

Navigational Methods

Overview:

Since ancient times people have used navigational methods to mark and find locations. A few of these methods include: using the stars as a navigational tool; using landmarks, such as trees and mountains; drawing maps; and using a compass. Students learn about some of these methods as they interview local Native Elders and use instruments similar to those used by current scientists. To infuse more Native language into the curriculum, consider teaching “Traditional Introductions” prior to this lesson.

Objectives:

The student will:

- understand that since ancient times people have used navigational methods for locating places on Earth;
- identify at least one traditional navigational method;
- understand that scientists use GPS receivers to pinpoint the location of instrument data sites;
- use a GPS receiver to mark the location of a specific site; and
- use a GPS receiver to locate a previously marked site.

Materials:

- Paper
- Colored Pencils (or other art supplies to prepare invitations for Elders)
- GPS receivers
- Plastic containers (one per GPS receiver)
- STUDENT WORKSHEET: “Traditional Navigation”
- STUDENT INFORMATION SHEET: “Using a GPS”
- STUDENT WORKSHEET: “GPS Navigation”
- VIDEO: *Garmin® Geko Series Personal Navigator*

Answers to Student Worksheets:

Traditional Navigation:

1. *D) all of the above*
2. *Answers will vary but may include: navigation using the stars, sun, or moon; mental maps; maps drawn on the ground or other surface; use of landmarks for navigation, etc.*
3. *Answers will vary according to stories shared by Elders. Answer should be formatted as a complete paragraph.*

GPS Navigation:

1. *B) Global Positioning System (GPS) receiver*
2. *True*
3. *B) Satellites orbiting Earth*
4. *D) in an open area such as a field*

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PART 1

Activity Preparation:

1. Compile a list of Elders in the community. The school secretary or local Native Council can help.
2. Select a date and time to invite Elders to visit the classroom.
3. Prepare snacks or other gifts to share with the Elders during their visit.

Activity Procedure:

1. Explain that since ancient times people have used navigational methods for marking and finding locations. A few of these methods include: using the stars as a navigational tool; using landmarks, such as trees and mountains; drawing maps; and using a compass. Explain that during this activity students will interview local Elders to learn traditional ways of finding locations.
2. Ask students to prepare and deliver invitations to Elders. Invitations should include the Elder's name; the date, time, place of the event; and purpose of the event. Encourage students to include artwork or photos with the invitations.
3. Explain that Elders can share a wealth of knowledge about traditional ways of locating places. Ask students to prepare a list of questions to ask Elders about navigation methods.
4. On the day of the visit, welcome Elders and explain that your class is studying ancient and modern ways of navigating, or finding places. Ask Elders to tell students about some traditional methods of navigating. Encourage students to ask the questions they have prepared.
5. When Elders have finished sharing, thank them for the visit with the gifts students have prepared. After Elders leave, distribute the STUDENT WORKSHEET: "Traditional Navigation." Discuss knowledge Elders shared, and ask students to complete the worksheet.
6. Help students prepare thank you notes to deliver to the Elders.

PART 2

Activity Preparation:

Teacher's Note: If your GPS unit is a different model from the one described here, make appropriate changes to the STUDENT INFORMATION SHEET.

GPS screen shots can be found at www.garmin.com/products/geko101/screen.html.

1. Select an open area such as a playground or field in which to conduct the GPS portion of this activity. Because GPS units must have a clear view of the sky to receive signals from satellites, the area should not be heavily forested or closely surrounded by buildings.
2. Prepare each GPS unit for student use by installing batteries (lift the flap on the back of the unit), and setting the position format, map datum, and unit system. (*See the following directions*)
3. Press and hold the POWER button to turn on the GPS unit.

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4. Press the PAGE button until the *Menu* page is displayed. Use the UP/DOWN buttons to highlight *Units*. Press the OK button.
5. Use the UP/DOWN buttons to highlight the *Position Format* bar. Press the OK button. Use the UP/DOWN buttons to highlight *H D°M'S.S.* Press the OK button.
6. Use the UP/DOWN buttons to highlight the *Map Datum* bar. Press the OK button. Use the UP/DOWN buttons to highlight *WGS 84*. Press the OK button.
7. Use the UP/DOWN buttons to highlight the *Units* bar. Press the OK button. Use the UP/DOWN buttons to highlight *Statute*. Press the OK button.
8. Press and hold the POWER button to turn the GPS unit off. Repeat these steps for each GPS unit.

Activity Procedure (Part 2):

1. Explain that the electricity created by the aurora can cause Earth's magnetic field to change. Scientists use magnetometers to monitor these changes. Magnetometers are located at many data-collection sites around Earth.
2. Scientists use Global Positioning System (GPS) receivers to determine the exact latitude and longitude of new magnetometer data sites. GPS units receive information from satellites, enabling them to pinpoint their location on Earth. This enables scientists to locate magnetometers later for repair or removal.
3. Tell students they will soon pretend to be scientists assigned to setting up data sites. Divide students into groups.
4. Distribute the STUDENT INFORMATION SHEET: "Using a GPS," and the STUDENT WORKSHEET: "GPS Navigation" to each student and review directions. Give each group a GPS unit and a plastic container (or other object for groups to hide). Ask students to put a note in the container with the names of all group members on it.
5. Each group will place an object near the school and use a GPS to mark its location. They will then trade GPS units with another group, and use the GPS to find the other group's hidden object.
6. Explain that a waypoint is a marked location. Demonstrate how to turn the GPS unit on and off and practice navigating to the "mark a waypoint" page on the GPS screen by holding the OK button down for two seconds. Direct students' attention to the numbers that appear at the bottom of the screen. These numbers represent the latitude and longitude of the waypoint.
7. Show students the VIDEO: *Garmin Geko Series Personal Navigator*, which describes how to operate the GPS unit. Take students outside and ask them to follow the instructions on the STUDENT INFORMATION SHEET: "Using a GPS." Instruct each group to find a "data site" in which to hide their plastic containers. Ask them to mark a waypoint at this site.
8. After all group containers have been hidden, ask groups to trade GPS units. Demonstrate how to "GOTO" a waypoint using the STUDENT INFORMATION SHEET: "Using a GPS." Ask each group to use this function to find the data site of the group with which they traded GPS units.
9. Return to the classroom and ask students to finish the STUDENT WORKSHEET: "GPS Navigation."
10. Ask students to complete the worksheet, then discuss why it is important to know methods of navigating that do not require a GPS. Students should be able to identify some of the following problems: battery life failure; interference with signals; losing the unit; etc.

Using a GPS

Overview:

Scientists use magnetometers in data-collection sites around the world to monitor changes in Earth's magnetic field. Scientists use Global Positioning System (GPS) receivers to determine the exact latitude and longitude of new magnetometer data sites. GPS units receive information from satellites, enabling them to pinpoint their location on Earth. This enables scientists to locate magnetometers later for repair or removal.

Instructions:

1. Press and hold the POWER button to turn on the GPS unit. Wait while the GPS locates all four satellites. Move away from buildings and trees to get a clear satellite signal.
2. When the GPS has located four satellites, follow the teacher to a starting point and mark this spot as a waypoint (a marked location) on your GPS. To mark a waypoint, press and hold the OK button for two seconds. When a person holding a numbered flag appears, release the OK button.
3. Record the number on the flag, and the latitude and longitude of the waypoint on the data chart provided on the STUDENT WORKSHEET: "GPS Navigation," then press OK again to confirm the waypoint. *Note: the latitude and longitude are the numbers at the bottom of the waypoint screen.*
4. As a team, hide the group plastic container. This location will represent a scientific "data site." Mark a waypoint at this location and record waypoint information on the data chart provided on the STUDENT WORKSHEET: "GPS Navigation."
5. Use the following steps to return to the starting point using the *GOTO* function on your GPS.
6. Press the PAGE button until the *Menu* page is displayed.
7. Use the UP/DOWN buttons to highlight *Waypoints*. Press the OK button.
8. Use the UP/DOWN buttons to highlight *List All*. Press the OK button.
9. The 0-9 bar should be highlighted. Press the OK button.
10. Look at the data chart on the STUDENT WORKSHEET: "GPS Navigation," to see which waypoint number is the starting point. Use the UP/DOWN buttons to highlight *this waypoint number*. Press the OK button.
11. Use the UP/DOWN buttons to highlight *GOTO*. Press the OK button.
12. Hold the GPS receiver in front of you walk in the direction the arrow is pointing until you arrive at your starting point.
13. Trade GPS receivers with another group and ask them which waypoint number marks the location of their "data site." Use the *GOTO* function to find the plastic container they hid. Return to the classroom.

GPS Navigation

Directions: Follow the procedure on the STUDENT INFORMATION SHEET: “Using a GPS.” Record Starting Point and Data Site information in the chart below as indicated in steps 3 and 4 of the instructions. Complete questions 1-4 after returning to the classroom.

Description	Waypoint Number	Latitude	Longitude
Starting Point			
Data Site			

1. Which instrument do scientists use to find the location of instrument data sites?
 - A) Magnetometer
 - B) Global Positioning System (GPS) receiver
 - C) All-sky Camera
 - D) Thermometer

2. True or False: GPS receivers are used to pinpoint locations on Earth’s surface.

3. From what source do GPS units receive their information?
 - A) from radio towers
 - B) from satellites orbiting Earth
 - C) from a super-computing station
 - D) from Earth’s inner core

4. To ensure a clear satellite signal, where should hand-held GPS receivers be used?
 - A) inside buildings
 - B) on a crowded city street near buildings
 - C) in a dense, thick forest
 - D) in an open area, such as a field