Playground Measurement

Summary

This lesson will help students to learn to measure more accurately to the nearest centimeter and apply that knowledge to measuring perimeter.

Materials

12-15 magazines

For each pair:

- *Centimeter Grid Paper*
  Ruler
  Metric measuring tape
  White wax pencil
- *Playground Measurement* worksheet

For each group:

20-8" bendable straws
6 pipe cleaners
Oil-based modeling clay
Plastic bottle caps--not to exceed 1 1/2 inch in diameter
Scissors
String

- *Construction Guidelines* handout
- *Construction Log* worksheet

Additional Resources

Book

- *Measurement Mania*
  , by Lynette Long; ISBN 0-471-36980-2

Background for Teachers

Prior to this lesson, students should have been introduced to metric measurements of length, in particular decimeters and meters. The purpose of the lesson is to help students measure more accurately to the nearest centimeter and apply that knowledge to measuring perimeter. This lesson usually takes three to four days to complete and assess. The format of this activity can also be used to teach customary measurements.

Intended Learning Outcomes

2. Become mathematical problem solvers.
3. Reason mathematically.
5. Make mathematical connections.
6. Represent mathematical situations.

Instructional Procedures

Invitation to Learn

Give one magazine to each pair of students. Ask them to look for structures, objects, or events where accurate measurement is crucial (e.g., bridges, stadiums, homes, etc.). Have students share their pictures with the class and why they think accurate measurement is critical to their example. Emphasize units of length, but if students include measurements relating to time or capacity, do not discourage them from sharing.

Instructional Procedures

To help students gain a concrete concept of the length of 1 centimeter, provide each pair with a *Centimeter Grid Paper*. Students measure the length of the tops of their desks using a square centimeter. After the students have measured the length, ask them what problems they faced using a square centimeter as a measuring tool. Give them a metric ruler and tape measure. Allow them to choose which measuring tool they would like to use to measure the width of their desks. Report measurements in centimeters. Use measurement to find the perimeters of their desks.

As a class, find a rectangular or square object in the classroom to measure. Before measuring, have students estimate the length, width, and perimeter of the object. Ask students how the methods of finding perimeters of rectangles and squares could be applied to finding the perimeter of other objects. Practice using classroom objects.

Provide each pair with a ruler/measuring tape. Instruct them to find an object of their choice in the classroom to measure. Allow them time to experiment with each of the measuring tools to determine which method is the most efficient. Ask the groups to share measurement information about the objects they measured. Discuss which groups used rulers, which groups chose to use measuring tape, and why.

Ask the students if they could record their measurement without changing its value to other units of metric measurement, such as decimeters or meters. Have the students convert their measurement to another unit. If needed, review the conversion process.

Ask students how they recorded their measurements. Follow by reviewing proper notation (if necessary).

Ask for an example of something in the room that appears to be longer than the measuring tape.

Model an estimation "think aloud"--"I think the structure will be at least _____cm in length because I know a _____ measures _____cm."

Model how to use the measuring tape on that item, emphasizing the accurate marking of the end of the tape using the wax pencil--and how to continue measuring to that point. Model how the measurement should be recorded.

Give each pair a measuring tape and *Playground Measurement* worksheet.

Note: Before going to the playground, place students in pairs. Use orange cones to designate the physical boundaries for the activity. Designate an area for early finishers to sit and wait while others finish, or challenge early finishers to measure other structures.

Make sure the students understand how to record the measurements to the nearest centimeter.

Have the students estimate the measurement of each playground object before measuring it.

Students record their estimates and actual measurements on the *Playground Measurement* worksheet.

Share findings with the class and if major discrepancies in data collection arise, have the students collaborate to find a solution.

Constructing a Playground Model

This continuation activity is intended to be completed the following day.

Each group of three students will receive a playground structure construction assignment. Refer to the *Construction Guidelines* handout. Students use pipe cleaners, straws, scissors, clay, plastic caps, paper, and string to complete the assignment.

As a class, discuss which structure(s) should be the largest and smallest. Determine the exact height for those items. This gives groups a starting point for determining the size of their

structures. To accommodate students who are struggling, assign them structures whose measurements have been predetermined for them.

One student from each group should be in charge of collaborating with other groups to help determine the design and size of their group's structure. For example, the group in charge of constructing the monkey bars needs to collaborate with the group constructing the slides to ensure the slides are not as tall as the monkey bars. The student in charge of inter-group collaborating must visit all of the other groups before construction begins.

After each group has completed the construction of their model, prepare a space in the room to set up the playground. A large table or empty floor space works well. Each group presents their model and briefly describes measuring decisions they made. Place each structure to create a complete model playground area.

As a class, design a fence or boundary line to surround the playground (perimeter).

Students complete their *Construction Log* worksheets and place in their math journals.

Extensions

Students who need an extra challenge can research engineering failures in relation to measurement, for example the Johnstown Dam (1889) and Charles De Galle Airport (2004).

Use construction or grid paper to make a "bird's eye" scale model of all of the rectangular, square, and linear objects in the classroom. Measure the actual objects before building a 1:200 scale model of the room, including the rectangular, square, and linear objects in the classroom. Be sure to include the perimeter of the classroom. Artistic additions and detail may be included to give the model a more authentic feel. This incorporates the concept of area.

1 cm on paper = 200 cm in actual size

actual size = scale size on paper
200

As a reinforcement activity, students use a trundle wheel to measure the shortest route to the lunch room, library, playground, etc.

Play *Centimeter Centipede* to provide extra support with the concept and measurement of centimeters and decimeters.

Objective: Using estimation, get as close to the edge of a piece of 12" x 18" paper as possible without going over.

Game Instructions

Materials

For each pair:

Die

12" x 18" construction paper

- *Centimeter Grid Paper*

In pairs, students take turns rolling a die. The number that is rolled determines the number of centimeter squares the student will place in a line on the paper, creating a "centipede."

As students near the edge of the paper, they choose whether to stop or keep rolling. Once they decide to stop, they may not roll again. However, if they roll too high of a number, causing their centipede to run off the paper, they lose.

Have the students give the length of their completed centipede in centimeters.

Family Connections

Using a piece of string, measure the smiles of those you live with. Measure the length of the

string using a ruler or measuring tape to see which of your family members has the largest smile.
Play *Guess The Object In The Room* by measuring an object in one of the rooms in your house. Take turns leaving the room, as one or two people choose an object in the room to measure. Have the rest of your family return to the room and give them the measurements of the item. They must then guess the items based on the measurements provided.
Choose two or more houseplants. Over a period of two months, measure and graph the differences in their growth.

Assessment Plan

Materials

Spool of string or lace
Posterboard cut in squares, rectangles, and nonstandard shapes

Evaluating the student's completed *Playground Measurement* worksheet provides the teacher with information on student understanding.
Students measure various shapes made from posterboard and calculate the perimeter. Using this information, they cut the appropriate length of lace or string to "frame" the object. If the lace frames the perimeter without overlapping or falling short, the perimeter was calculated correctly.
Invite a parent or member of the community whose career relates with measurement to make a presentation to the class. Before the presentation, students create a list of measurement related questions for the presenters.
Each student chooses two objects in the classroom to measure length, width, and perimeter. Write a riddle for each object using the measurement information. Students exchange and solve riddles.

Bibliography

Research Basis

Gerik, I. and Kavspvec. M. (1999). Differences in cognitive processing Observed with EEG. *Educational Technology Research and Development*, 47,(3).5-14
The activities incorporate the use of nonlinguistic representations. Examples of nonlinguistic representations found in the lesson plan are using manipulatives and constructing making physical models. "The more we (teachers) use both systems of representations--linguistic and nonlinguistic--he better we are able to think and recall knowledge. It has even been shown that explicitly engaging students in the creation of nonlinguistic representations stimulates and increases activity in the brain."
Sweet, D. (1993) Performance assessment. *Consumer Research*.
The assessment activity was developed to use the benefits of performance assessment. Research suggests that performance assessment provides impetus for improving instruction and increases student understanding of what they need to know and be able to do. "Performance assessment requires students to structure and apply information, and thereby helps to engage students in active learning."
Dance, R. and Moore A. (1997). A characterization of aspects of the culture of a successful mathematics classroom in an inner city school. College Park: University of Maryland.
Research conducted by Rosalie Dance and Ann Moore characterizing aspects of the culture of a successful mathematics classroom provided evidence that classroom activities offering "a sense of community," and "atmosphere of challenge" had a positive affect on student's responses to the study of mathematics. The activities in this lesson plan were designed with the intent of maximizing the benefits of working together as a learning community (group learning and activities) to solve challenging problems.

Authors

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