

GIS Implementation into 7th and 8th Grade Science Classes

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Introduction

7th and 8th grade science curriculums are in flux due to the recent release of the Next Generation Science Standards (NGSS) and the New York State P-12 Science Learning Standards that followed. With science and engineering practices such as developing and using models, planning and carrying out investigations, and analyzing and interpreting data, becoming more of a focus than learning content, Global Information Systems (GIS) can play a role in this transition while still focusing on targeted phenomena.

Next Generation Science Standards (NGSS)

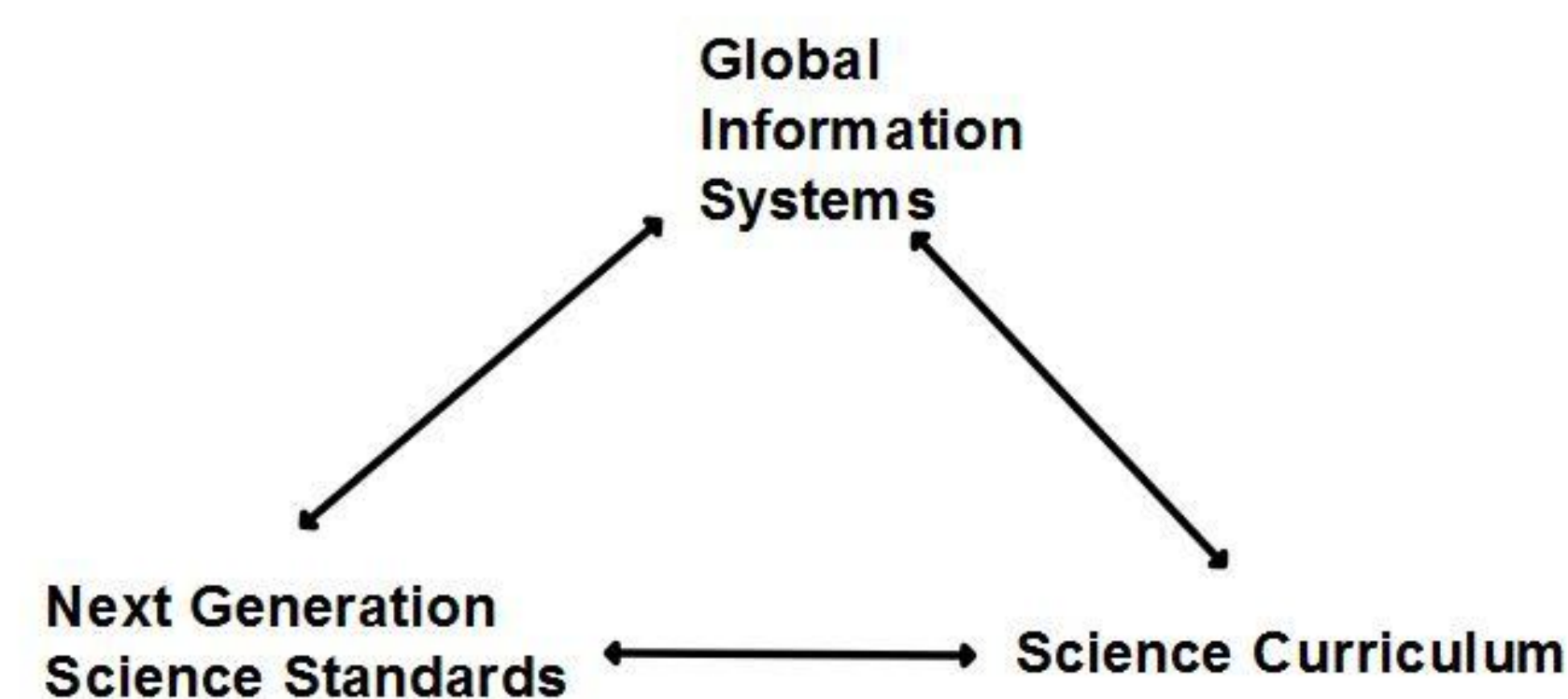
Practices

"The practices describe behaviors that scientists engage in as they investigate and build models and theories about the natural world."

- Asking Questions and Defining Problems
- Developing and Using Models
- Planning and Carrying Out Investigations
- Analyzing and Interpreting Data
- Using Mathematics and Computational Thinking
- Constructing Explanations and Designing Solutions
- Engaging in Argument from Evidence
- Obtaining, Evaluating, and Communicating Information



GIS allows us to "see" data in a new way. This new way of visualizing data can often make it easier to identify trends and patterns in the data. As a teaching tool, it can be used to help increase student engagement through the use of smartphones, computer software, and ArcGIS, an online mapping tool. Current curriculum can be enhanced by using GIS as a bridge to the science and engineering practices of the NGSS by helping to incorporate these practices into lessons that may be currently content driven.



Incorporating GIS into a Dichotomous Key Lesson

Overview: One of the skills from the old NYS MST standards was using a dichotomous key. The change to NGSS will not eliminate such a valuable skill but will require it to probably be taught in a different way with emphasis on the development of science and engineering practices as outlined in the NGSS. In the past I have had students go outside, find a tree and use a tree finder key to identify the tree. Although this activity helped students master the basic skill of using a dichotomous key in a field guide, it lacked any real science and engineering practices. Incorporating GIS into the lesson can help bridge this gap and make the lesson more NGSS qualified.



Topic: Using "Collector ArcGIS" and a Tree Identification Guide to geolocate trees, identify them, and add their latitude and longitude and attributes to collector.

Content Areas: life science, earth science

Grade level: 8th grade

Duration: 1.5 hour block

GIS Tool: Collector ArcGIS

Objectives:

Students will be able to:

- Identify a tree using a tree identification guide.
- Geolocate the tree in ArcGIS Collector.
- Enter the latitude and longitude of the tree into ArcGIS Collector.
- Enter attributes of the tree into ArcGIS collector.

Instructional Sequence:

Students will explore the park and neighborhoods around the school to locate trees. After finding a tree students will use a tree identification guide to identify the tree and then use ArcGIS Collector to geolocate the tree, enter the latitude and longitude, and write three attributes about the tree. (leaf shape, jagged or smooth edged leaves, leaf size)

Assessment: Student data entered into ArcGIS Collector will be checked for completeness and accuracy.

Create Ecosystems for Zoo Animals Using Sketch UP and Google Earth

Topic: Create ecosystems for various zoo animals using Sketch up

Content Areas: biology

Grade Level: 8

Duration: 40 mins

GIS Tool: sketch up, google earth

Objectives: Students will research the ecosystems of various zoo animals and then use Sketch up to design the building enclosure for their selected animal. Students will include a written description of the abiotic and biotic factors in the enclosure (ex. waterfalls, plant life, other animals, etc...)

Instructional Sequence:

Demonstrate sketch up on the smart board.

Have students practice making a building using sketch up.

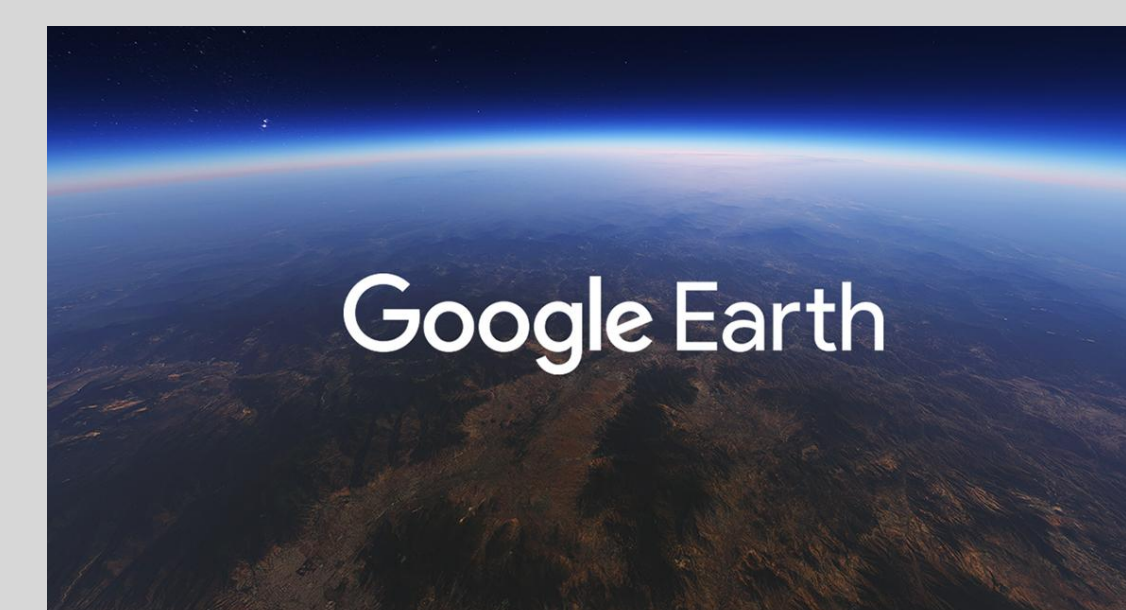
Assign each student or student group a zoo animal.

Students will research the natural ecosystems of their animal using the internet.

Students will then use sketchup to design a building for their animal.

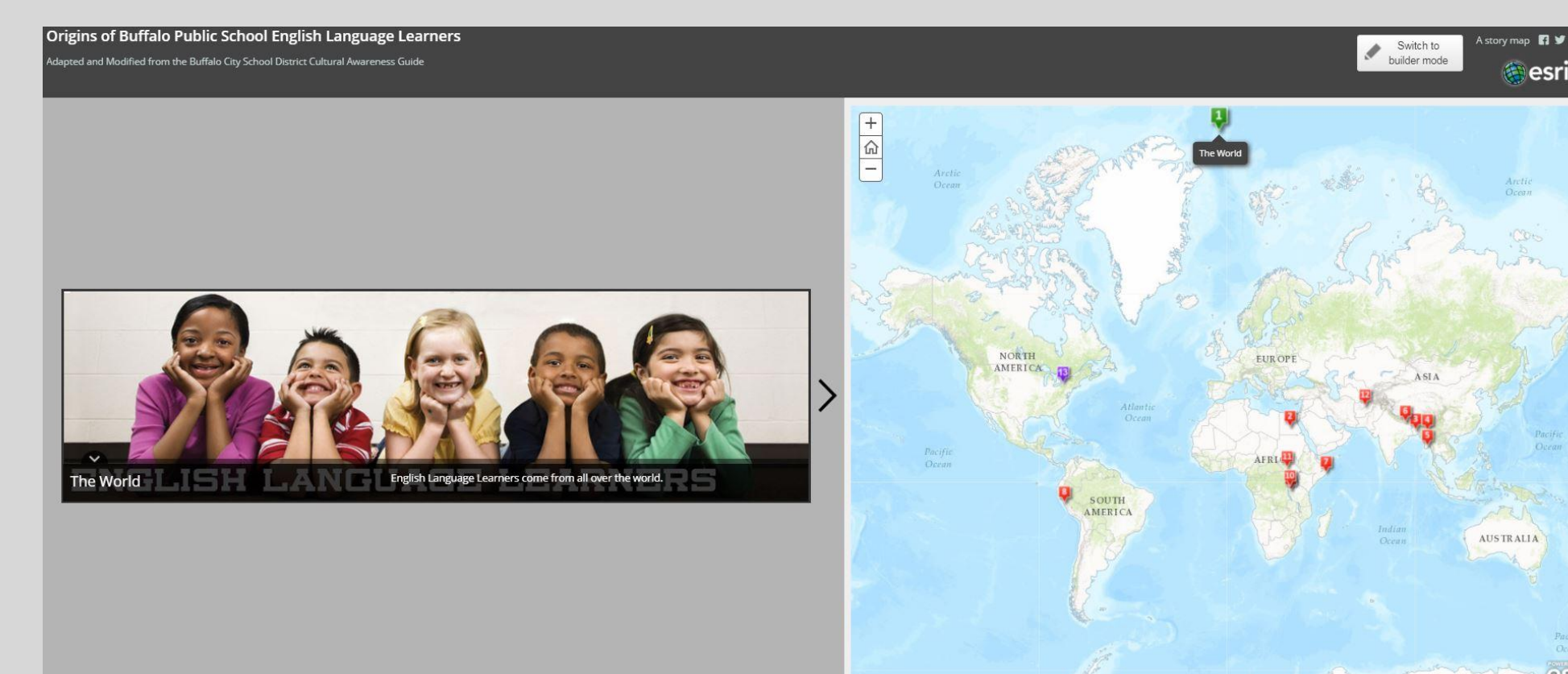
Students will write a description about what will be in their enclosure in terms of biotic and abiotic factors besides their animal.

Assessment: Student buildings will be pooled into a class zoo and students written descriptions of their building ecosystem will be graded.



Making a Story Map

Story maps are an effective way to convey information visually by using maps and geography, narrative text, and images. During the GIS camp at UB this summer every teacher and student was required to create a story map. Students and teachers alike proved that story maps are relatively simple to create with limited one to one guidance. Story mapping can be used for a wide variety of content so they can be integrated into instruction throughout the year in both 7th and 8th grade.



The story map depicted above was developed over the summer in the GIS camp.

Using Sketch UP to Understand Volume

Topic: Using Sketch Up to understand volume

Content Areas: STEM

Grade Level: 7

Duration: 40 mins

GIS Tool: Sketch Up

Objectives: Students will design shapes / buildings that have a specific volume using Sketch Up

Instructional Sequence:

Review length, width, and height and how these dimensions are used to calculate volume.

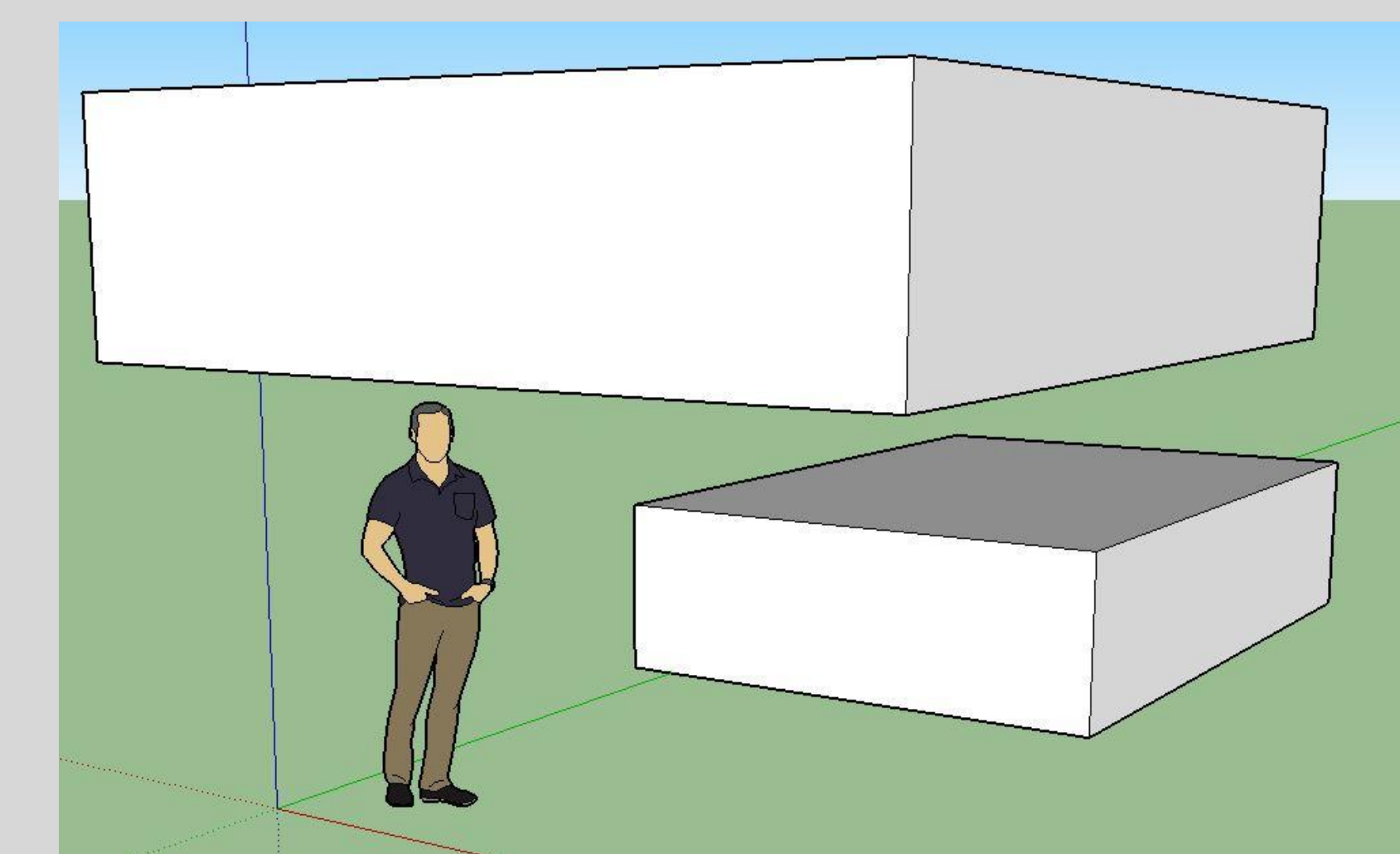
Demonstrate how to use Sketch Up to make shapes and buildings.

Give students about five minutes to make various shapes / buildings.

Give students a specific volume and have them make 5 different rectangles that have this same volume. They will have to pick lengths, widths and heights that will work for the given volume by using their calculators and the formula for volume. The teacher may need to demonstrate how use their calculator to work backwards from the volume to find an appropriate l, w, and h.

Add parameters. For example have students make a building made with more than one rectangle that has a specific volume. Students will have to realize that to that they will need to add the volumes of each rectangle to get the total volume.

Assessment: Students will be given a specific volume and will have to create a building that has that volume. Extra points can be given for buildings that are designed by using more than one shape.



References

1. Next Generation Science Standards
2. Google Images
3. ArcGIS.com
4. Sketch Up

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