

Best Practices of Technology Integration

Title: Mapping A Stream

Submitted by:

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Subject Area: Science, Math

Intended Grade Levels: Seven and Eight

Description:

Students will map an actual waterway. Stream reach lengths, stream transects, compass readings, scale determinations, and accurately recorded data is used by student teams to create a scale map of a stream. Map scale is 1cm = 50 cm, and the length of the stream mapped is 500 - 750 m.

Narrative:

The stream-mapping project is a success for several reasons. The lesson involves accurately drawing a repeatedly visited stream. The full color scale drawing includes windfalls, plant cover, types of streambed composition, and landmarks such as trees, boulders, and mass movements such as slumps. The data used to create the map is gathered over 10 weekly field trips made to the stream during the school day. Students enjoy leaving the school building during the day, especially during the spring weather after a long winter.

The project requires discipline, teamwork, and stresses individualized strengths of each student to complete the project. Some students shine in one area, other students in another, but overall the specific talents of each student complement the mapmaking. Underachieving students often show remarkable aptitude in the work taking place outside of the regular classroom.

Students see progress over time. The beginning of the plan teaches students to set a rectangular table to scale, by the end of the project these same students are making transect measures of a curved portion of an irregular stream bank and plotting this data onto paper. Progress is best seen, however, as the map begins to take shape and stretches over several meters.

Mapping the stream encourages the Standards of Authentic Instruction in that interpreting the collected coordinates and translating them onto a piece of paper is not an easy task. Students must be proficient at taking measurements. Students are required to analyze and evaluate these measurements to make sure that one set of data points corresponds to the next. The final product is a large map which students create by practicing proper measurement and using scale and orientation.

Basic forms of technology create a link to math and science and are used to collect data and complete the map. Both compass reading and using a protractor help students make and record the necessary measurements. One of the strengths of this project is that students are in the field using cartography tools to collect field data used to synthesize the map in the classroom.

Curriculum Benchmarks:

MI.SCI.I.1.MS.4 Use measurement devices to provide consistency in an investigation. (Key concepts: Documentation— laboratory instructions. Measurement units—milliliters, liters, teaspoon, tablespoon, ounce, cup, millimeter, centimeter, meter, gram, nonstandard units. Measurement tools: Balancing devices, measuring cups and spoons, measuring tape. Real-world contexts: Cooking for groups of various sizes; following or altering laboratory instructions for mixing chemicals.)

MI.SCI.I.1.MS.6 Write and follow procedures in the form of step-by-step instructions, recipes, formulas, flow diagrams, and sketches. (Key concepts: Purpose, procedure, observation, conclusion. Real-world contexts: Following a recipe; listing or creating the directions for completing a task.)

MI.SCI.II.1.MS.3 Show how common themes of science, mathematics, and technology apply in real-world contexts. (Thematic ideas: Systems-sub-systems, feedback models, mathematical constancy, scale, conservation, structure, function, adaptation. Real-world contexts: See Using Scientific Knowledge.)

Total Amount of Time for Lesson

The time to complete the lesson varies depending upon the length of stream being mapped. To accurately map a short section of the stream, 3-5 meters for instance, the lesson will require one hour per day for 15 to 17 days. Accordingly, longer stream segments will require more time. It should be noted that as the students continue with their mapping activities they will become more proficient and longer stream segments will be mapped within a shorter time period than would initially require.

Materials/Hardware/Software

The materials required for mapping are simple and straightforward:

- ruler - metric or standard, teacher preference;
- meter or yard stick - teacher preference;
- 15 sheets 48" by 24" white poster board;
- compass - 2 for each student team;
- waterproof measuring cloth tape - 100 foot or 30 meter - teacher preference;
- 25 foot/10 meter measuring tape, teacher preference;
- round protractor/compass
- large variety colored pencils;
- plenty of #2 pencils; and
- 1 notebook per student group.

Teacher Preparation

To prepare for this lesson teachers must be able to read a compass, draw to scale, and use a tape measure.

Prerequisite Student Skills

Students will master this lesson if they can read a compass, perform simple mathematics, and use a light touch when drawing.

Student Activities/Procedures

The activities leading up to drawing a full color, detailed scale map are designed to build one upon the other so that within a short time students progress from measuring rectangles and straight lines to making scale drawings of naturally occurring curves in a stream.

Day 1

Students use rulers to measure perimeters of desks, distances across a classroom, in short, any variety of distances from point A to point B. Accuracy and precision are both stressed to assure students repeatedly make the correct measurement.

This step requires 20 minutes.

Using lecture, students are next introduced to the concept of scale in drawings.

Lecture step requires 30 minutes.

Day 2

The concept of scale is reviewed in a recitation period. Student activity is to then measure tabletops and figure the proper scale to use to put an outline of the tabletop onto a standard sheet of graph paper. Close work between student groups and the teacher is imperative during this activity.

This step requires 55 minutes.

Day 3

Measurement and scale drawing is further stressed as students measure the room perimeter and any tables, desks, etc. in the room and then draw an outline of the room and the major pieces of furniture.

This step requires a 55-minute period.

Days 4, 5

Students are taken to a portion of the school hallway, preferably one with several doorways, and other structures such as fountains, trashcans, etc. Students measure all pertinent aspects of the hallway section and record these measurements in a notebook. Students are told this is only trip allowed to the hallway.

This step requires two 55-minute periods.

Day 6

Students use measurements taken during Days 4 and 5 to make a scale drawing of the hallway section. Inclusion of doorways, fountains, trash cans, etc. in the drawing is required for full credit.

This step requires 55 minutes.

Day 7

Using spray paint, teachers apply to the outside ground two wavy lines which represent the two banks of a stream. The lines should be between 10 - 20 yards in length, vary from 1 to 4 feet apart, and have both straight passages and curved portions. Students then use these lines to practice making stream measurements. Measurements are taken as follows:

A. DETERMINING DIRECTION AND LENGTH

- starting at one end of the lines, students stand in the middle between the two lines
- a straight reach beginning at the end of the painted lines to the first curve is selected
- a compass is used to determine magnetic north of this reach

- the compass is used to take the degree reading of this first straight reach

B. TRANSECTING STREAM BED

- measure down the center the length of the first straight reach
- starting at one end of the curved painted lines, measure stream width
- every 50cm along the reach make another measurement of stream width
- continue in this manner until the entire length of first reach is transected every 50cm
- repeat until entire stream drawn with paint is transected
- to avoid marking the same portion of the same stream twice or more flags are used to indicate a reach that has been measured.

After this procedure, students will have set of data which includes for each straight reach a:

- length;
- compass bearing;
- transect widths; and
- number and order of each reach.

This procedure requires 55 minutes.

Days 8, 9

Students will use measurements taken of the painted stream banks to sketch these banks onto a sheet of poster board. To do this requires that the following steps be taken.

- establish scale to be used
- establish magnetic north point on the paper
- determine where to begin drawing on poster to fit the entire stream using the least number of sheets
- draw starting point compass direction of reach relative to established magnetic north
- mark the beginning width of stream bed at starting point on poster
- proceed to mark every stream width according to scale set earlier
- work until entire stream bed is drawn onto poster board.

This procedure requires two 55-minute periods.

Day 10

Transport students to stream site. Establish beginning and ending locations for prospective map. Then, and this is important, allow to students to run around, jump in the stream, and basically have fun while the teachers sit back and let simply make sure no one gets hurt. THIS STEP IS NECESSARY.

This procedure requires 55 minutes PLUS travel time.

Day 11

Procedure for Day 11 will require using the stream banks that were previously made using spray paint. If this stream is no longer available a new 'stream' will need to be made. Break class into groups of 4. Each group will need to be familiar with procedures learned during Day 7. Each person in the group will assume one of the following:

- compass reader
- two people to determine each straight run of stream bed, also these two will measure the length of each straight run
- one person to mark the transects at each 50cm along the stream and measure the width of each transect
- recorder of the following data:
 - degree reading for each run
 - number of transects along each run
 - width of each transect reading taken
 - important topographical features along the run

This procedure requires 20 minutes.

Next, take groups outside and either using spray painted stream bed from Day 4 OR simply using another spray painted stream, have the groups each take a series of measurements so that each student becomes familiar with their position within the group. This is meant as a practice before the actual first trip to the stream.

This procedure requires 30 minutes.

Day 12

Make first field trip to the stream. Students break into their groups and proceed to take measurements of the stream to use for mapping in the classroom. The students have done this work in practice format using the painted stream outline but this is the first experience at the actual stream. Teacher involvement mainly requires that students are following the step by step procedure as outlined for Day 7. The students work downstream as far as possible in the time allotted for work in the field. Travel time also must be incorporated into the process, this varies depending on location of the stream relative to the school.

Days 13 - 15

Students use data and measurements taken at the stream the previous day to begin drawing map of the stream. The procedure as outlined for Days 8, 9 sketching the map of the painted stream is followed, only at this time the students are mapping the actual stream. Time requirements vary from two to four 55-minute periods, a major factor is the length of the stream which was measured for mapping on Day 12.

Day 16

Student groups place each drawn and mapped section of the stream in the order that corresponds to the actual stream. Once the correct order of each of the sketches is made they are numbered on the back to assure that the correct order of the sketches is maintained throughout the remainder of the project. After all pieces are placed in their correct position and double checked, the student groups then begin using colored pencils to color the map. It is of major importance that a delicate hand be used when coloring, and that all students use a similar shading stroke to assure as much color uniformity as possible throughout the overall map.

Time required varies, but usually 55 minutes.

Day 17

Students place each section of the map in the proper place to correspond to the actual path of the stream. The map is mounted on the wall, and a compass rose and scale marker are placed at the lower right-hand corner. The finished product is admired.

Time required is 55 minutes.

ASSESSMENT/EVALUATION

Student performance is assessed by grading on participation in the field and classroom. Proper attitude on the part of the student is considered. A willingness on the part of the student to undertake different chores is also important. Finally, students must demonstrate solid comprehension of all aspects of the mapping.

Technical impact is measured by determining individual student proficiency using the tools of the trade such as compass, circular protractor, and measuring tape both when making field measurements and translating the data into the drawn map.

Benchmarks are graded by:

- student knowledge of scale when drawing map;
- making accurate and precise measurements; and
- following a complex set of directions beginning with taking measurements in the classroom to completing a colored map drawn to scale.