Figure 1. COVID-19 Air Quality Lesson Plan

Lesson Planning
Benchmark(s)/ Standard(s): **HS-ESS3-6 -** Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.

HS-ESS3-1 - Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.

HS-ESS3-3 - Create a computational simulation to illustrate the relationships among the management of natural resources, the sustainability of human populations, and biodiversity.

SC.912.G.1.4 – Analyze geographic information from a variety of sources including primary sources, atlases, computer, and digital sources, Geographic Information Systems (GIS), and a broad variety of maps.

MA.912.DP.1.1 - Given a set of data, select an appropriate method to represent the data, depending on whether it is numerical or categorical data and on whether it is univariate or bivariate.

SS.5.C.2.5 - Identify ways good citizens go beyond basic civic and political responsibilities to improve government and society.

CTE-GPA.68.GENRL.05.01- Identify differing political or social perspectives on a public policy impacting the local community.

Lesson Objective(s): Students evaluated and analyzed COVID-19 Air Quality data in partnership with the University of South Florida's EcoFem Lab research team. They communicated the results in the form of a blog post using GIS story maps, data visualizations, and a related news article. They discussed urban issues connected to COVID-19, environmental ethics, and the relevance of geospatial and air quality data, and illustrated a claim or solution that could provide more equitable practices and policies for vulnerable communities due to the impact of COVID-19.

Essential Question(s): Who are the communities already impacted by the COVID-19 recession? What profound effects on populations can be identified using GIS? What are the historical implications? What strategies can be used by policy makers to safeguard the communities negatively affected during the recovery?

Materials/Resources: ArcGIS software, ArcGIS video: https://youtu.be/QKQFRY4YlJ4.
Desktop computers or iPads, chart paper for groups to plan and outline integration of

information for blog posts, calculators, rulers, markers, pencils, colored pencils, articles from online, instructional PowerPoints (with directions throughout the unit), Reflection Sheets, formative quizzes, journal notebooks.

Lesson Agenda: https://www.nytimes.com/interactive/2020/12/17/world/asia/india-pollution-inequality.html?action=click&module=Top%20Stories&pgtype=Homepage. Introduce students to the topic of global air quality and the current research findings using this *New York Times* article. Allow students 15 minutes to interact with the website and jot down: 1- One new and interesting fact that they learned from the article about air quality, 2 – How they think this phenomenon might relate to our air quality in the United States, and 3 – A question about air quality they have after reading the article. *Students met virtually with members of the research team at University of South Florida to ask student questions prepared throughout the project.* A weekly schedule was set up between Instructor and the University. They provided Twitter data and an explanation of how they analyzed this data for research. Students earned a certificate in GIS Basics from the ESRI online training site.* The following video is also used as an introduction: https://www.youtube.com/watch?v=5uYkNz8_iWg.

Grade Level: 9th -12th   Time Frame: 7-8 days

Lesson Delivery

Outline: Day 1–2: Intro to GIS, Journal Notes, and videos. ESRI website and GIS Basics Certification. Day 3*:* Students learned data-driven approach for mapping the level of financial vulnerability across a region and begin conducting their research. Days 4–6: They collected air quality data and created well-written data driven blog posts containing GIS maps, data visualizations, and news articles. Days 7–8: Presentations and Evaluations. Students viewed final posts by their peers and articles using technology to explain local COVID-19 phenomenon and sustainable solutions. Students gave peers an opportunity to pose arguments against their claim and can review or revise their original work.

Engage: Day 1–2: *Intro to GIS*- PowerPoint, journal notes, and videos are used to communicate new content to students. They used the ESRI website to earn GIS Basics Certificate

ESE/504/ESOL Accommodations- Cooperative learning groups for students to support each other, utilizing technology (read-a-louds/translators) and visuals, connecting a hands-on-activity with new vocabulary to provide clear meaning.

Explore: Example ArcGIS Mapping. Instructor introduced important vocabulary for students to access and review at any time during the lesson (see PowerPoints enclosed with lesson). Instructor conducted Live Sessions online to help students who need additional assistance maneuvering the program. A website and step-by-step PDF file was posted for students who would like them.

Students explored the following link on how to plan and outline GIS story maps into blog posts: https://www.esri.com/arcgis-blog/products/arcgis-storymaps/sharing-collaboration/planning-and-outlining-your-story-map-how-to-set-yourself-up-for-success/?adumkts=product&aduc=pr&adum=blogs&utm_Source=pr&aduca=mi_arcgis_storymaps_awareness&adut=covid-storyteller-blog&adulb=multiple&adusn=multiple&aduat=storymap&adupt=awareness&sf_id=701f2000001C379AAC. Students worked in groups or independently to 1) identify an air quality incident or issue here in the US, 2) Create a research question related to COVID-19 and Air Quality in their state or community, 3) plan for their GIS story maps.

ESOL/504/ESOL Accommodations- Utilizing visuals, providing examples, chunking, connecting an activity to speaking, sketching/writing activities, providing notes.

Guided Practice: Instructor provided access to additional videos and demonstrations to help guide student practice and exploration through the tasks. Using the checklist and planning sheets, students came up with their own layouts for the project and checked off each task as they completed it. Each student was given a checklist/timeline with all the steps of the project outlined. Students collected and created a table in Excel of air quality data.

ESE/504/ESOL Accommodations- Planning Guide/tools, encourage students to use vocabulary to express their understanding [framework included in planning sheets], repetition of expectations, and emphasis on key concepts.

Explain & Elaborate: Students created story maps, coordinated brief interviews with USF Researchers, analyzed data, and constructed their own blog posts using all the data visualizations and images together. They worked to complete their planning sheets and carefully create cohesive stories to share in a digital format. Students shared their posts and plan to provide potential solutions that would help solve the issue they selected as a topic. Students can encourage further research of their topic, discuss more possible solutions, give references, and cite their sources at the end of their presentations.

ESE/504/ESOL Accommodations- Facilitated group discussions. Extended time and assistance (as needed), checks for understanding (deliberate questioning), Directed reading and thinking activities, graphic organizers, and brief audio/visual sources integrated into lessons.

Evaluate: Students were assessed using the ongoing activities outlined on the checklists and submitted items as they became due on the timeline issued by the Instructor. A Rubric *(Table 1)* is used to assess the final presentations as a group. However, formative assessment questions (Image on new vocabulary and concepts are given to each individual student and graded individually). Journals were graded for accurate notes and story boarding.

ESE/504/ESOL Accommodations- Extended time with written assignments as needed, Visual examples provided/native language translator accessible online at any time if needed, alternative assessments: Reflections, Reports, and Posters for students preferring not to present. Students give oral answers or arguments to support their opinions related to the themes being studied.