ED 5661 Mathematics and Navigation Lesson Plan 2

Lesson Overview:
This will be a continuation of the lesson for a Freshman Geometry class from the previous day that focused on introducing latitude, longitude and finding location on a map provided. The activity today will reinforce the skills from day 1, but will add 2 different tools. The students will use the website www.USGS.gov and a handheld GPS to reinforce the topics and introduce error estimations.

Sources Consulted:
This lesson is a continuation of Lesson Plan 1. Much of the information and techniques are the same as day one. The conversion of the latitude and longitude was done in class following a Powerpoint lecture by Dr. Roblee. The definition of the nautical mile equaling a minute of latitude was part of a precourse activity and was used throughout the course both in-class and on the boat. Finding the position using a chart and finding the distance between 2 points using the changes in latitude and longitude was done multiple times in class both in the classroom and on the water. We also found the estimated position (using charts) and actual position (using landmarks and GPS) and found the error in our estimate compared to actual.
The students will be using a copy of a topographical map found on Garmin software package for the local area and will be using the website www.USGS.gov map locator to find position.

Materials Needed: (each group of 3 will need one of each item)
- Unit conversion table
- Rolling ruler
- Divider
- Handheld GPS
- Photocopies of Michigan topographic maps for local area from mapping software.
- Calculator
- Computer with internet access.

New Vocabulary:
There is no new vocabulary introduced today. We will just be expanding concepts from the previous day and introducing other mathematical techniques.

Focus Questions:
- How can we find our position more accurately on a chart?
- How does a GPS give our location?
- What are some sources for online mapping aides?
- What do you think USGS stands for? What do you think this agency does?
Learning Objectives:
After completing this lesson, students will be able to:
1. Find their approximate location on a map and determine the latitude and longitude in both D° m's and D mm.mm
2. Find the distance between 2 points using the latitude and longitude.
3. Use the key on a map to estimate the straightline distance between 2 points.
4. Use a gps to find their location in D mm.mm.
5. Use dimensional analysis to find the error in distance between the gps and approximated position to the nearest foot.
6. Use the USGS website to find their location in D mm.mm and compare it to the GPS coordinates.

State Benchmarks:
STANDARD L1: REASONING ABOUT NUMBERS, SYSTEMS, AND QUANTITATIVE SITUATIONS
L1.1 Number Systems and Number Sense
L1.1.5 Justify numerical relationships
L1.2 Representations and Relationships
L1.2.3 Use vectors to represent quantities that have magnitude and direction, interpret direction and magnitude of a vector numerically, and calculate the sum and difference of two vectors.

STANDARD L2: CALCULATION, ALGORITHMS, AND ESTIMATION
L2.3 Measurement Units, Calculations, and Scales
L2.3.1 Convert units of measurement within and between systems; explain how arithmetic operations on measurements affect units, and carry units through calculations correctly.

Classroom Activities:
The day will start by reviewing the techniques learned yesterday. The students will be question on how to convert between the 2 forms of lat/long measurements and will describe how to find the distance between the 2 points of interest they found. We will discuss techniques they found that would increase their accuracy and things that hurt.

The discussion will turn to other methods of finding location including handheld GPS and online mapping software including Mapquest, Google maps and USGS maps and we will discuss any experiences with them.

The student groups will be directed to the website www.USGS.gov and to the maps, imagery and publications. From there they will navigate to the Map Locator and experiment with the search engine for a few minutes. This will give them the chance to investigate the site a little. The handout (included) will direct them to find 2 locations. The northwest corner of the Calumet High School and the Northeast corner of the bleachers on Aggasiz Field. They will navigate around the site, and write down the coordinates of the 2 points to the nearest thousandth of a minute and use the techniques from yesterday to find the distance between the 2 points.

Once each of the groups has had time to determine the distance, I will pass out the handheld GPS units. They will turn them on and navigate to the settings feature and ensure that they are set to the proper display D mm.mm. The class will head outside to capture the location of the 2 points on the GPS units and will be comparing the 2
coordinates mathematically and finding the distance both mathematically and using the GPS. All of the questions will be found on the worksheet provided and each student will be filling out their own sheet.

Outside, the students will use the GPS to capture the 2 points and plot waypoints on the GPS so the locations will be saved for use in the classroom. When they get to the second point, they will use the GPS to determine the distance electronically which they will record and compare to their finding. The GPS will give the distance to the nearest tenth of a mile, but they will be calculating the distance using the difference in latitude and longitude.

Following completion of the activity of the day, the students will take the same test as on the first day to further assess their new understanding.

**Assessment:**
The students will be informally assessed throughout the entire activity through question and answers. They will formally be questioned on a pre-post test that will be given on the day before the 1st day of the activity and the day following the 2nd activity. They will also be assessed using 2 worksheets that will be completed by each student and turned in following the days activities and will be primarily completed in class working with their small groups, but the pre-post tests will be done independently. Both assessment tools are provided.