

## SESSION FIVE DEVELOPING DECIMAL CONCEPTS

### Outcomes

- To maintain a positive tone for the class by promoting conversation and success with mathematical endeavors.
- To use paper strips and base ten blocks as manipulatives for illustrating decimal concepts.
- To explore decimal notation, comparing decimals, and addition and subtraction with decimals.
- To introduce participants to the **NCTM Technology Principle**.

### Overview

In the fifth session of Thinking about Fractions, Decimals, and Percents, the focus shifts to decimals. Activities will reinforce participants' understanding of fractions while developing decimal concepts. In this session, paper strips and base ten blocks are used to illustrate decimal notation, addition and subtraction with decimals, and decimal comparisons.

### Time

- 15-20 minutes** In the first part of the session, participants share their experiences with the **Bringing Mathematics Home 4** activities and their solutions to the homework problems.
- 60-70 minutes** Next participants use number strips and base ten blocks to investigate decimal concepts.
- 3-5 minutes** The **NCTM Technology Principle** is then introduced as a way to introduce the **Bringing Mathematics Home** activities for the next two sessions.
- 10-15 minutes** In the closing activity parents reflect on something they learned, something they are still wondering about, and something they want to share with their families.

The homework for this session invites parents to investigate web sites dedicated to parents and mathematics. Discuss ways for participants to get online if some parents do not have home access to the internet. Some ideas might be to come to class early or stay late if computers are available at the school. Local libraries often have computers available to the public.

### Materials

Facilitator	Transparencies (English & Spanish)
<ul style="list-style-type: none"> <li>• One set of base ten blocks for the overhead projector</li> <li>• Sample Completed Strips</li> </ul>	<p><i>BLM 26: NCTM Technology Principle</i> <i>BLM 27: Which is Larger?</i></p>
Participant	Handouts (English & Spanish)
<ul style="list-style-type: none"> <li>• One pair of scissors for each participant</li> <li>• Base ten blocks for each participant—about 3 flats, 20 longs, 20 units (participants will need to take these home)</li> </ul>	<p><b>One per participant on cardstock</b> <i>BLM 28: Decimal Strips</i> <b>One per participant for home</b> <i>BLM 29: Bringing Mathematics Home 5</i> <i>BLM 30: Decimal Problems I</i></p>

**Activities**

Preparation of Classroom	Notes
<ol style="list-style-type: none"> <li>1. Prepare three sheets of chart paper for the closure activity. Label sheets: "Something I Learned," "Something I Wonder," and "Something I Want to Share with My Family."</li> <li>2. Post the <b>Fraction-Decimal-Percent Chart</b> from the previous sessions.</li> <li>3. Set up the <b>Chart It!</b></li> <li>4. Place the name cards from last class near the front of the room where participants can easily find them.</li> <li>5. Place a supply of pattern blocks on the tables (do not use the tan and orange blocks) and encourage exploration of the materials as participants arrive.</li> </ol>	
Discussion of Homework (15-20 minutes)	
<p>Invite participants to share their solutions to the problems on <b>Fraction Problems III</b>.</p> <ol style="list-style-type: none"> <li>1. Have them share with the people at their table.</li> <li>2. Hand out a transparency sheet and transparency marker to each group.</li> <li>3. Instruct each group to write a solution to one or more of the homework problems.</li> <li>4. Ask volunteers to present their solutions to the class.</li> </ol>	<p>As each group presents, be sure to point out the variety of strategies used and the benefit to the class of hearing how others thought about the problems. It is important to validate every participant's contribution.</p>
Exploring with Base Ten Blocks (60-70 minutes)	
<p><b>Introduction to Base Ten Blocks and Number Strips</b></p> <ol style="list-style-type: none"> <li>1. Introduce the activities for this session by telling participants that today they are going to learn about decimals and ways to represent them using objects and pictures. To set the stage, ask them these questions: <ul style="list-style-type: none"> <li>• <i>Where on the <b>Fraction-Decimal-Percent Chart</b> do you see similar uses for fractions and decimals?</i></li> <li>• <i>What is the connection between decimals and fractions?</i></li> <li>• <i>How might you use money to help a child learn about decimals?</i></li> </ul> </li> <li>2. Tell them that money is one manipulative that can be used to illustrate decimal concepts. Two others are number strips and base ten blocks. Base ten blocks will be used in this session.</li> </ol>	<p>Participants will likely say that decimals and fractions are ways to show part of something. They might point out that pennies and dimes represent hundredths and tenths of dollars.</p> <div data-bbox="1071 1386 1315 1764" style="text-align: center;"> <p><b>Number Strips &amp; Base Ten Blocks</b></p> <p><b>Chart It!</b></p> </div>

**Activities**

**Exploring with Base Ten Blocks (60-70 minutes)**

**Using Number Strips for Decimal Concepts**

1. Show the following words on a transparency:

**decade, decimeter, decagon, decathlon.**

- Ask them to define each word.
- Ask what all the words have in common.
- Tell them that the word decimal comes the same root as these words and also relates to ten. It will be useful for them to think of decimals as relating to things grouped in tens or divided into ten equal parts. **Chart It!**

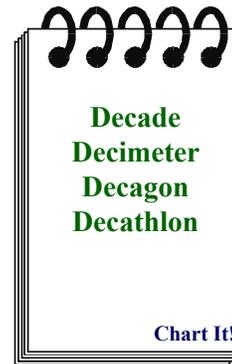
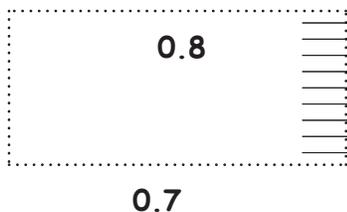
2. Hand out **Decimal Strips** and scissors to each participant.

- Instruct them to cut on the dark solid lines to form two strips each with ten parts.
- The first strip's dotted lines are to be labeled with fractions to show the relative position of that line.
- Tell them they are not labeling the area of the sections, but the position of the dotted lines.
- Have them label each line using a fraction with a denominator of 10, as shown on the sample completed strips on page 42.
- Have them label the second strips using decimals, as shown on page 42.
- Model how to read and write decimals.

3. Now pose this question:

- *What is the decimal name for the spot halfway between 0.7 and 0.8?*
- *How did you determine this?*

4. Remind participants that decimals describe things divided into ten equal parts, so in order to understand the decimal name for places between the dotted lines, the section between 0.7 and 0.8 must be divided into ten equal parts. Have participants do this by eye making 9 evenly spaced marks between 0.7 and 0.8 as shown below:



- Decade: 10 years
- Decimeter: one-tenth of a meter
- Decagon: a ten-sided shape
- Decathlon: an Olympic event consisting of 10 contests.

In Spanish, *década*, *decimetro*, *decágono*, *decatlón*.

These strips will be used for another purpose in the next class. It will be useful to have “unreduced” fractions rather than lowest terms fractions as labels.

Make sure participants are comfortable with decimal notation and can read decimal numbers such as 0.2 both as “zero point two” and as “zero and two-tenths”. Point out that when reading the values on either strip, they sound the same.

Let participants discuss this. Even if participants know that 0.75 is the halfway point, they will likely not be able to explain why this is.

It may be necessary to discuss why they need to make 9 marks rather than 10 marks to create ten spaces.

## Activities

Exploring with Base Ten Blocks (60-70 minutes)	Notes
<p>5. Have them notice that the fifth line is halfway between 0.7 and 0.8. Explain that the numerical notation for this is 0.75 to indicate that the spot is five notches above the 0.7 line. Tell them that this decimal is read "75 hundredths," and ask them if they can see any logic for using the word "hundredths" to describe these small marks.</p> <p>6. Have participants divide the entire strip with small marks to show hundredths. These need not be precise, but should be fairly evenly spaced.</p> <p>7. Instruct participants to practice finding and naming places on the number line by working with a partner in this way:</p> <ul style="list-style-type: none"> <li>• The first partner writes a two-digit decimal (such as 0.47).</li> <li>• The second partner points to that spot on the number strip using his/her pencil and reads the decimal using "hundredths."</li> <li>• Trade jobs and practice some more.</li> <li>• Circulate while partners practice and make sure that all participants are able to find and read decimal locations on the number strip</li> </ul> <p>8. Ask participants to find 0.6 and 0.06 on their number strips. Point out the difference between these two values.</p> <p>9. Ask some or all of these questions for discussion:</p> <ul style="list-style-type: none"> <li>• <i>Where is the mark for 0.20? How do you know?</i></li> <li>• <i>How does the relationship between 0.2 and 0.20 relate to prior experiences fractions?</i></li> <li>• <i>How would we name a spot located between two of the hundredths lines we have drawn?</i></li> <li>• <i>What would the numerical notation look like?</i></li> <li>• <i>How would we read such a decimal?</i></li> <li>• <i>Where would we find 0.437?</i></li> <li>• <i>Where would we find 0.291?</i></li> <li>• <i>Where would we find 0.58316219?</i></li> <li>• <i>What logic is necessary to locate any decimal on the number line?</i></li> </ul> <p>10. Tell participants that using the number strip can help when comparing decimals.</p> <ul style="list-style-type: none"> <li>• Display the <b>"Which is Larger?"</b> transparency.</li> </ul>	<p>Participants should notice that if all of the sections between dotted lines were divided into ten parts, there would be 100 parts in the entire strip.</p> <p>Participants should see that the dotted line for 0.2 is the spot for 0.20. This is another example of equivalent fractions.</p> <p>Remind participants that decimal names are the result of dividing sections into ten parts. If all of the hundredths sections were divided into ten parts, there would now be 1000 parts from 0 to 1. Theoretically, this process could be repeated again and again to give infinite decimal precision.</p>

**Activities**

Exploring with Base Ten Blocks (60-70 minutes)	Notes
<ul style="list-style-type: none"> <li>• Ask participants to make the determination for each pair by pointing to their locations on the number strip.</li> <li>• Discuss each example and pose additional examples if necessary to make sure all participants can confidently compare decimals</li> </ul> <p>11. Ask participants to save both of the strips made in this class for use in Session 6.</p> <p><b>Decimal concepts and operations with base 10 blocks</b></p> <p>1. Hand out base ten blocks. Tell participants:</p> <ul style="list-style-type: none"> <li>• <i>Number strips give a length model or number line representation for decimals.</i></li> <li>• <i>Another useful manipulative for decimals are base ten blocks because they provide an area model.</i></li> <li>• <i>Examine this manipulative and consider why it is appropriate to illustrate decimals.</i></li> </ul> <p>2. Instruct participants to take out collections of blocks to represent the following decimal values:</p> <ol style="list-style-type: none"> <li>a) 1.4</li> <li>b) 0.65</li> <li>c) 2.31</li> <li>d) 3.20</li> </ol> <p>3. Circulate among the participants to make sure all are able to represent decimal values using base ten blocks.</p> <p>4. Ask:</p> <p style="padding-left: 40px;"><i>How might a piece look if we wanted to represent thousandths or smaller decimal values?</i></p> <p>5. Return to <b>Which is Larger?</b></p> <ul style="list-style-type: none"> <li>• Instruct participants to work in pairs.</li> <li>• Have them consider the same set of comparisons, but use the base ten blocks to justify their answers.</li> </ul> <p>6. Tell participants that we can represent decimal operations using base ten blocks.</p> <ul style="list-style-type: none"> <li>• Have them use base ten blocks to model this addition problem <b>1.5 + 2.44</b>.</li> <li>• Have them find an answer to the addition problem.</li> </ul>	<p>If participants do not suggest it, point out that if a flat represents one whole, the longs (skinnies) can represent tenths, and the units (bits) can represent hundredths.</p> <p>Encourage them to explore multiple ways to represent b, c and d.</p> <p>They should notice that the second addition problem requires regrouping.</p>

## Activities

Exploring with Base Ten Blocks (60-70 minutes)	Notes
<ul style="list-style-type: none"> <li>Connect this model to the standard algorithm for adding decimals. Point out that the rule "line up the decimal points" ensures that tenths will be group with tenths and hundredths with hundredths when combined.</li> <li>Ask them to do the same for <math>2.8 + 0.63</math>.</li> <li>Ask them what makes this problem different from the previous example..</li> <li>Point out how the blocks help illustrate the process of regrouping.</li> </ul> <p>7. Provide more examples if needed until participants are comfortable modeling addition of decimals.</p> <p>8. If time allows, provide examples of subtraction of decimals first without regrouping, and then with regrouping.</p>	
National Standards (3-5 minutes)	Notes
<p>1. Tell participant that while we have not yet used technology in class, the activities of the next class session and the next two <b>Bringing Mathematics Home</b> sheets will relate to the <b>NCTM Technology Principle</b> which states:</p> <p style="padding-left: 40px;">Technology is essential in teaching and learning mathematics; it influences the mathematics that is taught and enhances participant learning.</p> <p>2. Tell them that the <b>Bringing Mathematics Home</b> activities for this session and the next one involve looking at web pages dedicated to mathematics and parent involvement.</p>	<p>Display the <b>NCTM Technology Principle</b> transparency.</p> <p>Some parents will not have access to the internet. If computers are available in the Math For Parents classroom, it would be a great idea to invite parents to come early or stay late to the next few sessions and look at the web pages together. Another option is to arrange to meet several of them at a library during the week and log on together!</p>
Closure (15-20 minutes)	Notes
<p>1. Ask participants to reflect on the experience of reviewing decimal concepts using manipulatives. Post the three chart paper sheets prepared prior to class labeled: "Something I Learned," "Something I Wonder," and "Something I Want to Share with My Family."</p> <p>2. Tell them that today they will share with the group by walking around and writing a sentence or two on each of the sheets.</p> <p>3. Close the session by asking them to return to the sheet that they started with and read what others have written.</p>	<p>If the class is large, you can provide two of each sheet to make the process go more quickly.</p>

**Activities**

<p><b>Take Home Activities (5 minutes)</b></p>	
<p>1. There are two items for participants to take home: <b>Bringing Mathematics Home 5</b> and <b>Decimal Problems I</b>.</p> <p>2. Discuss options for getting on the internet for those who do not have prior experience with this technology. Participants might visit the public library or their child's school to find computers with internet access.</p> <p>3. The <b>Decimal Problems I</b> sheet shows common participant errors and asks participants to explain the correct answer using number strips, base ten blocks, money, or pictures.</p>	<p>In order to complete the assignments, participants will need:</p> <ul style="list-style-type: none"> <li>• their paper strips</li> <li>• a set of base ten blocks</li> <li>• access to computers</li> </ul>
<p><b>Preparation for the Next Session (5 minutes)</b></p>	
<p>1. Collect name cards for use in the next sessions.</p> <p>2. Fold or roll the <b>Fraction-Decimal-Percent Charts</b> in a way that preserves the items posted on them and bring them to the next class.</p> <p>3. Save the <b>Chart It!</b> and bring it to the next class. If desired, you may have the log typed and distributed to participants at the next class.</p>	

**Facilitator Resource****Sample Completed Strips / Muestra de Tiras Hechas**

$\frac{1}{10}$
$\frac{2}{10}$
$\frac{3}{10}$
$\frac{4}{10}$
$\frac{5}{10}$
$\frac{6}{10}$
$\frac{7}{10}$
$\frac{8}{10}$
$\frac{9}{10}$
1

0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1