisable emblem of India. It's a mausoleum, or tomb, commissioned in 1632 by Emperor Shah Jahan, one of the greatest Mughal Emperors, to house the body of his wife Mumtaz Mahal. What does the Taj Mahal look like from top?

Scan the QR code and experience.

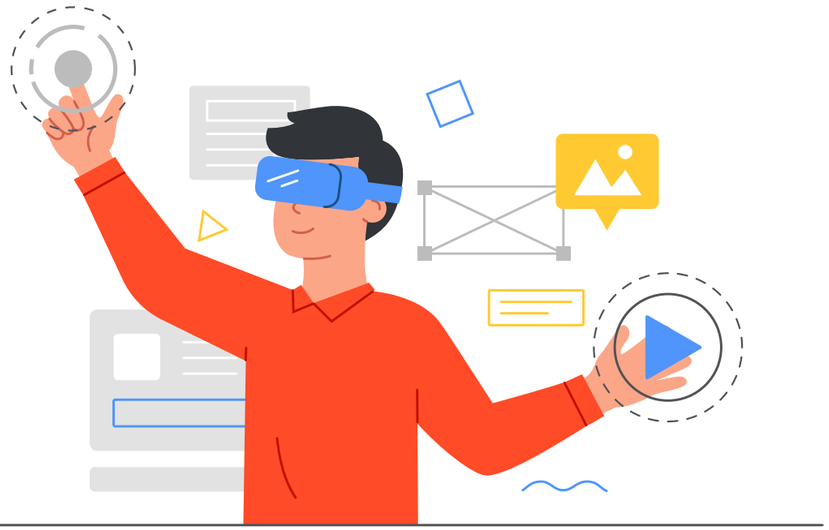
Slide 12

04. CONCERNS OF USING XR

Teacher's Note: Have a classroom discussion around students' understanding of the concerns of using XR, before proceeding further.

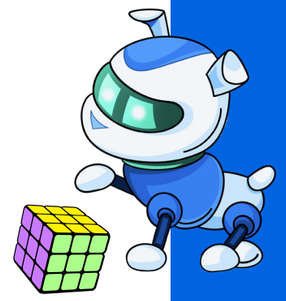
The number of users for XR technology increases day by day. But the rapid rise of these technologies has also left some users wondering what are the privacy, security, and safety concerns they raise. Let us spend some time discussing the dangers they could pose.

4.1. SAFETY AND HEALTH ISSUES



- Read and follow all the instructions provided with the device
- Always use an XR device under adult supervision
- Do not use XR when you are tired, need sleep, under emotional stress, or anxiety, or when suffering from any sickness
- Avoid prolonged usage of XR as this could negatively impact hand-eye coordination, balance, and multi-tasking ability
- Use only in a safe environment
- Immediately discontinue using the headset if you experience any discomfort
- It may be addictive
- It may lead to a loss of human connection

Slide 13



ACTIVITY

ACTIVITY
RIGHT OR WRONG

Put a tick mark against the correct usage of a headset and put a cross for incorrect usage.

1. I should not use sharp or dangerous objects while using XR. _____
2. I can use XR while walking or cycling. _____
3. I can use XR even when I feel discomfort in my eyes. _____
4. I should not use a broken or damaged headset _____
5. I should always listen to the audio on the maximum volume when using XR applications. _____

Answers

1. ✓
2. x
3. x
4. ✓
5. x

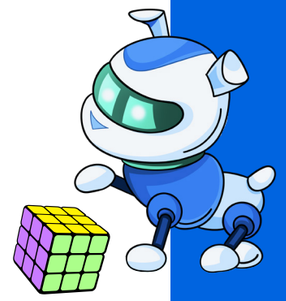
Slide 14

4.2. SECURITY AND PRIVACY ISSUES

Here are some points to keep in mind with respect to security and privacy while engaging with XR.

- XR systems are prone to **cyber attacks** and hacking
- The content on XR applications might not always be reliable
- Our personal data such as our photos and our location can be misused
- Our privacy may be compromised by devices equipped with cameras and microphones
- Online bullying can affect users psychologically
- Fake identities and identity theft may become increasingly common in the virtual world
- Users may come across unwanted and age-inappropriate experiences

Slide 15



ACTIVITY

RIGHT OR WRONG

Put a tick mark against the correct usage of a headset and put a cross for incorrect usage.

1. I can casually share my photos in virtual reality. _____
2. I should only allow location access to my devices when I am using the app. _____
3. I can ignore the age limits applied in various XR applications. _____
4. I may bully other people in the virtual world. _____
5. I should not trust a person in the virtual world till I have verified their identity. _____

Answers

1. wrong
2. right
3. wrong
4. wrong
5. right

ACTIVITY

Slide 16

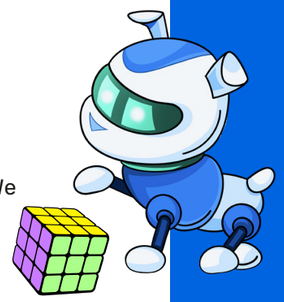
05. IMMERSIVE XR EXPERIENCES

ACTIVITY

MY FAVOURITE PLACE! CREATE YOUR FAVOURITE PLACE WITH AUGMENTED REALITY

This activity gives a chance to create an AR setup.

It's been about 2 years since COVID-19 and everything around us has changed. We all have adapted to working from home.



KEY QUESTIONS

The following questions do not have a particular right answer. Please encourage students to share answers based on their own experience. Sample answers are provided for your reference.

How much do you miss going on a vacation?

Answer: I really miss going on a vacation with my parents and seeing new and interesting places!

What is your favourite place in the world?

Answer: My favourite place in the world is a forest!

How about you make your own home your favourite place?

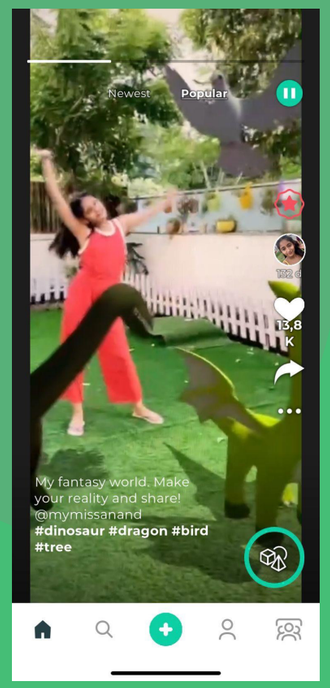
Answer: I wish I could create a forest in my home quickly!

Go ahead and try making a hashtag "#myfavouriteplace" on 3DBear. (You can download this app on your phone, scan the QR code below)

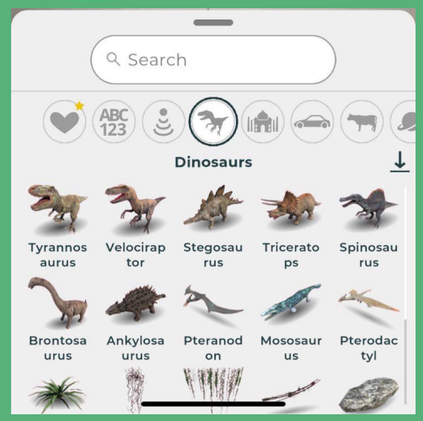
ACTIVITY

Let's take you through the steps to make it happen.

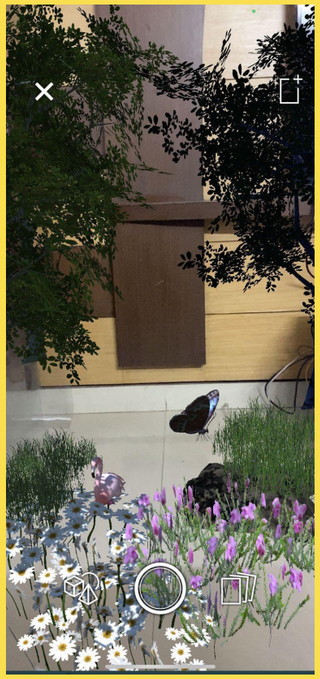
Step 1: Here's an example of how a user made her garden a favourite place with her pets.



Step 2: You can add any objects, emoticons, and figures to create your own space the way you like it through AR. You can observe and learn how AR can help see how you visualise a space augment reality through 3D images.

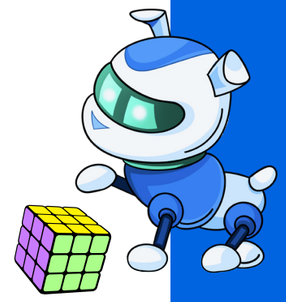


Here is another example of how a living room was made into #myfavouriteplace



Now go ahead and make your favourite place the way you like it, creating an environment and adding different objects, animals, pets, characters, monuments etc.

You can also register and create a username to upload your completed design to share for everyone to see and create your own hashtag.



Slide 17

ACTIVITY
ENTER THE METAVERSE

This activity provides an immersive metaverse experience.

What is Metaverse?

Ask the students to recall the meaning of AR from the last lesson.
Answer: A metaverse is a virtual environment where users can interact with each other in a digital space, similar to the real world.

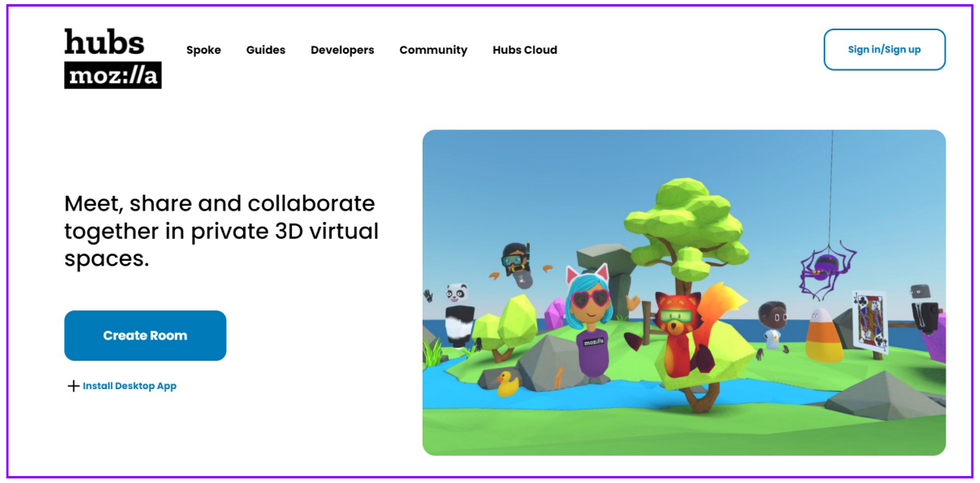
Slide 18

Are you excited to enter your first metaverse with your friends? In this activity, we invite you to immerse yourself in a virtual world, talk to your friends, roam around, click photos, chat, and have fun!

Request your students to be respectful of their own selves and their peers.

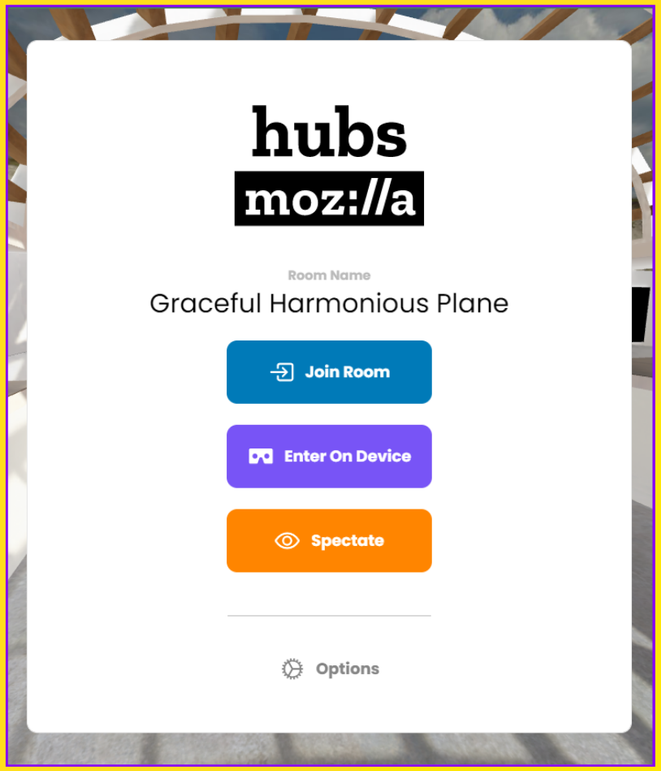
Bonus - Sign up to get access to more interesting features.

1. Search for Mozilla Hubs to get started

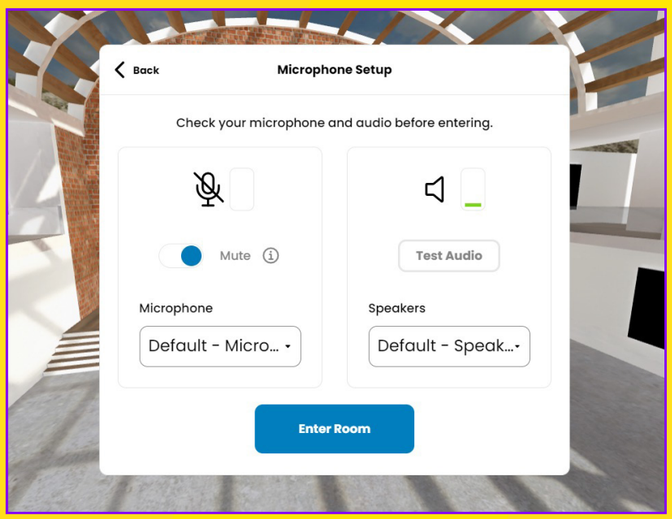


ACTIVITY

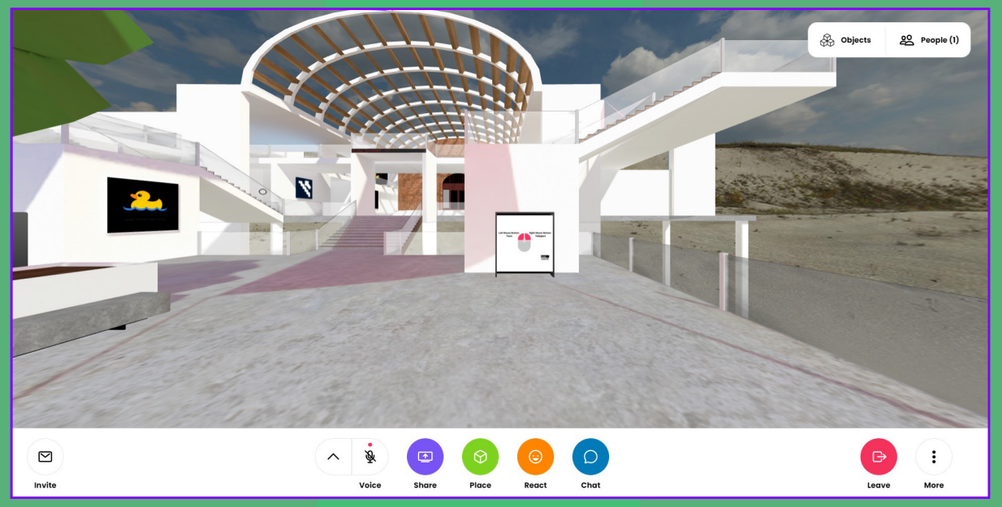
2. Click on ‘**Create Room**’.



3. Click on ‘**Join Room**’.



4. Click ‘**Enter Room**’ and start exploring!



5. You can invite your friends to your virtual room by clicking on the ‘**Invite**’ option at the bottom left corner on your screen and sharing the link that appears.

6.You can build things, watch videos together, and enjoy!

NOTES

GLOSSARY

- **Wearables**: They are a type of electronic device that can be worn on the human body.
- **Tethering**: Connect to another device with the help of a wire.
- **Cyber attacks**: It is an attempt to gain unauthorised access to a digital device with the intent to cause damage.

Lesson 4

XR Applications

Slide 02

01. OVERVIEW

The last lesson would have given the students their first experience of using XR technologies. In recent years, the use of XR has increased tremendously, with the onset of advanced computers, fast internet, and big datasets. In this section, we will explore and identify different ways of using XR in our day-to-day activities.

1.1. LEARNING OBJECTIVES

At the end of this unit, students will:

- Identify applications of XR in daily life
- Appreciate the benefits of using XR applications and challenges in implementing them
- Identify XR in various sectors with its improvements and challenges that come along with it
- Look at XR use cases in different sectors
- Ideate cases of XR in metaverse

Slide 03

02. XR AROUND US

This activity encourages identification of existing XR use cases and their benefits. The activity may be done in pairs or in groups.

Gone are the days when we had only one world to live in and only the things around us to experience! Today, we can participate in exciting alternate realities and interact with digital objects. We keep seeing exciting uses of XR around us in our daily life.

ACTIVITY: XR IN DAILY LIFE

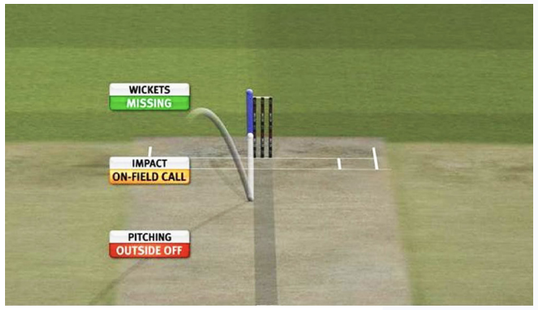
DURATION: 30 MIN

Can you identify 5 such use cases where we use AR, VR, or MR and become a part of the digital world out there? Think about movies, sports, shopping, driving, and anywhere else you might have seen XR being used. Mention the use cases and at least one benefit of each use case to complete the activity.

Two examples have been given for your understanding.

Example 1 – Ball Tracking in Cricket Match.

Benefit - Helps on-field umpires to take correct LBW decisions.



Example 2 - Virtual Car Showrooms.

Benefit - Helps buyers to look at cars without having to visit the showroom.

ACTIVITY

1. **Use and Benefit**

Use - Virtual Flight simulators
Benefit - Helps trainee pilots to hone their skills before flying a real aircraft

2. **Use and Benefit**

Use - Head-up display in cars
Benefit - Helps car drivers by displaying useful information in front of them

3. **Use and Benefit**

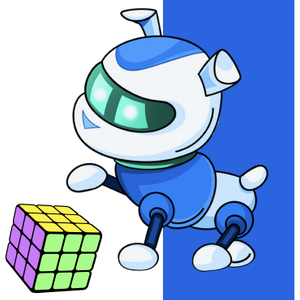
Use - Virtual backgrounds and filters in online meetings
Benefit - Help users protect their privacy

4. **Use and Benefit**

Use - Virtual gaming environments
Benefit - Help players by providing an immersive gaming environment

5. **Use and Benefit**

Use - Augmented furniture trial
Benefit - Helps the buyer experience furniture in their own surroundings before making a purchaset



ACTIVITY

Slide 04

Ask students any technology that they are fond of. Ask them to list its benefits and challenges.

03. XR APPLICATIONS - BENEFITS AND CHALLENGES

In the previous activity, you came up with at least 5 benefits provided by XR. Because of such usefulness, XR has gained a lot of popularity in recent times. It is being adopted by all kinds of businesses, and is receiving appreciation by their customers alike. But, as with any new technology, there could be some potential challenges in implementing XR. Some relate to the technology itself; others relate to its accessibility. Let's take a look.

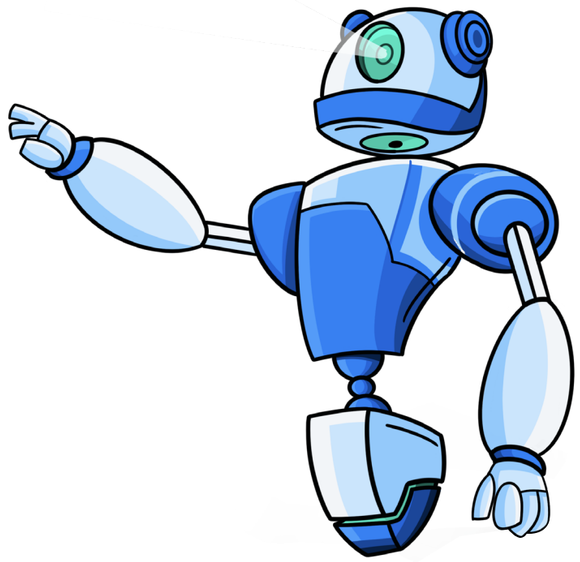
3.1 BENEFITS

- **Knowledge retention**: XR helps to remember and retain the experience better as it gives scope for practice and trial.
- **Higher engagement:** With no external distractions, it helps the users stay focused and get an engaging experience.
- **Reduces travel and training costs**: XR provides the flexibility to engage with the world from anywhere and wherever necessary.
- **Immersive experience:** The overall usage of XR allows to have an immersive experience
- **Create an emotional connection:** XR can evoke a true-to-life sense of a range of emotions ranging from empathy, gratitude, and joy to pressure, anxiety, and awkwardness.
- **Overcome physical constraints:** It also helps move past what is physically possible. It allows us to revisit the past or imagine the future in a more impactful and real way.
- **Communicates relevant information conveniently:** It can display in a more intuitive and easy to understand manner.
- **Reveals the invisible:**- XR can help bring the hidden information in our world to the surface - from the network of pipes running under our cities to the veins in our bodies.
- **Perform hands-free**: The ability to interact with XR technologies without using our hands leads to an increase in productivity of the users.

Slide 05

3.2 CHALLENGES

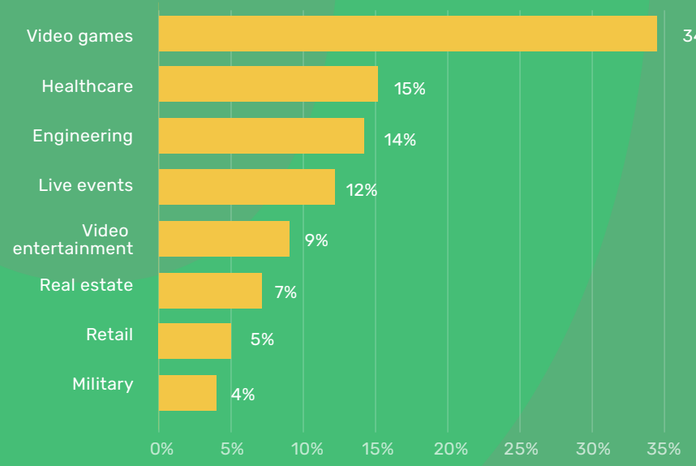
- **Limited user-experience:** Most of the common digital devices are unable to provide full-**fledged** AR/VR experiences. Users need powerful and advanced devices to get the full ‘flavor’ of XR technologies.
- **Aesthetics and comfort:** The **aesthetics** of any device is very important for its adoption. Currently, most XR devices are very heavy and bulky.
- **Digital fatigue:** A lot of users are getting wary of spending too much time interacting with their digital devices, with laptops and mobile phones having become an important part of our lives.
- **High price of developing new technology:** Still in its infancy, access to most XR technologies is still very costly.
- **Issue of miniaturization:** Everyone wants to use a fully functional XR headset just like an everyday eyeglass, but this has proved hard to achieve till now.
- **Technology and skill gaps:** A lot of business owners, engineers, and users have cited a lack of knowledge about using XR. This has kept them away from openly accepting the new realities.



Slide 06-07

04. SECTOR-WISE DEMONSTRATION OF XR APPLICATIONS

Numerous organizations from the gaming industry, healthcare, engineering, entertainment industry, real estate, retail, and military forces around the world are already making the most of XR. Let’s explore some examples of successful XR use cases.



Gaming Sector: Video games are the main consumers of XR technology as it provides the companies the ability to provide a full-fledged immersive experience. It offers the players a life-like, rich, and captivating 3D experience.
Take a look at India’s first VR free-roaming gaming experience.

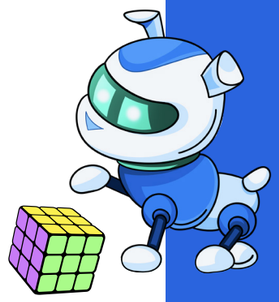
Entertainment: Events such as concerts, exhibitions, and sports events are also thriving on AR, VR, and MR. Now, you don’t need to hustle in overcrowded stadiums or museums, but can experience the World Cup final or visit the worldwide tourist attractions sitting at your home. Watch this immersive cricket match experience between India and Pakistan or see a painting come to life at The National Museum in Krakow.

Real Estate: XR allows potential customers to get information about vacant accommodations or view properties without having to physically be there. It can also help with architecture and interior designing.
Here is a concept video of what future of real estate might look like with XR.
Take a look at how we can explore various interior designs using VR.

Healthcare: XR enables 3D representation of human bodies instead of the traditional 2D images, which improves the efficiency of diagnosing. This technology also provides opportunities for virtual surgeries to medical students for their training.
SentiAR's technology provides physicians with a real-time, interactive, 360-degree view of the treatment they're delivering. By using augmented reality, AccuVein company uses a handheld scanner that projects over the skin and shows nurses and doctors where veins are in the patients' bodies.

Education: XR is making the toys and books in our schools more interactive to aid the learning. The possibilities here are boundless!
See this interactive globe which takes you on a global journey.
This is a video of a virtual reality class for pilots.
Elements 4D app makes learning chemistry more fun.

Slide 8-9



ACTIVITY
BUILD YOUR OWN CITY!

This activity provides an experience of building a virtual world. The students will also be encouraged to think of sector-wise XR use cases for their virtual world.

DURATION: 30 MIN

Have you ever wanted to build your own metropolis? How many hospitals and police stations will you build, and where will you locate the residential apartments and offices?

Well, it's time that we stop thinking about it and start building it! Let's play a quick game which offers you a chance to build your own city.

Go ahead and create your dream city with forests, sports stadiums, lakes, golf courses, supermarkets, fire stations, spaceports, and more!

Once your city is ready, we need to find ways to explore this city. Imagine how XR technology can assist you in interacting with this city. Can you play golf virtually, or would you like to learn how to fly a spacecraft using MR?

Choose 5 different places that you have built in your city, and come up with new and exciting use cases of XR for each of these places! A couple of examples have been given for your understanding.

Place	XR use case
Sports stadium	Watching sports matches in the stadium using VR.
Movie Theater	Watching movies in a virtual theater.
1. Supermarket	Buying groceries and other products from the supermarket.
2. Hospital	Consulting doctors virtually in the hospital.
3. Museums	Take a virtual tour of the museum.
4. Forest	Explore the flora and fauna in the forest.
5. Spaceport	Learn how to build a space rocket.

Bonus: Go on to complete the challenge by meeting the goals set for your chosen city and share with your friends!

Did You Know?

More than 10 million VR devices are set to be in the world by the year 2022.

NOTES

GLOSSARY

- **Full-fledged**: Something which is completely developed.
- **Aesthetics**: It refers to the way a product looks and feels.

Lesson 5

XR for Social Good

Slide 02

01. OVERVIEW

Ask the students about any pressing social problem in today's world according to them? How can these problems be solved? What role can technology play in the solution? Can technology also be harmful if used maliciously?
As the students have learned so far, the fact remains that the world is embracing XR as a power technology with all the benefits it brings to various sectors. As a part of the experience, empathy and social perspectives have become essential elements. It is important to understand XR in terms of ethical aspects, and efficiency. The applications must be designed in such a way that it does not hinder our human abilities.

In this lesson, the students will learn the positive and negative outcomes of XR and how to ensure that it brings out the best in the world around us, as it becomes an integral part of our daily lives.

1.1. Learning Objectives

t the end of this unit, the student will:

- Learn about ethics in XR
- Learn how to use XR to overcome social and developmental challenges
- Learn about SDGs and how to use XR to meet the goals

Slide 03

02. ETHICS IN XR

Have a discussion with the students about their understanding of ethics before sharing what it means.

What are Ethics?

Ethics deals with the way things ought to be - it deals with what is good and bad. Understanding ethics can help people decide what to do when they have choices.

The enthusiasm for XR and its technology has rapidly increased along with its application and affordability. Both the users and the developers consider XR an efficient medium to deliver a powerful and immersive experience. However, just like anything else in our world, XR comes with its own ethical dilemmas. These ethical questions can be categorised as below.

Slide 04 - 05

These ethical questions can be categorised as below.

Have a small classroom discussion around each of these questions.

Morality

- How to create age-appropriate experiences?
- How to represent culture inclusively?
- How true are the virtual experiences?

Mentality

- What kind of an impact does XR have on the state of mind of the users?
- How does XR affect the world understanding of users?
- How to deal with any trauma inflicted in the virtual world?

Responsibility

- How do we punish the wrong doings in the virtual world?
- Who decides the laws and regulations for XR users?
- Whose responsibility is it to safeguard individual users against organisations?

Human Rights

- How do we ensure users' privacy?
- How do we ensure users' security?
- How do we guarantee data protection?
- Will XR create inequalities in a society?

The above questions do not necessarily have a right answer. Thus, it becomes important to have an analytical lens while creating XR applications and using them so that it supports a flourishing society in an inclusive manner.

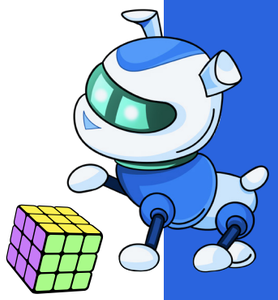
Accept all answers

Slide 06

THINK!

Ethical XR design should honour a user's time as a valuable resource; it should be respected the way privacy and other digital rights are protected

Harris, T. (2016). How Technology Hijacks People's Minds—From a Magician and Google's Design Ethicist. San Francisco: Medium Magazine.



ACTIVITY

Slide 07

ACTIVITY: YES, NO, MAYBE !?

DURATION: 10 MIN

It is important to reinforce that ethical questions do not have right or wrong answers. You are most welcome to formulate your answers to these questions before taking them up in your class.

Listed below are situations for which you should think with an ethical lens and decide if the respective statements can be agreed with a 'Yes', disagreed with a 'No' or a 'Maybe' for more thought and discussion.

Accept all Answers

1. **Can XR replace teachers in your classrooms with virtual avatars?**

   Yes, No, Maybe? _____ Why?

2. **Can a poor person and a rich person benefit from XR in the same way?**

   Yes, No, Maybe? _____ Why?

3. **Should a person be punished in real life if they commit a crime in the virtual world?**

   Yes, No, Maybe? _____ Why?

4. **Should governments and organisations depict the pressing social issues in the virtual world? Yes, No, Maybe? _____ Why?**

5. **In a virtual world, should a 12-year-old child be allowed to enter a place reserved for people 18 years or above?**

   Yes, No, Maybe? _____ Why?

Slide 08

03. USING XR TO OVERCOME SOCIAL AND DEVELOPMENTAL CHALLENGES

There are no bounds to how much XR can be utilised and applied in various fields as we learnt earlier. Although XR has its own benefits and challenges, it has been adapting to the new informative age and is being used to help overcome the social and developmental challenges. The growing dependence of augmented and virtual environments is set to extend our collective human cognizance. Almost every sector at some stage depends on technology to mitigate any obstacles that hinder the progress. XR is making its mark for social good. Following are some of the areas where XR is creating wonders.

- Overcoming geographical and technical barriers in the field of education

- Inclusive XR design for accessibility and inclusivity for the specially challenged -

  Microsoft and many other companies have taken initiatives to have inclusive design thinking for XR tools. XR tools are now available to enhance the experience for the visually blind, wheelchair users and for motor rehabilitation.

- XR is transforming the healthcare industry, changing the way doctors provide care to patients from most kinds of therapy, pain management, anatomical visualisation, medical education & awareness, physical fitness and rehabilitation.

Slide 09

THINK!

How interesting would it be for a wheelchair user to be able to experience a football game or a tour through the amazon forest just from where they are.

Watch this cool video that gives us the Mowgli experience as it creates awareness about the endangered species, an initiative by WWF.

Slide 10

04. WHAT ARE SDGS?

Can you guess what SDG stands for?

Answer: Sustainable Development Goals

Sustainable Development Goals (SDGs), also known as the Global Goals, were adopted by the United Nations in 2015 as a universal call to action to end poverty, protect the planet, and ensure that by 2030 all people enjoy peace and prosperity.

Do you know how many SDGs have been formulated?

Answer: 17 goals

They recognize that action in one area will affect outcomes in others, and that development must balance social, economic and environmental sustainability.

Countries have committed to prioritise progress for those who're furthest behind. The SDGs are designed to end poverty, hunger, AIDS, and discrimination against women and girls.

How many countries do you think are a part of this partnership to achieve the goals?

Answer: 193 countries

The creativity, knowhow, technology, and financial resources from all of society is necessary to achieve the SDGs in every context. You will learn more about how XR can help to meet the Sustainable Development Goals.

Slide 11

Project and play the video

Watch this video to learn more about the Sustainable Development Goals and their importance.

Do you think we can achieve them by 2030?

Accept all answers

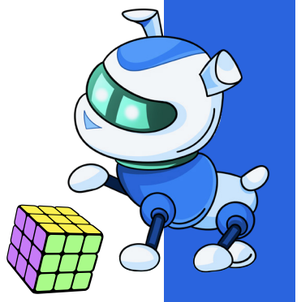
Slide 12

05. USING XR TO MEET THE SDGS

The main agenda for learning about XR is to make sure it ultimately is used for the social good around us. At this stage, it makes it important to see how XR can help achieve the Sustainable Development Goals. SDGs were created to address the challenges in every field and sector and here we see how XR can help overcome these challenges with its benefits and applications.

XR plays an important role in creating awareness, using the XR design to make some innovative solutions, creating opportunities for interactive experiences and more conversation around important concepts, altogether helping in taking steps towards sustainability and development.

You may now have an understanding of what the goals are meant for and how it can make the world a better place.



ACTIVITY

Slide 13

ACTIVITY: XR FOR SDGS

DURATION: 5 MIN

Can you list some SDGs where XR can be applied directly for better reach?

Implore students to discuss how XR can be useful in furthering their chosen goals. Accept all answers

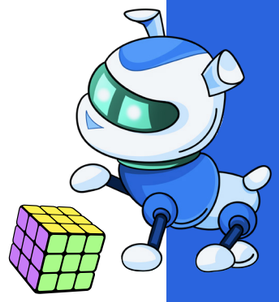
Although we talk about direct impact, XR has its own approach to support each SDG and accelerate its achievements.

For example, SDGs 13 Climate Action, SDG 14 Life Below Water and SDG 15 Life on Land are some great examples of how XR can help create awareness to understand the whole problem and plan interventions accordingly.

Slide 14

At this stage we're sure you are motivated to take some action towards achieving the SDGs through XR. But it is very important to first understand what's happening in the respective area behind the SDG. This video shows how VR can help understand SDGs, create sustainable solutions and achievable goals from the grassroots.

You can learn more about each area of SDG from here.



ACTIVITY

Slide 15

ACTIVITY: ENVISION THE FUTURE OF SDGS WITH XR

DURATION: 10 MIN

Choose 5 of your favourite SDGS and write down new ideas/innovations you can introduce to accelerate the goal.

One has been given as an example for you.

Example – Augmented and Virtual Reality to plan and conceptualize a sustainable cities and communities (SDG 11).

Sample answers are given below for your reference.

1. Goal 3: Good Health and Well-being - Providing health diagnosis using AR.
2. Goal 4: Quality Education - Creating virtual classrooms for learners who do not have access to physical classrooms.
3. Goal 14: Life Below Water - An AR system to experience life below water with marine animals.
4. Goal 9: Industry, Innovation, and Infrastructure - Controlling machines in industries using MR can lead to enhanced performance.
5. Goal 6: Clean Water and Sanitation - Visualising water cleaning process using AR.

Accept all other answers as well

NOTES

GLOSSARY

- **Empathy**: The ability to understand and share the feelings of another.
- **Dilemma**: A situation in which a difficult choice has to be made between two or more alternatives, especially ones that are equally undesirable.
- **Inclusive**: Avoiding usages that could be seen as excluding a particular social group.
- **Data Protection**: The process of keeping data safe from cyber attacks.

ADDITIONAL RESOURCES

1. Website | VR For SDGs, VR4SGDS.Org
2. Website | XR Arcade for SDGs, Gamesforchange.org

Level 1

Bibliography

Lesson 1: Demystifying eXtended Reality

1. Resource | "What Happens On The Internet In A Minute", The Economic Times, 30 November, 2021
2. Video | "Roblox Trailer", Roblox, 9 October 2020
3. Article | "Our Digital World and Big Data: CompTIA's Future of Tech", Futureoftech.org
4. Resource | "The fourth industrial revolution and what it means", World Economic Forum, 14 January 2016
5. Resource | "What Is Extended Reality (XR) and How Is it Changing the Future?, HPTech Takes
6. Resource | "3D Try On", Lenskart
7. Video | "Say Hey to Ikea", Ikea, 12 September 2017
8. Video | "AVEVA XR for training", AVEVA Group , 4 August 2020
9. Video | "Extended Reality Studio: SmartStudio XR", Tateside, 12 March 2021
10. Video | "This Spider-Man VR Game is AMAZING! (Oculus Meta Quest 2)", Nathie, 21 December 2021
11. Video | "Creed: Rise to Glory VR Boxing", NAME-FAN, 30 January 2018
12. Video | "Daler Mehndi | Virtual Experience", Daler Mehndi, 26 January 2022
13. Video | "Ready Player One - Intro scene", JForce 11, 31 July 2018
14. Game | "Real Player Me", Ready Player Me
15. Video | "What is the Fourth Industrial Revolution?", CNBC, 23 Jan 2019
16. Video | "Facebook gives a glimpse of metaverse, its planned virtual reality world", Guardian News, 29 October 2021

Lesson 2: Understanding eXtended Reality

1. Resource | "What is Augmented Reality", Avity Infomedia
2. Video | "Discover Pokémon in the Real World with Pokémon GO!", The Official Pokemon Youtube Channel, 15 September 2015
3. Article | "Significant Applications of Extended Reality (XR) in Future Pandemics", Augray
4. Resource | "How does Augmented Reality work?", Harvard Business Review, November- December 2017
5. Video| "Interactive Paranormal Activity Seance", IGN, 16 December 2015
6. Article | "What is VR?", 1 September 2021
7. Video | "Discover the 360° world that inspired Filled Cupcake Flavored Oreo Cookies", Oreo Cookie , 19 February 2016
8. Video | "[Beat Saber] Light em up- Fall Out Boys", Nab_Iwl, 18 July 2020
9. Video | "360° VR Spacewalk Experience | BBC HOME", Vicinity360, 9 November 2020
10. Resource | "What is Mixed Reality (MR)? | Interaction Design Foundation (IxDF)", Interaction Design Foundation
11. Video | "Infinite Office", Meta Quest, 17 September 2020
12. Video | "Envisioning the Future with Windows Mixed Reality", Windows, 1 June 2016

Lesson 3: Experience XR

1. Resource | "How does Augmented Reality work?", Harvard Business Review, November - December 2017
2. Resource | "Kelloggs CocoPops Adventures", Kelloggs
3. Article | "What Is Virtual Reality: Definitions, Devices, and Examples", Marxent, 29 March 2022
4. Resource | "Timberland", Timberland AR Experience
5. Resource | "Taj Mahal: A Tour from the Top", Google Arts and Culture
6. Resource | "Virtual Reality Health & Safety Usage Guide - ClassVR", ClassVR, 2020
7. Activity Resource | "3DBear", 3D Bear

Lesson 4: XR Applications

1. Article | "What is the Future of XR? Applications and Use Cases - PIXO VR", Pixo, 2020
2. Article | "New book explores business benefits of immersive technology", TechTarget, 21 January 2022
3. Article | "Significant Applications of Extended Reality (XR) in Future Pandemics", Augray
4. Video | "Virtual Reality Gaming Experience In Mumbai", Curly Tales, 16 August 2019
5. Video | "A 360° virtual reality look at one of world sport's greatest rivalries", ICC, 14 June 2017
6. Video | "Augmented Reality (AR) Applications for Museums", CinematicVR , 15 May 2020
7. Video | "The Future of Real Estate AR", LNG Studios, 3 June 2021
8. Resource | "Toy Box Metropolis by Second Dimension Games", Toy Box

Lesson 5: XR for Social Good

1. Article | "Frontiers | The Ethics of Realism in Virtual and Augmented Reality", Frontiers of Virtual Reality, 3 March 2020
2. Video | "Augmented Reality Environmental Campaign by WWF-Armenia and ARLOOPA", Arloopa Augmented Reality, 8 September 2017

ACKNOWLEDGEMENT

Thank you to the teachers and academic advisors who helped with the development of the curriculum.

Name	School
Achint Kaur Sandhu	Manav Rachna International School, Mohali
Anjali Malik	Jaypee Public School, Noida
Anni Kumar	Vikas Bharati Public School, Rohini, Delhi
Avantika Yadav	Jaypee Public School, Noida
Harmeet Kaur	K R Mangalam Global School, Delhi
Naveen Gupta	St Marks Senior Secondary School
Neeru Mittal	SR DAV Public School, Delhi
Neha Sharma	GD Goenka Public School, Ghaziabad
Nidhi Tiwari	Ridge Valley School, Gurugram
Rani Kumari	DLF Public School, Ghaziabad
Seema Jerath	DLF Public School, Ghaziabad
Shelly Batra	Mt Carmel School, Dwarka
Swati Sharma	Heritage Xperiential Learning School, Gurugram
Vineeta Garg	SR DAV Public School, Delhi
Ramya Sriram	Meridian School, Kukatpally, Telangana
Smitha Athreya	Delhi Public School, Rourkela
Uzma Fathima	Delhi Public School, Bangalore North
Bijit Paul	Vivekananda Kendra Vidyalaya, Arunachal Pradesh
Ivan Dorjee Lepcha	Paljor Namgyal Girls' School, Sikkim
Smita Sahu	Shakuntala Vidyalaya, Ramnagar, Chhattisgarh
Ishwar Khakare	Oxford International School, Nanded, Maharashtra
Gayatri Naidu	Delhi Public School, Chhindwara, Maharashtra
Aparna Mathur	Nath Valley School, Aurangabad
Goldy Banerjee	Delhi Public School, Duliajan, Assam
Azhar Uddin	Fatima Leyan Public School, Bareilly
Roshni Sundrani	Dr. Cyrus Poonawalla English Medium School, Uruli Kanchan, Maharashtra
Irene Manning	1M1B
Rhema Joseph	1M1B
Anip Sharma	1M1B

NOTES

NOTES

NOTES

Level 1 | **AR/VR** | Teacher Handbook

Curriculum developed by teachers and academic advisors,
managed by 1M1B and supported by Meta Platforms Inc.