Using GPS with Students
High Tech Hide & Seek!

Introduction:

As we continue into the twenty-first century, we are continuously being challenged by new technologies. As teachers, we try to use technology effectively inside and outside the classroom. Our goal is to help students take ownership for learning and help students develop practical and critical thinking skills. To meet this challenge, students will be taken to task with an emerging GPS-based activity by using the technology tool, GPS receivers, and , geocaching with rubber ducks.

Geocaching is a great way to instill a curiosity about geography and math. In addition, it provides students with an opportunity to work collaboratively in a group, solve problems and incorporate the characteristics of active, engaged learning in a constructivist learning environment.

What is A GPS?

Launched in 1978 by the Department of Defense, Global Positioning System (GPS) is a satellite-based radio-navigation system which allows users to determine their location anywhere in the world at any time of the day. A GPS unit receives data transmitted from GPS satellites then interprets the data to provide information on longitude, latitude and altitude. Each satellite passes around the earth twice in a 24-hour period at an altitude of about 12,500 miles. The satellites continuously broadcast position and time data to users throughout the world.

Our students will use handheld GPS devices. Each device will receive data from the closest satellites to determine the unit's absolute location of a duck. We are calling this: ***Geocaching with Ducks***. Geocaching is a fun, engaging adventure activity for GPS users. The basic idea is to have individuals and organizations set up caches all over the world and share the locations of these caches on the Internet. GPS users can then use the location coordinates to find the caches.

Background Information for Students:

Geocache comes from the terms geo (earth) and cache (hidden supply or treasure). A bit of trivia: explorers and miners used caches to hide food or other items for emergency purposes and animals (especially squirrels) hide food in caches for later use. Today's geocaches are usually inexpensive little

trinkets or maybe just a written clue in waterproof container with the cache's coordinates. All hidden caches contain the absolute location because these coordinates, along with other details of the location, are posted on the Internet so other geocachers can collect the coordinates and find the cache using their GPS handheld receivers.

Getting Started: Warm up activity
Global Positioning System Classroom Exercise: **Find Daffy**
Materials
pacing and measuring tape, paper, pencils

How did early explorers navigate? They relied on the stars for guidance. Today, instead of using a constellation starts, we use a constellation of navigation satellites orbit our planet, providing us with real-time, accurate information about our position on land, sea, or air.
Satellites help travelers calculate their latitude, longitude, altitude, speed, and direction of travel with accuracy to within 300 feet. If you have a Garmin system in your car, it can tell you the speed you are traveling!
Let's Practice!
Find the Lost Duck: In the Class before using the GPS
1. Explain that the class has to locate a Duck lost in the woods who is trying to relay information about his location by radio to his flock. Ask for a volunteer to play the lost Duck.
2. Ask for a second volunteer to play the role of a **mountain**. Position the mountain about 10 feet from the lost Duck. Assume that the lost Duck can only see the mountain.
3. Ask for a group of students to play the roles of the "Search and Rescue Team – the flock." They ask the Duck to describe his position to them. (Probable answer: "I can only see a mountain.")
(The Team may find it easier to put a symbol for the mountain on a piece of paper and discuss where the Duck might be in relation to the mountain on the map.)
Will this information help the Search and Rescue Team?
4. Add a **second landmark** (another volunteer): a television transmission tower. Position the TV tower about 8 feet away from the lost Duck, so that the Duck, TV tower, and mountain **form a triangle**.
5. The lost Duck now has **two points** of reference for the Search and Rescue Team when asked to describe his location. (as, "I see a mountain off to my right, a TV tower to my left.").
Is the Team able to narrow down his location better? Hopefully, yes!
6. Add a **third point** of reference: a **giant redwood tree** 6 feet away from the Duck, so that the mountain, TV tower, and redwood tree form a triangle around the lost Duck.

7. Now have the Team ask the Duck for his probable location. ("I can see a mountain to my right, a TV tower ahead and to the left, and a giant redwood tree behind me.")
Using 3 points, the Team can now **triangulate** the position of the lost Duck.
8. Explain to students that this is how GPS (Global Positioning System) works. Instead of mountains, TV towers, and other landmarks, it uses highly-accurate satellites as points of reference. Instead of relying on vision to estimate one's location and distance, handheld satellite receivers communicate constantly with the orbiting satellites, triangulating on at least three of them. This enables the receiver to display one's position to within 100 meters.
Find the lost Duck.

GPS Time! Let's Go Outside

Directions and Maps

In two parts, teach your students about the cardinal directions and how to use a compass and maps. The lesson includes outdoor activities.

Follow these steps:

Part 1: Directions

- 1. Sit in a circle outside. Ask students
    - Where's the Sun?
    - What direction is the Sun?
    - Which way is north?

- 2. Use an object, such as a branch, to depict north. Explain the other cardinal directions and use a mnemonic device to aid students' memory, such as the sentence "Never eat soggy Wheaties."
- 3. Ask students to use materials in the area to mark the other directions.
- 4. Explain what a compass is and how it functions.
- 5. Use a compass to test the accuracy of where students placed objects to mark directions in step Make any needed corrections.
- 6. Say the different directions out loud, and ask students to point where the direction is on a compass wheel or on a makeshift wheel outside. You can also hand out cards with directions for students to place on the wheel. For older students, ask them to determine more precise directions, such as northwest or southeast.

GPS Units

Teach students about mapping latitude and longitude lines using GPS units. This lesson is split into three parts. The first part focuses on an activity of mapping the schoolyard to engage students, the second part introduces GPS units and how to use them, and the final part ties the others together by getting students to pinpoint exact locations on the schoolyard map.

Follow these steps:

Part 1: Mapping the Schoolyard Geographically

<u>Materials</u>

Large 4 ft square paper
GPS
index cards
Something to write with

Prelesson Preparation: Create a rough diagram of your schoolyard on a **4-foot-square piece of colored paper**. You will add landmarks and points of interest later.

- 1. Show students your diagram of the schoolyard and discuss the orientation. Which way is north on our school grounds?

- 2. Ask students to sketch a map of the schoolyard in their field journals, noting important landmarks and geography.
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- 3. Brainstorm different elements they'd like to include on the map, such as flagpoles, swings, trees, baseball diamonds, or lights.
- 4. Write the points of interest you come up with on **note cards**, and give one to each student.
- 5. Each student will draw the object listed on his or her note card on small pieces of paper. They will add these to the schoolyard diagram.
- 6. Ask students to attach each item to the diagram where they think it belongs. Use transparent tape so students can move the objects around easily in the next section.

Part 2: Latitude and Longitude Lines and Using GPS Units

In the class, give students the GPS and handout. Explain the parts of the GPS and how it works.

NOW….

- 1. Ask students how they can validate the location of objects placed on the diagram in the previous activity. Brainstorm possible answers.
- 2. Show the students a globe, and explain to them the lines of latitude and longitude.
    - Lines of latitude run horizontally and provide locations north and south, depicting north as a positive number and south as a negative number.
    - Lines of longitude run vertically and provide locations east and west.
    - Explain that each number reflects location in degrees, minutes, and seconds. For example, one reads "47* 15' 25" as "47 degrees, 15 minutes, and 25 seconds."
    - Degrees of longitude vary in size, decreasing as one moves in both directions toward the poles.
- 4. Group students together in small groups (4-5), and equip each group with a GPS unit. Explain that students will take turns read the unit while the other student records readings in his or her field journal.

- 6. Ask students to walk the lower scoccer field from south to north, writing latitude numbers every 50 feet as directed.

- 7. Repeat the step for writing longitude numbers from east to west.
- Have students report back when they finish. Ask if they see any patterns.

Part 3: Finding Ducks

- 1. Explain to students that they'll use the GPS unit to test how accurate their GPS is by locating hidden ducks placed around the field.
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- 2. Give students a list of 5 – 6 coordinates of the hidden ducks.
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- 3. Ask students to take GPS and enter each coordinate. Once they've entered them, it's time to go forth and seek missing ducks!!! Each duck will have a word on the bottom. When they find it, they must write down the word.
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- 4. Once a duck is found, they have to unscramble the words to form a sentence.

Assessment: How did your students do? Here are some ways to assess your students' comprehension of the material, reflective of grade level.

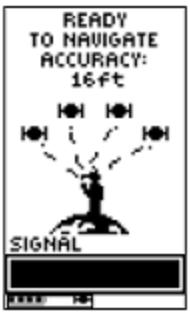
- **Exceeds standard (4):** Student was able to identify the correct latitude and longitude coordinates ten out of ten times.
- **Meets standard (3):** Student was able to identify the correct latitude and longitude coordinates nine out of ten times.
- **Below standard (2):** Student was able to identify the correct latitude and longitude coordinates eight out of ten times.

Juicy Geography – great site!

http://www.juicygeography.co.uk/gpsschool.htm

Getting Started

How does GPS work?



A good initial activity is to turn the handheld unit on and get students to observe the initial page which shows the unit acquiring a satellite.

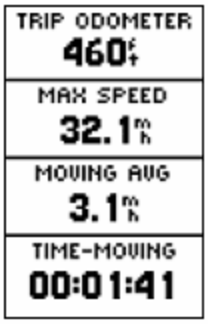
What is a waypoint?

The next stage might be to get students to learn the basics of creating a **waypoint** (or GPS location) On the Geko 201 this is just a matter of pressing the OK button for a couple of seconds. It is good to show students how to edit the names of waypoints.
demonstrated.

- **What is a track?**

Once the basics of waypoints have been understood, the next stage is to get students to observe the electronic 'breadcrumb trail' that is left behind as you walk. This is the **track**. and is visible on the map page of the Geko 201. Students should be shown how to clear the track log and save and name new tracks.
The track can be used to retrace your route while outside, and it can also be uploaded to a map or Google Earth to see where you have been. Individual tracks can be saved and named for use in various projects.

What information can be recorded with a GPS?



Students should be shown how the unit monitors their speed, elevation and other variables The trip computer page illustrates a number of data fields that can be displayed on the screen.

Objectives:

Standard Nag 5.1 e, f
Develop an awareness of Global Positioning Systems (GPS) and how people use them.