GEOZOO Whitepaper

Excited to share that the VR/GIS student activities for the TREX GeoSeed Grant – GEOZOO: Promoting Community Science through GIS and Immersive Technologies can now be found here on Lindenwood's Digital Commons! This project's main objective was to create and test how GIS and VR technologies could work together out-of-the-box to produce meaningful and equitable Open Educational Resources (OER = Free) learning activities for K-16 students. Our team comprising of expertise from Lindenwood University (Tara Vansell, GIS Instructor – Joseph Weber, Assistant Professor Art and Design, and Keegan Favors, Research Assistant Information Technology major) and the St. Louis Zoo (Michael Dawson, Conservation Education Liaison) were able to leverage ArcGIS Story Maps to deliver the interactive digital maps and immersive experiences together so that students could complete the created learning activities on an Oculus Quest VR headset.

A huge thank you to TREX and our amazing Lindenwood and St. Louis Zoo team on this project! This work has been a journey of discovery! It is a joy to now be sharing what we have learned with educators and students. We hope that this work inspires others to create GIS/VR stories of their own.

How does this work?

ArcGIS Story Maps are a browser-based presentation tool that allows the story author to combine text, audio, interactive maps, photos, and videos. This project discovered that ArcGIS Story Maps are also able to serve up 360 images, 360 videos, and 360 scans as well! Once a story is created it can then be shared publicly and becomes freely accessible to anyone with the url address. This is special because it means that any VR device that has a browser (because really a VR headset is just a computer you are wearing on your face) can access the story map. What is even more exciting is the accessibility this affords to students. If you have a student that is unable to complete an activity wearing a VR headset, they can still access the same story map activity on their desktop, phone, or tablet and receive a comparable experience to their peers. This also means one story map activity created by an educator can be used over all these device platforms, the educator does not have to create individual activities for each device. Perhaps the icing on the cake is that ArcGIS Story Maps are included in the free Esri K-12 bundle. Because the ArcGIS Story Map software itself is free, this means educators with no coding or game design background can begin building and creating stories that house immersive VR content allowing them to teleport their students to new learning environments.

Levels of GIS/VR Design

On Lindenwood's Digital Commons there are five GIS/VR Story Map Activities that were created for this project, each at a different level of design complexity.

Level 1 - Medieval Europe: Invasions – This was created using solely ArcGIS Story Maps and Esri GeoInquiries (also OER). For this activity the maps and content of the Medieval Europe: Invasions GeoInquiry was adapted into the Story Map. Then a simple search of YouTube360 was done to find tours of a few of the castles highlighted within the lesson. Links to these videos were then embedded within the Story Map. Last, the story was shared publicly, giving it it's unique url to be provided to students for them to access on their device of choice. This level of GIS/VR activity build is for the beginner and requires only access to the ArcGIS Story Map software.

Level 2 – Topography and Our National Heritage – This is for the educator already familiar with ArcGIS Story Maps. While this too uses the ArcGIS Story Map software and Esri GeoInquiries, it does require the author to have more knowledge of ArcGIS products and how they can fit together enhance the user experience. This activity has the map take center stage and uses the map to house and organize the VR content. Some coding is needed to create this type of experience, but no worries, directions on how can be found here.

Level 3 – Lewis and Clark: The Journey Begins – The difference here is that instead of utilizing YouTube360 for the VR content, original 360 images and video were created using a Insta360 One X2 camera. The images and video were then hosted on kuula.co (free account) and using those url links could be embedded into the Story Map. These images give

you a 360 view from one point in space. Think of this as standing in the VR environment surrounded by a photosphere. Want to use these images and videos in your own lesson? Check out our documentation here!

Level 4 – GEOZOO Ecosystems and Biomes – What makes this storymap activity awesome is that you get the experience of visiting three different habitats at the St. Louis Zoo! A Matterport camera was used to capture and scan the habitats, creating a digital twin of the spaces. These scans are housed on a Matterport cloud account (subscription needed) and then embedded into the story map. These scans allow you to step through the VR environment. These experiences allow you to "walk" through the exhibits and view the space from different viewpoints.

Level 5 – GEOZOO Community Science – Emphasis on Wetlands – This activity again uses a Matterport camera to scan the space giving the user the ability to "walk through" the habitat. Added to this story map is a 360 video, captured using a GoPro Max. How fun is it to hear the zoo train whistle in the background!?

What do students say?

Once the activities were created, they were then tested with middle/high school students at Lindenwood's GIS Day events (2022&2023) as well as during two of the zoo's summer camps (summer 2022). While more research needs to be done over a longer period with students to really understand learning comprehension using GIS/VR technologies combined in this way, the overall feedback from students was positive. Of the students who tested the activities at the zoo camps, 80% said they would like to see more of these types of lessons integrated into their schoolwork.

What's Next!

1. Getting the word out to educators that these activities exist and getting the activities into the hands of students!
    a. Lindenwood Digital Commons – Geospatial Education and Tech
        i. Geospatial OER – Houses all the story map activities also linked above
        ii. Documentation – Holds a tutorial video on navigating the activities with an Oculus Quest headset. This is great to show the class before getting started.
        iii. 360 Images/Scans/Videos – We are trying to create a repository of pictures/scans/videos that can be shared among educators to mash-up into your own VR activities.
        iv. Photos – Repository of 2D photos to again be shared among educators.
2. Continue building more!
    a. There are so many lessons/activities out there where simply adding this immersive element can engage students for the larger lesson!
        i. Continue to build out activities for upper elementary, middle school, high school using Esri's GeoInquiries.
        ii. Look for more opportunities to create activities such as theses at the undergraduate level using these technologies.
        iii. Take the camera everywhere! More 360 images and videos to share!
3. Collaborate with us!
    a. We'd love to hear your ideas for the next great GIS/VR activity! Please reach out to Tara Vansell (tvansell@lindenwood.edu) at Lindenwood University and/or the Immersive Realities Lab at TREX (insert address).