

Comparing Decimals 1

Sample Student Responses

The *Comparing Decimals 1* diagnostic assessment focuses on a particular misconception that students have regarding how to compare decimal numbers. Sample student responses indicative of this misconception are provided separately below, along with samples of correct student responses. To determine the degree of understanding and misunderstanding, it's important to consider both the student's answer to the selected response and the student's explanation text and representations.

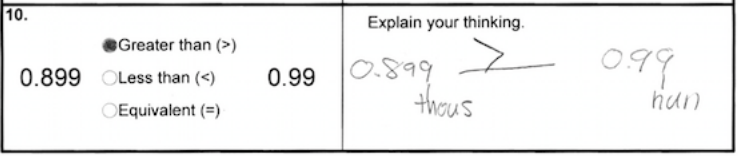
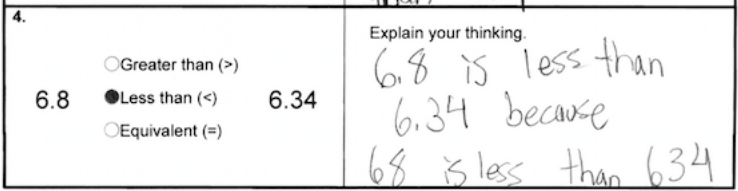
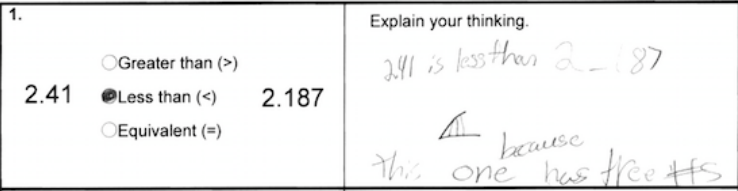
Misconception 1 (M1): Using Whole-Number Thinking / A Focus on "Longer Is Larger"

Students with this misconception consistently compare decimals by comparing the numbers to the right of the decimal point as if they were comparing whole numbers (e.g., they consider 0.34 to be greater than 0.8 because 34 is greater than 8). Because they are accustomed to thinking of numbers with more digits as larger, they overgeneralize from their experiences with whole-number comparisons and extend this rule to decimals. (For more information, go to the "Research-Based Misconceptions" tab.)

Students typically do not apply this thinking when comparing numbers with different digits in the ones place, such as 2.36 and 5.1. Instead, they tend to appropriately compare the values of the digits in the ones place, in this case reasoning that since 5 is greater than 2, 5.1 is greater than 2.36.

The following student responses show examples of this misconception.

Item	Sample Student Responses with Evidence of Misconception 1	Notes
Pre-Assmt #3	<p>3.</p> <p> <input checked="" type="radio"/> Greater than (>) <input type="radio"/> Less than (<) 0.88 <input type="radio"/> Equivalent (=) </p> <p>0.788</p> <p>Explain your thinking.</p> <p>0.788 is bigger because it has 1 more number than 0.88</p> <p>"0.788 is bigger because it has 1 more number than 0.88"</p>	<ul style="list-style-type: none"> The misconception selected response is chosen <p>AND</p> <ul style="list-style-type: none"> The student says the first decimal number is bigger because it has more numbers
Pre-Assmt #2	<p>2.</p> <p> <input checked="" type="radio"/> Greater than (>) <input type="radio"/> Less than (<) 12.659 <input type="radio"/> Equivalent (=) </p> <p>12.86</p> <p>Explain your thinking.</p> <p>I think 12.659 is bigger becse it has more digets.</p> <p>"I think 12.659 is bigger [bigger] becse [because] it has more digets [digits]."</p>	<ul style="list-style-type: none"> The misconception selected response is chosen <p>AND</p> <ul style="list-style-type: none"> The explanation focuses on which decimal number has more digits

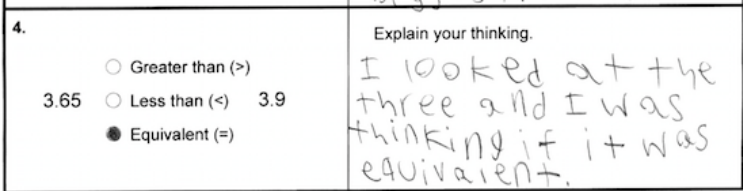
Item	Sample Student Responses with Evidence of Misconception 1	Notes
Post- Assmt #3		<ul style="list-style-type: none"> The misconception selected response is chosen <p style="text-align: center;">AND</p> <ul style="list-style-type: none"> The digits after the decimal point are labeled “thous” and “hun,” as if they were whole numbers
Post- Assmt #4	 <p style="text-align: center;">“6.8 is less than 6.34 because 68 is less than 634”</p>	<ul style="list-style-type: none"> The misconception selected response is chosen <p style="text-align: center;">AND</p> <ul style="list-style-type: none"> The student removes the decimal point and compares the decimal numbers as whole numbers
Post- Assmt #2	 <p style="text-align: center;">“2.41 is less than 2.187 because this one has tree [three] #s”</p>	<ul style="list-style-type: none"> The misconception selected response is chosen <p style="text-align: center;">AND</p> <ul style="list-style-type: none"> The explanation states that the larger decimal number is the one with more numbers

Incorrect Reasoning That Is Not an Example of This Misconception

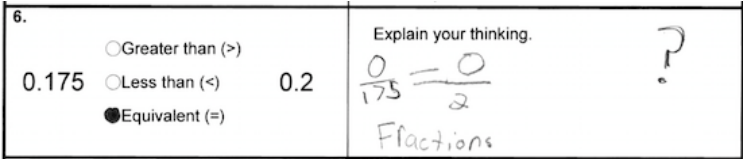
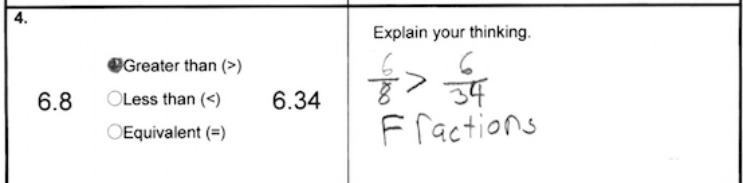
Some students exhibit another common difficulty when they compare decimal numbers by **looking only at the digits to the left of the decimal point** and then determining that the decimal numbers are equivalent.

Note: This diagnostic probe is **not validated to test for this other common difficulty**. However, it may still be helpful to be aware of it, since you may notice this type of reasoning as you look through your students’ work.

The following student response shows an example of this other common difficulty.

Item	Sample Student Response with other Incorrect Reasoning	Notes
<p>Pre- Assmt #4</p>	 <p style="text-align: center;">“I looked at the three and I was thinking if it was equivalent.”</p>	<ul style="list-style-type: none"> •The selected response, “Equivalent,” is an indicator of this difficulty <p style="text-align: center;">AND</p> <ul style="list-style-type: none"> •The explanation makes it clear that the student is focusing on the digit to the left of the decimal point

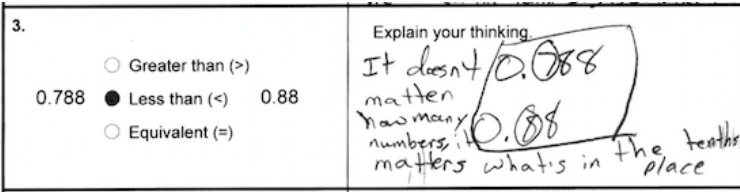
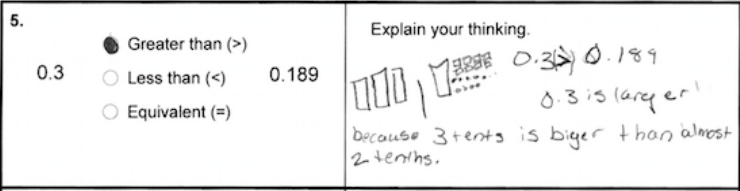
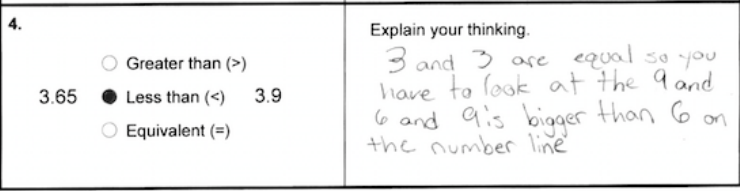
Some students may try to convert the decimal numbers into fractions (often incorrectly) and then compare the fractions. Here are two examples:

Item	Sample Student Responses with other Incorrect Reasoning	Notes
<p>Not on the Pre- or Post- Assmt</p>		<ul style="list-style-type: none"> •The selected response is neither correct nor the M1-aligned response <p style="text-align: center;">AND</p> <ul style="list-style-type: none"> •The student incorrectly converts the decimal numbers into fractions (although the student’s comparison of the value of the fractions is correct, in that they both equal 0)
<p>Post- Assmt #4</p>		<ul style="list-style-type: none"> • The student selects the correct response <p style="text-align: center;">HOWEVER</p> <ul style="list-style-type: none"> •The student incorrectly converts the decimal numbers into fractions (although the student’s comparison of the value of the fractions is correct, in that 6/8 is greater than 6/34)

Correct Reasoning

Students with correct reasoning about comparing decimals are often able to do one or more of the following:

- Correctly name the place values of different digits to the right of the decimal point
- Compare digits in corresponding place values in each decimal number

Item	Sample Student Responses with Correct Reasoning	Notes
<p>Pre-Assmt #3</p>	 <p>3.</p> <p> <input type="radio"/> Greater than (> <input checked="" type="radio"/> Less than (<) 0.88 <input type="radio"/> Equivalent (=) </p> <p>0.788</p> <p>Explain your thinking. It doesn't matter how many numbers, it matters what's in the tenths place. </p> <p>"It doesn't matter how many numbers, it matters what's in the tenths place"</p>	<ul style="list-style-type: none"> • The student selects the correct response AND • The student names the place values correctly and identifies corresponding digits to compare the decimal numbers
<p>Pre-Assmt #5</p>	 <p>5.</p> <p> <input checked="" type="radio"/> Greater than (> <input type="radio"/> Less than (<) 0.189 <input type="radio"/> Equivalent (=) </p> <p>0.3</p> <p>Explain your thinking. because 3 tenths is bigger than almost 2 tenths. </p> <p>"0.3 > 0.189 0.3 is larger because 3 tenths [tenths] is bigger than almost 2 tenths."</p>	<ul style="list-style-type: none"> • The student selects the correct response AND • The student correctly names each decimal number AND • The student draws accurate pictures of the numbers using base 10 block images
<p>Pre-Assmt #4</p>	 <p>4.</p> <p> <input type="radio"/> Greater than (> <input checked="" type="radio"/> Less than (<) 3.9 <input type="radio"/> Equivalent (=) </p> <p>3.65</p> <p>Explain your thinking. 3 and 3 are equal so you have to look at the 9 and 6 and 9 is bigger than 6 on the number line </p> <p>"3 and 3 are equal so you have to look at the 9 and 6 and 9 is bigger than 6 on the number line"</p>	<ul style="list-style-type: none"> • The student selects the correct response AND • The explanation describes how to compare the decimal numbers by comparing digits with corresponding place values