Ideas With
IMPACT

Using Virtual Reality to Teach Climate Change

Project: Using Virtual Reality to Teach Climate Change

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CTE Standard
CTE-TECED.68.CONTEC.03.01
Recognize and analyze the development of the built environment and its impacts on the natural environment such as pollution.

Science Standards
SC.912.L.17.4
Describe changes in ecosystems resulting from seasonal variations, climate change and succession.

SC.912.E.7.9
Cite evidence that the ocean has had a significant influence on climate change by absorbing, storing, moving heat, carbon, and water.

SC.912.L.17.8
Recognize the consequences of the losses of biodiversity due to catastrophic events, climate changes, human activity, and the introduction of invasive, non-native species.

SC.6.E.7.6
Differentiate between weather and climate.

 Social Science Standard
SS.912.G.5.6
Analyze case studies to predict how a change to an environmental factor can affect an ecosystem.

Goals & Objectives

I wanted to have a project that integrated the concept of using technology for good. How can I integrate Virtual Reality and technology to teach concepts about climate change? I thought introducing my students to The Sustainable Development Goals — also known as the SDGs or the Global Goals, would be a good start. The SDGs cover a wide range of sustainability issues; highlighting local, national and international priority areas to end poverty and hunger, improve health and education, make cities more sustainable and combat climate change.

I teach Information Technology and Gaming courses utilizing virtual reality. I wanted to have a specific project that introduced students to climate change that focused on content using VR units. I also had a goal of getting students involved in climate change or other issues integrating technology to make a positive change in the community.

Educators have the ability to guide the positive energy of learners to make change possible. When learners are empowered with knowledge, critical reflection tools and media literacy. Educators can nurture students' curiosity and provide them with the technology tools and resources to inquire, understand, engage and communicate the importance of sustainability.

Objectives
- Students will learn about seal level rise and how it impacts in their local community.

- Students will learn how to use virtual reality devices to infer climate change consequences around the world.

- Students will learn how to gather information to take action in a sustainable global goal relating to climate change

- Students will learn how to teach and mentor others using virtual reality and climate change resources.

- Students will be able to use this lesson for service learning and advocacy

Students will have an opportunity to learn about What Virtual Reality is and learn about sea level rise using This Is Climate Change (A Virtual Reality Series). I use the Oculus Quest and Google Cardboard for the project. This is Climate Change is a virtual reality docu-series. Students can go on four journeys across the globe to be fully immersed in the direct impact of climate change: Famine, Feast, Melting Ice and Fire. Each short film takes a look at a key topic—deforestation, global warming, wildfires and famine. Al Gore, American politician and environmentalist, provides the voiceover for the "Melting Ice" film as you observe the melting glaciers and the impact this has on the environment all over the globe. It is a raw and harrowing set of films that educate and shock in equal measure.

Students will be given a brief overview of what Virtual Reality is? Using resources and videos, students will be given an introduction to sea level rise. The goal is to give students an awareness of the impact of climate change in their own city using virtual reality.

 Students will be able to correlate their acquired knowledge about Sea Rise Level with Miami.Scientific American published an article this year titled Miami Is the "Most Vulnerable" Coastal City Worldwide . With a population of over 2.7 million people, there are hundreds of billions of dollars in assets under assault from winds, storm surges, coastal flooding, and sea-level rise. From our health to our economy, everything is at risk. (floridaclimatepledge.org)

Essential Questions

What is Virtual Reality?What are the Sustainable Development Goals? What is
Sea Rise Level?
This lesson works to introduce students to virtual reality and in the process
introduce the Sustainable Development Goals. Students will be introduced to
sea level rise and climate change.
I used material from https://cleanet.org/,
https://climate.nasa.gov/resources/education/, and
https://www.inksmith.ca/blogs/news/the-inksmith-global-goals-challenge-free-resource
Combining all three to create a VR experience to teach Climate change

Materials

Oculus Quest
Google Cardboard or Other VR Headset
Videos - I have provided links to videos needed

Background

[Watching Raising Seas from the Ocean](#)

In the News

"Sea level rise" – we hear that phrase, but what does it mean, really? How does
it affect us? Do I have to be concerned about it in my lifetime? These are all
great questions!Sea level rise is the increasing of the average global sea level. It
doesn't mean that seas are higher by the same amount everywhere. In fact, in
some areas, such as the west coast of the US, sea level has actually dropped
slightly … for now. But before we get into that, let's understand the main
contributors to sea level rise:

1. **Melting mountain glaciers** - Glaciers are bodies of ice on land that are constantly moving, carving paths through mountains and rock. As glaciers melt, the runoff flows into the oceans, raising their levels.
2. **Melting polar ice caps** - Think of our north and south polar regions. At both locations, we have ice on land ("land ice") and ice floating in the ocean ("sea ice"). Melting sea ice, much like ice cubes melting in a drink, does not affect the level of the oceans. Melting land ice, however, contributes to about one third of sea level rise.
3. **Thermal expansion of water** - Consider that our oceans absorb over 90 percent of the heat trapped by greenhouse gasses in Earth's atmosphere. When water heats up, its molecules become more energetic, causing the water to expand and take up more room, so that accounts for about a third of sea level rise.

Let's take a closer look at global sea levels. Sea level is not constant everywhere. This is because it can be affected by ocean currents and natural cycles, such as the Pacific Decadal Oscillation, or PDO, a 20- to 30-year cyclical fluctuation in the Pacific Ocean's surface temperature. Because of the PDO, right now the Eastern Pacific has higher sea levels than usual, while the Western Pacific has lower sea levels than usual. However, the global average of 3 millimeters of sea level rise per year is increasing and the rate that it's increasing is speeding up. That means that sea level is rising, and it's rising faster and faster. Take a look at this video for some great visuals and further explanation of how phenomena such as the Gulf Stream affect local sea level heights

You may be asking yourself, how do we know sea levels are rising? Well, a couple of ways. First, for the past 23 years we have been using data from several NASA satellites to constantly measure sea surface height around the globe. Data from these ocean altimeters is integrated to refine and calibrate measurements. Additionally, we have tide gauges on Earth to ground-truth (locally validate) our satellite measurements. As for historical data, we use

sediment cores -- drillings into Earth that yield the oldest layers on the bottom and the youngest layers on top -- to examine where oceans once reached thousands of years ago.

Why is it important?

Locally, folks are making observations – and already seeing the impacts of sea level rise on their communities. **Places such as Miami** are now experiencing regular flooding in downtown city streets at high tide. As of 2017 global sea levels are increasing at a rate of about 3.4 millimeters each year. That's about the height of two quarters stacked on top of each other. While it might not seem like a lot, scientists are monitoring the situation because these changes can have a significant impact on low-lying coastal regions like South Florida. Even NASA is concerned about some of its facilities that are located in low-lying areas.

Besides wiping out dry land, encroaching salt water can pollute our fresh water supplies and damage fresh-water dependent ecosystems. It's not just fresh water rivers and lakes that are at risk – our aquifers, or natural underground water storage, are at risk of filling with salt water as the ocean encroaches on the land above them.

Clearly, sea level rise is something that is already affecting people and will continue to do so. All three contributors to sea level rise can be attributed to the warming of the Earth system. Warming temperatures cause mountain glaciers and polar ice caps to melt, thereby increasing the volume of water in the oceans. At the same time, our oceans are getting warmer and expanding in volume as a result of this heat (thermal expansion). Since 1880, global sea level has risen 20 centimeters (8 inches); by 2100, it is projected to rise another 30 to 122

centimeters (1 to 4 feet). Watch this video for some illustrations of these facts:

[NASA's Earth Minute: Sea Level Rise](#)

Also check out the [Climate Time Machine for Sea Level](#) to see what impact a 1 meter to 6 meter rise in sea level will have on the coastal US and other areas of the world.

If we can control our contributions to the rise in greenhouse gases in Earth's atmosphere, we can perhaps level out the warming of the Earth system and eventually stabilize our sea levels. In the meantime, we need to be prepared for the impact encroaching seas will have on our coastal communities and water supplies.

Procedures

Teacher Procedures

1. I always start my lesson with this video [Jack Black: Saving Miami](#)

   Miami may not look like a city on the verge of disaster, but rising seas and political roadblocks are turning this glistening coastal paradise into the next Atlantis. Jack Black investigates for Years of Living Dangerously, traveling to Miami to search for answers. He speaks to some of the world's top scientists, who show him just how drastically tides are rising due to climate change.

2. After the Jack Black video I have a discussion with my students if they think sea level is an important issue using NearPod. I will attach the Nearpod lesson I use if you use Nearpod. If not, just follow the rest of resources :)
3. I show this one minute video [Sea Rise Level](#)
4. After introduction to Sea Rise I show the students the Global Goals Slides - 1-4

5. At this point I take out the VR Quest units and Google Cardboard. Students using Google Cardboard will need to download the Within VR app. Have students search for This is Climate Change and have them go through Melting Ice(https://www.with.in/watch/this-is-climate-change-melting-ice) There are three more videos in the series: Famine, Fire, and Feast. https://www.ecowatch.com/this-is-climate-change-2561510291.html

6. Before I assign students anything I talk briefly about what is Virtual Reality?
   MIT Explains: How Does Virtual Reality Work?
   How does Virtual Reality Work?

7. **Assignment for CoSpaces**:https://cospaces.io/edu/tours.html Students will create their own 360 tour using a location that is most in danger of climate change.
   Example:https://www.cntraveler.com/gallery/10-places-to-visit-before-theyre-lost-to-climate-change

8. **Assignment using Google Slides**: Teachers can use this slide. Have students use google slides to construct an informative text poster relating to the United Nations Sustainability Goals.
   https://docs.google.com/presentation/d/1J_FRXP3xIKk2awbsZnl3s9yoqod8S866UqnP71dcSCo/mobilepresent?slide=id.g96f6637d19_7_20

9. **Outreach activities:** I use Nature Trek, Ocean Reef, and Tilt brush in the community. I have students create a scene in Tilt brush that makes them think of climate change. For example, Illustrate a picture showing your understanding of what sea rising levels mean to you

Extension Activity
https://www.jpl.nasa.gov/edu/teach/activity/the-science-of-earths-rising-seas/

Other Videos relevant to sea rise you can use in other lessons
Will climate change turn Miami into a 'future Atlantis;?
How art intersects with technology and climate change in Miami
Changing Climate South Florida South Florida 6
How Climate Change Affects Hurricane Season
Surging Seas website for students to investigate
Hurricanes and Climate change channel 6
Sea Level Time Machine
Global Temperature Timeline

Websites/Learning Ideas/Resources

<u>Oculus Quest Apps</u>

[Oculus Quest 2](#)

Oculus Quest ($299.00)

These are the apps I use with the Oculus Quest Unit

https://www.with.in/

Within is an app where you experience the best in Virtual Reality storytelling directly on your computer, smart phone, or VR headset.

https://www.with.in/watch/this-is-climate-change-melting-ice

This is Climate Change is found in WithIn app

https://www.oculus.com/experiences/rift/1253785157981619/?locale=en_US

Ocean Rift is the world's first VR aquatic safari park. Explore a vivid underwater world full of life including dolphins, sharks, turtles, orcas, sea snakes, rays, whales, manatees, sea lions

Ocean Rift is divided into 12 unique habitats ranging from coral reefs, shipwrecks and lagoons, to the arctic, the deep and prehistoric seas.($9.99)

https://www.oculus.com/experiences/rift/1253785157981619/?ranking_trace=0
_1253785157981619_SKYLINEWEB_1NcrB4WCSjwe8bMBM

Nature Trek VR

Students will explore tropical beaches, underwater oceans and even take to the stars. They will be able to discover over 60 different animals. Students will be able to command the weather, take control of the night or shape their own world.

https://www.oculus.com/experiences/rift/1111640318951750/?ranking_trace=0_1111640318951750_SKYLINEWEB_1yPyemEwNldfzWY9b

Tilt Brush allows the students to paint in 3D space with virtual reality. They can unleash their creativity with three-dimensional brush strokes, stars, light, and even fire..($19.99)

https://www.globalgoals.org/

https://www.inksmith.ca/blogs/news/the-inksmith-global-goals-challenge-free-resource

A free resource for educators to teach Global Goals in the classroom!

https://www.linkedin.com/pulse/vr-hygiene-safety-everything-you-need-know-evelien-ydo/

How to clean VR devices

https://cospaces.io/edu/

Step into a new dimension with the power of VR! Explore your creations in an immersive 360° and 3D virtual environment.

Other Apps and Media

https://www.inksmith.ca/pages/merge-vr

Merge VR

https://edu.google.com/products/vr-ar/expeditions/?modal_active=none

Google Expeditions

https://www.google.com/earth/education/resources/

Google Earth resources

https://thehydro.us/

Developed by The Hydrous, *IMMERSE* is a 360-degree film aimed to generate awareness and scientific understanding of coral reefs and the threat they face due to rising ocean temperatures

https://apps.apple.com/us/app/earth-now/id494633346

Earth Now

https://download.cnet.com/news/8-eco-friendly-apps-to-help-combat-climate-change/

https://climatesan.org/climate-vr-info/

360 Videos to share with students on the web

https://vrforimpact.com/

VR for Impact

https://www.magicleap.com/en-us/news/partner-stories/xennial-digital-makes-climate-change-real

How a Miami company uses Mixed reality and Magic Leap to predict climate change

Ten Great Climate Apps

- Painting with time: climate change ($1.99) ...
- Earth Now (Free) ...
- Chasing Ice (Free) ...
- Wayfarer (Free) ...
- World Bank Climate Change DataFinder (Free) ...
- iHurricane HD (Free) ...
- Carbon Emissions Calculator (Free) ...
- Light Bulb Finder (Free)
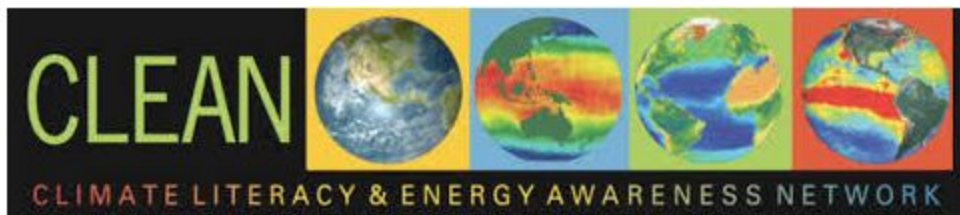
https://xrimpact.com/be-earth/

A project that uses VR for climate action

CLEAN — with financial backing from NOAA, the National Science Foundation and the Department of Energy — provides a free database of all the vetted resources on its website

Any questions email: katie.boyd@colorado.edu

(CLEAN Program Manager)

The CLEAN collection contains 700+ free, online, peer-reviewed, NGSS aligned, and ready-to-use educational resources for teaching about climate and energy including activities, lab demonstrations, visualizations, and videos which are easily searchable through various tags. CLEAN also provides pedagogical support for teaching climate and energy topics through background knowledge pages, a professional development toolkit, and a professional learning community to help educators with many aspects of bringing climate into the classroom.

CLEAN = the Climate Literacy and Energy Awareness Network

https://cleoinstitute.org/

The **CLEO Institute** is a 501(c)(3) non-profit, non-partisan organization exclusively dedicated to climate crisis education and advocacy.

https://cleoinstitute.org/climate-resilient-schools/#the-teachers-network

The CLEO Institute provides a professional development workshop for teachers that helps them discover innovative ways to include climate change education in their curriculum.

https://cleoinstitute.org/cleo-speakers-network/

Climate training and professional development to improve communication of the climate crisis. The goal of the CLEO Speakers Network (CSN) is to build individuals' speaking capacity to simplify climate science, its seriousness, and solutions for the general public. Participants use credible science to shape their own climate narrative with personalized guidance from The CLEO Institute.

https://floridaclimatepledge.org/

Pledge to make a change

https://floridaclimatepledge.org/florida-climate-crisis/

https://floridadep.gov/osi/green-school-designation/content/apply-green-school-designationrenew

About Green Schools Designation

http://dreamingreen.org/

Dream in Green

https://myemail.constantcontact.com/Resources-for-teachers--parents--and-students.html?soid=1101872142024&aid=zmBM47ZWPZo

Dream in Green Resources

https://evergladesfoundation.org/

The EverGlades Foundation

https://www.sierraclub.org/

Sierra Club

https://www.earthday.org/climate-civic-camp-toolkit/

Climate Civics Toolkit

https://www.drawdown.org/solutions/table-of-solutions

Project Drawdown

https://drawdown.ecochallenge.org/

EcoChallenge

https://www.worldwildlife.org/teaching-resources

World Wildlife Fund content

http://vischange.org/

Toolkit for Teachers using visual narratives on climate change

https://www.climategen.org/our-core-programs/climate-change-education/

Curriculum for grades 3-12

https://www.globalchange.gov/climate-change

Understand Climate Change

https://climate.nasa.gov/interactives/climate-time-machine

Climate Change interactives

https://www.projectwet.org/climate

Project Wet (Climate, Water, and Resilience)

https://www.globe.gov/web/elementary-globe/overview/climate

Elementary GLOBE is designed for students in grades K-4

https://pdxscholar.library.pdx.edu/pdxopen/28/

Climate Toolkit

https://sfcc.plt.org/#prettyPhoto/0/

Project Learning Tree

https://phet.colorado.edu/en/simulation/legacy/greenhouse

The Greenhouse Effect in Phet

https://www.climateinteractive.org/tools/online-resources/

Climate Interactive website

https://climate.nasa.gov/resources/education/

Global Climate Change Resources for Educator

https://www.cis.fiu.edu/virtual-reality-storm-surge-visualization-system/

Virtual Reality Storm Surge Visualization System