Early Development of Measurement Concepts

Measurement is not an easy topic for students to understand. The data from both international studies and from NAEP consistently indicate that students are weaker in the area of measurement than any other topic in the curriculum (Thompson & Preston, 2004).

How should we teach early measurement skills based on the articles and what tasks or activities do the authors recommend?

- According to the article, "*Assessing Children's Understanding of Length Measurement*", the author points out three important measurement concepts for students to understand: Transitive reasoning, use of identical units and iteration. Transitive reasoning is a concept based on comparison and is a skill that develops over time, but should be introduced early on. Identical units is also important for students to understand when measuring with either standard or non-standard units. "If an accurate measure is to be gained, the units of length used to measure an object must be identical" (Bush, 2009).

- Teachers need to provide opportunities for students to use objects for direct and indirect comparison in order to make judgments about length. One task recommended was to draw chalk lines of different lengths and some distance apart outside. Ask the students to suggest how the lines could be compared if they cannot be moved. Encourage students to decide what sort of object may be used. Have students measure with the outside object and discuss which line is longer.

- Too much reliance on pictures and worksheets rather than hands-on experiences and "a focus on skills with less attention to the concepts of measurement may be a factor in the poor performance of measurement understanding among students" (Thompson & Preston, 2004).

- One task suggested, used the book, *Inchworm and a Half* by Elinor Princiz. An example of using a "hands-on" task would be having students use paper cut outs of an inch worm to measure different fruit. The authors chose "to develop and use fractional models for length measurement by representing the different lengths of the worms in the story: 1 whole worm, 1/2 worm, 1/3 worm and 1/4 worm" (Moyer & Mailley, 2004).

- Keep the concept of measurement relevant to students. Show students all the things in our daily life that we measure: time, distance on a map, science, cooking, act.

- Exposing our child, and perhaps yourself, to some of the history of measurement may prove very useful in your endeavors. Who is responsible for the metric system of measurement?

Reference Page

Bush, H. (2009). Assessing Children's Understanding of Length Measurement . *Teaching Children Mathematics* , 29 - 32.

L.Haury, D. (2003). Fundamental Skills in Science: Measurement. *ERIC Clearinghouse for Science Mathematics and Environmental Education* , 237-239.

Mailley, P. S. (2004). Inchworm and a Half: Developing Fraction and Measurement Concepts Using Mathematical Representations. *Teaching Children Mathematics* , 244 - 252.

Thompson, R. P. (April 2004, Volume 9, Issue 8). Integrating Measurement across the Curriculum. *Mathematics Teaching in the Middle School* , 436 - 441.

What are the major misconceptions that students may have or develop related to this topic? How will you determine if each student understands the topic?

Common Misconceptions

- "By fourth grade less than half the students were able to construct units and separate their own actions from that of an instrument used to measure time" (L.Haury, 2003).
- Measurement is only linear.
- The metric system is more accurate than other measurement systems (such as the English system).
- You can only measure to the smallest unit shown on the measuring device.
- An object must be "touched" to be measured.
- The only way to measure time is with a clock or a watch.
- The density of two samples of the same substance with different volumes or shapes cannot be the same.
- Because measurement is such a common feature of modern life and seems nearly intuitive to adults, there seems a danger that explicit, direct instruction in measurement and the instruments of measurement may get less attention than is warranted unless teachers maintain continuous attention both to the concepts and the processes of measurement at all grade levels.

Assessing Understanding

- Measurement, like any other area of math, is not simply the knowledge of measurement facts. Printing charts such as a liquid measurement chart is not helping your child understand measurement. "It is simply giving them the answer" (Bush, 2009).
- Hands on activities and discussion "help foster a deeper understanding when teaching measurement, and really any concept" (L.Haury, 2003). Hands on activities are also useful when assessing learning. (Student's can measure objects, make ice-cream or any other recipe, measure different temperatures)
- To assess student's understanding of Transitive reasoning, "the following task was provided: The Straws and the Barrier" (Bush, 2009). In this task, students are observing different lengths of straws, comparing lengths using the "loose" straw provided and using language such as, *longer than and shorter than*.
- Assessing students understanding of Identical units is important and the idea that, "if an accurate measure is to be gained, the units of length used to measure an object must be identical" (Bush, 2009). Bush suggests using the task, The Straw and the Mixed Paper Clips. In this task students are given a handful of different sized paperclips and a straw. They are to measure the straw using the paperclips. Do the student's use the same sized paperclips when measuring?

How are the suggestions similar or different to how you were taught about measurement?

- One difference, is I remember beginning my measurement understandings using a ruler and learning about inches and feet. I don't remember ever learning about the concept of measurement as a whole. Tasks where student's were asked to measure objects with different objects could have been helpful to me when younger