Lesson 6 – Metrics and Measurements *(optional)*

Background

Reading a map can be challenging for students. One of the most challenging skills is using a map to locate items or using it to locate the distances between places. Scientists use many different scales to measure distances between planets, comets, and asteroids in our solar system. To understand how to measure objects on a map, students must know how to use a map scale and the metric system.

The best method for getting the students more comfortable with using maps is for the students to generate their own maps and manipulate the map they generate to find locations and measure distances.

Teacher Notes and Hints

Prior to the lesson

- Preview Part A of the activity with the students and relate the lesson to a variety of real-life situations. They should know how this lesson relates to their upcoming mission work, and should also be familiar with the idea of using a map to find their way to different locations. (Perhaps their parents used a map on vacation; they may have used a map of an amusement park to find rides.)
- Dividing the class into teams works well. Sometimes students enjoy the challenge of competing with one another.
- Have the graph transparency and overhead projector ready for generating the map along with the students and for labeling the parts of a map. If you are using the board, use a graphing (chalked) tool, if available, to draw grid lines on the board.
- The students' worksheet/procedure has been written in order to provide you with flexibility; there are a number of extensions and modifications you can make according to grade level, mastery, and available space. You can make these without having to modify the student directions.
- Part B (optional) utilizes scale distance to extend the mapping concept. This could be used for 5th graders, but may be too difficult for 3rd of 4th graders.

Skills and Objectives

Students will be able to:

- Generate a map of their classroom
- Will work cooperatively to decide which items in their classroom will be on their map
- Identify specific locations on a map
- Use map symbols
- Develop knowledge and understanding of map scale
- Become familiar with parts of a map: compass points, legend, scale
- Practice measuring skills using a ruler and metric units

Activity Overview

In Part A of this activity, the students will learn how to make their own maps of the classroom on graph paper using a variety of reference points. They begin by choosing a reference point and working out from that point to plot major locations in the room and major items (pencil sharpener, atlas, science cabinet, etc.).

After the students have made their own maps and have reviewed and labeled the parts of a map, they use the maps to find different "mystery" items in the room when given the measured locations. If they have measured correctly, they will identify the selected item.

In Part B (optional), students can then practice their coordinate knowledge by mapping a less familiar setting (the library, computer room, another classroom) and finding objects in those areas. They will select a scale to represent distances on their graph paper maps. Using north/south/east/west directions, they count the squares toward a location and then calculate the actual distance according to the chosen scale.

Vocabulary

compass rose – a symbol on a map with points for direction

legend – an explanatory table or list of symbols on a map or chart

scale – a system of marks at fixed intervals used as a standard for measurement

Key Concepts

1. Scientists use maps to find locations and distances between objects in space.

2. Coordinate maps use fixed points on x- and y-axes to accurately indicate a specific location.

Materials

- Graph paper
- Markers
- Rulers
- Transparency graphing sheet (optional if using the board)
- Overhead projector (optional if using the board)

Metrics and Measuring Activity – Part A: Making a Map and Locating Points

Procedure

Preview the lesson objectives with the students. Distribute graph paper (1 cm graph paper works best) and have the graph transparency and the overhead ready for use.

Begin to generate the classroom map on the overhead transparency while you talk the students through the process. Have them draw the different reference points on their maps along with you and ask them to suggest each next step; problem-solve/trouble-shoot their suggestions. They will make fewer mistakes as they progress.

(Check their progress so you know they are copying down the correct information.)

Label the main points of a map on the "working copy."

Have several objects ready that will be "mystery objects" for the students to find.

After they have completed the classroom map, show them how they can find their way to a "mystery object" by following and counting the grid lines on the graph paper. (You must have several objects identified by this time. You can do this easily as you go, counting the squares north and then east to the pencil sharpener, for example, while the students are drawing the different locations during the discussion.)

You can present more difficult objects as you go and can make this into a game. Give them directions to an object that needs some description because there are multiple objects in one location. For example: 10 squares east of the door, 2 squares south, 5 squares east, 6 squares north – find the black rectangular object (an eraser).

Check for understanding by distributing a list of directions to "mystery objects" and checking the students' responses.

Note:

Using 1 cm graph paper allows them to move on to measuring in cm's and not just counting squares.

Counting squares sets up the x, y coordinate work they can do in another activity.

Using different sized graph paper will add to the difficulty for higher grade levels. Students will have to measure in cm's and then convert using a selected scale (for example, 1cm = 1 m or 1 ft).

Metrics and Measurements Activity – Part B: Using a Map Scale *(optional)*

Skills and Objectives

Students will be able to:

- Generate a map of an assigned area
- Work cooperatively to select a scale to use when mapping their area
- Measure a distance to a specific object
- Convert the measured scale distance to an actual distance
- Understand the reasons for using scales in everyday situations

Procedure

Choose an area of the school that the students are not as familiar with as their classroom. (You may switch classrooms with another teacher, take the students to the school library, or go out in the playground area.)

Preview the lesson objectives with the students. Discuss the concept of using a scale to represent a certain distance on a map and relate this to real-world situations by displaying local or state maps.

Distribute graph paper (I cm graph paper works best).

Direct the students to map the area. (For third or fourth graders, you should draw at least two borders or walls for them and label as x- and y-axes so they already have points of reference. Fifth graders should be able to do this by following your oral directions.)

Check their progress often so they do not get too far off track if they make mistakes.

When their maps are finished, discuss scale as a group and decide on the scale to be used to find distances.

Have them measure the distance on the graph paper to several locations. Using a scale, have them figure out calculated distances. (For example, if you had the students use 1 cm graph paper, you may choose that each 1 cm would equal 1 meter, or one foot depending on the area you choose for them.)

Note:

The students will not have drawn maps that will be accurate to scale if they check the actual measured distance. This does not detract from the concept; you can use this opportunity to discuss how difficult it would be to make an accurate map to scale.

Have them record their measurements and calculated distances on the student worksheet.

Extensions

If you divide the class into teams, the teams can write directions to a "mystery item" and trade directions among teams. The teams then compete to find out who can correctly find the mystery object. Assessment of the "winners" depends on the quality of the directions, scale, and map and how well the directions are followed.

Distribute a city or state map and have the students find the distances between different locations using the scale.

You may want to make a map of a more "complicated" area for assessing mastery of the map skills learned. You may assign this to different classes; the classes then trade maps to find the locations and distance to different objects.