

I. What do we want to learn from this lesson? (*Research Lesson Goals for Teachers*)

Do the students understand how to measure to the nearest inch, $\frac{1}{2}$ inch, $\frac{1}{4}$ inch and $\frac{1}{8}$ inch? Do the students understand the concept of equivalent fractions? Will working in depth to create their own ruler help them understand the value of the markings on all rulers?

II. The overarching Lesson Study goals are:

Students will use self-created materials to measure different objects to the nearest inch, $\frac{1}{2}$ inch, $\frac{1}{4}$ inch and $\frac{1}{8}$ inch, allowing them to feel more confident about using a ruler. Student will transfer understanding of fractions and be able to apply it to measurement as well as understand the concept of equivalent fractions.

Steps of Research Lesson	Students	Teacher	Evidence of student learning/engagement	Observer's Comments: Things to think about for next time
Building a context for the lesson 7 minutes	Doing: Recall prior knowledge of measurement – students recall examples. Students move to table with groups. Using their pre-cut licorice ropes to measure the length of their tables.	Doing: Can you give me some examples of ways we measure? <i>Teacher writes and categorizes measurements mentioned by students on board or overhead.</i> Divide students into groups. Pass out licorice ropes. How many pieces of your licorice will it take to measure the length of your table?	Students volunteer, participate, and contribute. Students comment on or correct themselves. Students are not just playing with the licorice rope.	
	Possible Questions or Misconceptions: Why can't we just use our rulers, etc.?	Possible Responses/ Questions to Pose: If students ask if the licorice is different sizes, rather than answering, ask them to figure it out.		
Laying the framework for the learning experience (<i>Launching the activity</i>) 10 minutes	Doing: Deliver licorice samples, discuss relationship between pieces. Have each group bring up their licorice and lay side by side so that they can see the relationship between each piece. Have the students use what they have learned today so that they may make their own measuring tools, ie. Rulers.	Doing: Using overhead fraction bars to represent licorice. Overhead fraction bars show the relationship between the licorice and fraction parts. Leading students to equivalent fractions. -Write symbolically -Show with fraction bars -Verbal answer -Tactile touch on ruler or licorice -Students write on worksheet	Students volunteer, participate, and contribute. Students follow discussion and provide input.	

	<p>Possible Questions or Misconceptions: Why don't we use centimeters (or some other metric unit?)</p>	<p>Possible Responses/ Questions to Pose: We are using standard units today, and we will work with metric units in the future. How many pieces did it take each group use to measure? It took "n" many pieces to measure the table, so each piece of licorice is 1/nth of a table. It take n/nths to make a whole.</p>		
<p>Engaging students with concepts <i>(Exploring, investigating, problem solving)</i></p> <p>15 minutes</p>	<p>Doing: Labeling and identifying parts of the whole inch on their rulers. Students will confirm using inchworm patterns the value of the fractional parts of the ruler. The students are exploring the relationships of the values of the fractional parts. Students will label halves, confirm 2 halves = whole, label fourths for the first inch, confirm 4 quarters=whole, label eights for the first inch, confirm 8 eighths= whole. Students will also label equivalent fractions for their first inch ($2/4 = 1/2 = 4/8$, etc.)</p>	<p>Doing: Distribute Inch standards to teams. Emphasize that they need to check each measure to prove it is correct. Teacher will ask random questions about different measurements, Ex. What would the second line after the 8-inch marked be labeled?</p>	<p>Each member of the team is verifying measurements. Each student is involved in discussion, participation, and making a contribution.</p>	
	<p>Possible Questions or Misconceptions: Guessing thirds or tenths or some other portion of an inch.</p>	<p>Possible Responses to student questions and/or strategies: Emphasise a half of a half (of a half..)</p>		
<p>Sharing ideas/solutions <i>(Whole group, small group, written)</i></p> <p>7-10 minutes</p>	<p>Doing: Measure licorice, record data. Students will measure licorice to the nearest $1/2$, $1/4$, and eighth. Students write the measurement on their worksheets. Students orally report their results. <i>The sizes of the licorice pieces will be $3 1/2$, $7 3/4$ inches.</i></p>	<p>Doing: Pass out $3 1/2$, $7 1/4$ inch pieces. Explain that there will be 4 groups and Groups 1-2 groups will measure to the nearest half while the Groups 3-4 measure to the nearest fourth on the first piece. On the second piece, Groups 1-2 measure to the nearest $1/4$ and Groups 3-4 will measure to the nearest $1/8$. Add student data to overhead worksheet.</p>	<p>Each member of the team verifies the measurement, and the students work together to get the correct answer. Students write legibly.</p>	

	<p>Possible Questions or Misconceptions: Students may change their answers to match what the other teams answered.</p>	<p>Possible Responses to student questions and/or strategies: Ask them whether they are sure, did they double check their answers and think for themselves.</p>		
<p>Closure/Summarizing <i>(Tying ideas together – summarize what math/strategies were learned)</i></p> <p>5-7 minutes</p>	<p>Doing: Comparing their rulers with the wooden commercial rulers.</p>	<p>Doing: Leading discussion of what the students learned. Discussion of how their newly made rulers are different than the other rulers (ie 1/16 inch). If time allows have the students measure the width of their rulers. <i>PASS OUT LICORICE PIECES TO EAT!</i></p>	Each student participates.	
	<p>Possible Questions or Misconceptions: The wood ruler has metric centimeters, why doesn't ours?</p>	<p>Possible Responses/ Questions to Pose: What kind of things did we work with today? We will use metric units in the future, but today we wanted to stick to inches. How is the standard ruler different from your ruler? What is the smallest marking on a standard ruler? So how many would there be in an inch? What other equivalent fractions would be true?</p>		