

Spatial Skills

In geography, maps provide a way to tell stories and arrange data in a visually appealing and easy to understand format. However, with geospatial technology advances, we now have access to increasingly complex data, and it is important for students to know how to make sense of it. Students must understand how to use spatial tools, content, and skills to think critically, and geographically, about the world around them.

Video 2.1: Geospatial Revolution, https://www.youtube.com/watch?v=s_QHJfPD1s

This video encourages the viewer to think spatially and to understand what tools can be used to aid spatial thinking through a series of questions. What is happening currently at a specific location? What tools can you use to know and understand your surroundings? To understand your surroundings, you can use a tool such as a map. What do you need to use a map? What skills do you have to have to make a map? What role can technology play in spatial thinking and spatial skills? What role can your cellphone or a family member's cell phone have in this?

Introduction

Geospatial technologies, including cell phone locational services, Google maps, [Esri's ArcGIS](#) (geographic information systems), and GPS (global positioning systems), are increasingly household tools. GPS functions as a daily navigational tool, allowing drivers to hop in their car and drive anywhere with turn-by-turn directions. The ability to map almost any data makes the study of geography and its skills even more important. Geospatial technologies may successfully navigate you to the correct location, but reliance on them may mean that you have no idea where you are. (Read [Without mental maps, we're lost](#)) The study of geography puts a location into context. Geographic skills help answer the questions "where" and "why there".

When approaching a problem, a geographer goes through an inquiry process. (This process is explored more thoroughly in the Places and Regions module.)

1. Ask a Geographic Question – Identify a problem or decision requiring a geographic understanding in order to find a solution.
2. Acquire Geographic Information – Data acquisition can be a daunting task. In acquiring this information, a geographer must consider the validity and reliability of the data acquired.
3. Organize Geographic Information - While geographers rely upon the creation of maps to organize information, other tools, including graphs, charts, timelines, etc. are helpful as well.
4. Analyze Geographic Information- At this stage, the problem solving begins. The geographer must rely upon an understanding of how places and spaces relate to each other to analyze the collected data.
5. Answer/Act on Geographic Question – Present a solution, decision, or conclusion based upon the data. Some people consider “Act” in this method as well, to act upon the information received.

While the other modules in this series focus on WHAT geographers study, the Spatial Skills module emphasizes HOW geographers study. Geography asks how location matters: how spaces and places came to be, how they relate to each other, and how they will change in the future. This module introduces the tools and techniques needed to answer these questions.

Case Study - Global Positioning System (GPS) and Geographic Information Systems (GIS)

Video 2.2: Why Study GIS?

<http://www.pbslearningmedia.org/resource/psu10sci.vid.geospatial.whystudy/geospatial-revolution-why-study-gis/>

This video shows the application of GIS to wildfire issues in California. The GIS process is shortly explained in the video. It is outlined as: collecting data, creating a map, and analyzing the map to find the solution to a problem. One can use GIS to understand and find a solution to today's major issues.

GPS, GIS, and Biology

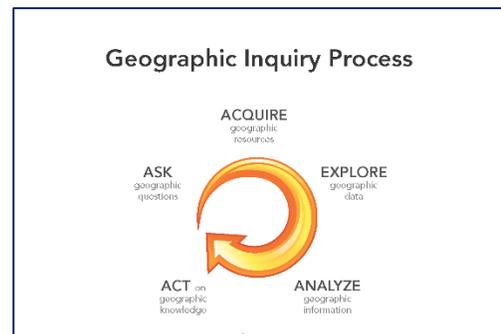
Early on a Saturday morning, long before the boaters and tourists arrive, a biologist paddles his kayak around a lake setting out sensors to collect data for a water quality survey. The biologist needs to understand what is happening to the lake, why it is happening, and how best to keep the lake healthy for the fish, the wildlife, and for the humans who use the lake. The sensors are small, but they collect enormous amounts of data. The biologist realizes that by simply collecting the GPS (global positioning system) coordinates of each sensor, he can use GIS (geographic information systems) software to map the collected data. By adding a spatial component to his survey, the data is presented in a more streamlined way, sections of the lake that are being affected the most are easily located, and the source of the pollutants is identified more effectively.

Just as the biologist above used GPS to collect and organize data, mobile technology now allows anyone to do the same. Many cell phones and tablets can record and geotag photo locations, and mobile apps like ESRI's Collector for ArcGIS collect GPS data in the field. This poses certain safety and security risks but also is a streamlined way to connect data. (Read [Geotagging poses security risks](#)) The video below is an excellent case study of people using GPS, GIS, and mapping to put themselves on the map.

Video 2.3: Mapping Power to the People, <https://www.youtube.com/watch?v=ChWj4yBmE0E>

This video shows the power of the application of GIS to problems across the world, such as the mapping Kibera, Kenya. There is a true power in mapping and using your geospatial toolkit. In Kibera, the power of mapping and using GIS assisted the local people with mapping issues and other local issues such as security.

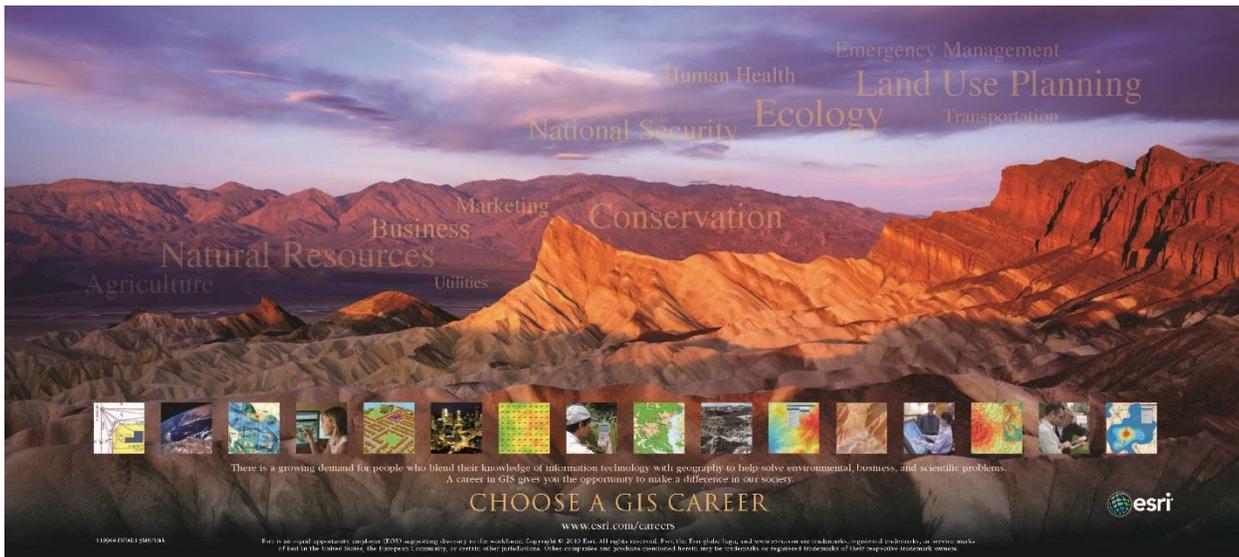
Classroom Application: Using the Geographic Inquiry Method (learn more about this method in *Places and Regions*), plan out a project. To get comfortable with the devices, record selected locations around your school, perhaps trees, water fountains, or other significant structures. Then map these locations using pen and paper, Google Earth or ArcGIS online. Combinations of geospatial technologies (GPS, GIS) can be used for cross-curricular projects with science, math, or even art and literature classes. Students can create tracks of their movements to “write” words or “draw” pictures, which can then be “mapped” using GIS. Students can practice calculating the area of shapes mapped out using the GPS device, or record sites where litter is often found around the school – perhaps new trash cans need to be installed? GPS units can record everything from school bus routes to areas where traffic jams are common in the school halls. Once



students have more skill in using these devices, they will come up with their own location data to collect. ESRI's Story Maps (<http://storymaps.arcgis.com/en/>) can be powerful teaching tools for using maps to tell stories (how about a map showing supposed locations for Odysseus' journey, locations of famous authors' homes).

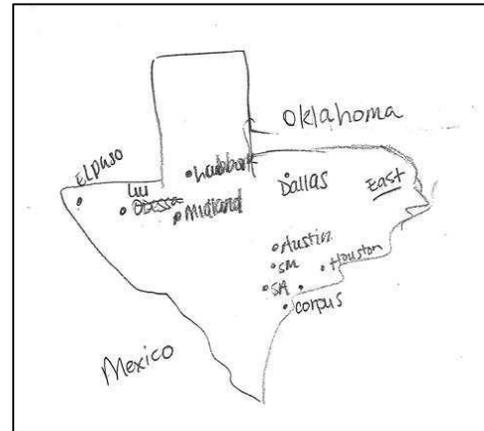
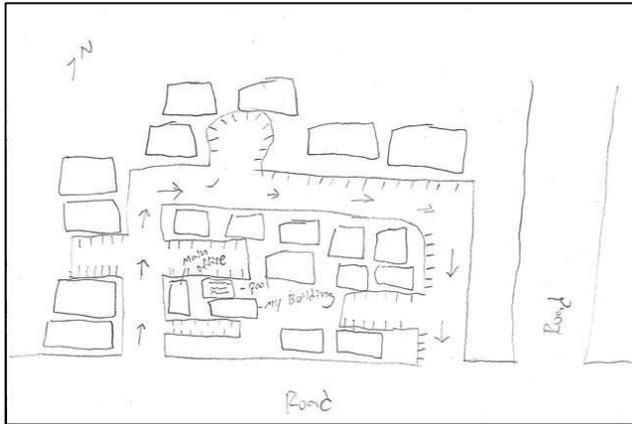
Once students have collected their data using their GPS devices, and have created their maps, it is important to finish the activity with an analysis of what this location data shows and to ask some questions about the use of the devices.

- How did using GPS affect your understanding of the data?
- Did using the GPS make creating your map easier or more difficult?
- How does mapping your data affect your ability to understand the information and its underlying causes?
- How does using GPS and mapping your data impact your ability to predict future patterns and/or solutions to your study topic?



Instructional Strategy: Sketch Maps

One of the most important geography skills is the ability to create maps. Maps are an ideal way to organize and present a large amount of information. As technology advances, students have the ability to create increasingly sophisticated maps using GIS, Google Earth, and other platforms. The sheer amount of data available through these technologies may overwhelm students, resulting in cluttered and unfocused maps. Students may become so involved in using the technology that they fail to understand the purpose of the map. Many decisions are involved in making a successful map. The sketch map can lay a foundation for understanding geographic relationships, organizing information, and answering questions.



Unfortunately, the idea of drawing maps by hand, or sketch maps, can be intimidating to both teachers and students. Many people feel that they do not have enough artistic ability or that their maps must be perfect. It is important to reassure students that sketch maps are for student reference. They are judged on content, not artistic merit, and ALL maps – even the best ones – are imperfect representations of the Earth's surface with some distortion and error. Mapmakers choose specific projections [<http://education.nationalgeographic.com/education/activity/investigating-map-projections>] to minimize this distortion and error.

TEACHERS: It is important for you to model sketch maps on the board. Watching the teacher create less than perfect maps can help eliminate some of the fear, especially if the teacher purposefully creates a VERY simplistic representation and allows the students to see that perfection is not the goal. It can be difficult to grade sketch maps. Below are two rubrics for your use:

There are two methods of using sketch maps that can be particularly effective as note-taking devices. The first method, Mapshots, comes from TEA’s Lighthouse Initiative. Mapshots are note-taking templates where students organize information in a matrix around a central blank area where they can sketch a map or color in a simple thematic map. The sample shows a template created for a Texas History course. Students take notes about explorers from different colonial powers in the boxes around the blank center. In the center, students sketch a map of Texas and draw in the explorer’s routes. They can draw the routes in a different color for each country or each explorer. Finally, this mapshot has been modified to include a timeline across the bottom where students can record the dates. Once completed, this is a powerful study aid for students when preparing for an exam. More information on the Lighthouse Initiative and “Mapshots” can be found at <http://www.tealighthouse.org/socialstudies/>.

The second method, the Annotated Sketch Map, serves as a graphic organizer. Rather than sketching out the entire map at once, the students add features to their map during the note-taking process, essentially writing their notes onto their map. This form of guided note-taking (and guided map-making) helps to alleviate student apprehension by allowing the students to focus on only one step at a time. This technique may be a bit more time consuming than traditional notes, but with guidance, practice and proper time management, it is an extremely effective tool. Additionally, by drawing in the features themselves –taking the time to annotate features and ensure that features are in the proper relative location, students develop their mental maps, an internal representation of the Earth’s surface and a foundation of spatial thinking.

Instructional Materials

Three lesson plans developed specifically for this module include a lesson on NFL Geography and the Texas Independence Trails. All lessons are modifiable for different locations and scales. Additional resources includes lesson plans from external sources that support the instruction of places and regions.

[Download Instructional Materials and Resources](#)