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Class Activity 0A: Misconceptions in Comparing Decimal Numbers

The following list describes some of the misconceptions children can develop about comparing decimal numbers. The list is based on the work of mathematics education researchers Kaye Stacey and Vicki Steinle, who have gathered data on thousands of children in Australia (see [?] and [?] for further information, including additional misconceptions and advice on instruction).

Whole number thinking Children with this misconception treat the portion of the number to the right of the decimal point as a whole number, thus thinking that $2.352 > 2.4$ because $352 > 4$. These children therefore think that longer decimals are always larger than shorter ones.

Column overflow thinking Children with this misconception name decimal numbers incorrectly by focussing on the first non-zero digit to the right of the decimal point. For example, they say that 2.34 is “two and thirty-four tenths”. These children think that $2.34 > 2.5$ because 34 tenths is more than 5 tenths. These children usually identify longer decimal numbers as larger; they will, however, correctly identify 2.5 as greater than 2.06 because 5 tenths is more than 6 hundredths.

Denominator focused thinking Children with this misconception think that any number of tenths is greater than any number of hundredths and that any number of hundredths is greater than any number of thousandths, and so on. These children identify 5.67 as greater than 5.432, reasoning 67 hundredths is greater than 432 thousandths because hundredths are greater than thousandths. Children with this misconception identify shorter decimal numbers as larger.

Reciprocal thinking Children with this misconception view the portion of a decimal number to the right of the decimal point as something like the fraction formed by taking the reciprocal. For example, they view 0.3 as something like $\frac{1}{3}$ and thus identify 2.3 as greater than 2.4 because $\frac{1}{3} > \frac{1}{4}$. These children usually identify shorter decimal numbers

as larger, except in cases of intervening zeros. For example, they may say that $0.03 > 0.4$ because $\frac{1}{3} > \frac{1}{4}$.

Money thinking Children with this difficulty truncate decimal numbers after the hundredths place and view decimal numbers in terms of money. If two decimal numbers agree to the hundredths place, these children simply guess which one is greater, sometimes guessing correctly, sometimes guessing incorrectly. Most of these students recognize that 1.8 is like \$1.80, although some view 1.8 incorrectly as \$1.08.

1. Put the following set of decimal numbers in order from least to greatest. Then show how children with the misconceptions described above would probably put the numbers in order.

3.3 3.4 3.05 3.25 3.251

Correct order (least to greatest):	
Whole number thinking:	
Column overflow:	
Denominator focused:	
Reciprocal thinking:	
Money thinking:	

2. Make up a decimal comparison quiz which provides 10 pairs of decimal numbers and asks children to circle the larger decimal number in each pair. Try to pick the 10 pairs so that children with the different misconceptions described above will not give exactly the same answers for all 10 pairs. For each misconception above, show how children with that misconceptions would probably answer the quiz.