Exploring Decimals and Hundredths with Money

Overview

Many adult learners who have little experience with the meaning of decimal notation have difficulty understanding the differences between numbers such as, 5, 0.5 and 0.05. This activity uses the familiarity of local currency to clarify these differences. Decimal numbers are modelled with coins, and emphasis on the name 'cents' is used to establish the second decimal place as representing one hundredth part and establish the significance of the zero in .05.

This activity may be done after students display confidence with the meaning of the first decimal place in '*Exploring Decimals and Tenths 1 & 2*' and also after they have had some practice at estimating and adding decimals with one decimal place, as in the game '*Dicing with Decimals 1 and 2*'.

Skills and Knowledge

- Meaning of decimal place value
- Relationship between decimals and hundredths
- Money expressed in decimal notation

Preparation and Materials

- Prepare sets of decimal numbers and money cards by copying Activity Sheet 1 (1 per small group) and cutting the pieces as indicated. Keep the small sets together with paper clips and place in labelled envelopes, set 1, set 2 etc.
- Assemble a collection of local currency coins either real or play money.
- Alternatively photocopy Activity Sheet 2 onto card or stiff paper and cut into cards each with a separate coin picture on them.
- Photocopy Practice Sheet 1 (1 per student).

Note: If you are using play money or photocopies, rather than real coins, make sure students recognise what each coin and note represents. You may need a few real coins at hand to compare with.

Suggested Procedure

Modelling decimals with money

Arrange students into small groups. The group size will be determined by how much equipment you have. There should be enough money so that each student in the group can see the coins clearly on their table.

Ordering decimals – trial 1 (without money)

Give each group set 1 of the prepared cards or slips of paper [with just the decimal numbers on them]. Explain they should work together and explain their thinking to each other. Observe the students as they do various stages of the task.

Explain:

- *Together try to put these in order from smallest to biggest*
- *Leave them on the table in front of you*

Now share the coins or play money amongst the groups. [If you are using play money rather than real coins make sure students recognise what each coin and note represents.]

Ordering decimals as money

Give out the second set of cards.

Explain the task:

- *Make the amount of money on each of the cards*
- *Now order them from smallest to biggest*
- *Compare the two lines of cards you have made*
- *Do you want to change anything in your first set?*

Hopefully using money, which is familiar to the learners, will help them to sort out the different values of the two decimal places, and the significance of the 0 in .05, something that is easy for people to overlook. Also it is important to ensure they understand that 0.5 and 0.50 mean the same thing in the common use of decimals.

Brainstorming 'cent' – connecting to hundredths

Hold up a five cent piece.

Ask:

- *Can anyone tell me why this is called 5 'cents'?*
- *Do you know what is special about the word 'cent'?*
- *Can you think of other words we hear that have 'cent' in them?*

The discussion needs to focus on the meaning of 'cent' as relating to 100 parts in the whole thing.

Write 'cent' in the middle of the board and brainstorm other words, teasing out their meaning as you go. For example, century (100 years or 100 hundred runs in cricket), centimetre (100 of them in 1 metre), degrees centigrade (100 degrees between freezing and boiling point of water), percent (out of every hundred), centurion (1 of 100 Roman soldiers), centenarian (a person who has lived 100 or more years), centennial (celebration of 100 years), centipede (supposedly 100 legs) ...

Ensure the discussion clarifies that:

- *One whole dollar is divided into 100 parts called cents*
- *Each cent is 1 out of 100 in the whole dollar*
- *If it is written as a fraction it is* $\frac{1}{100}$ *of a dollar*
- *If it is written as a decimal it is .01 of a dollar*
- *For example 5 cents is* $\frac{5}{100}$ *of a dollar and also .05 of a dollar, written $.05 or $0.05*

Strengthening the connection – hundredths as decimals and fractions

Hold up individual coins one at a time and ask:

- *How could this amount be written as a fraction of a dollar?*
  [For example, a 10 cent coin would be $\frac{10}{100}$ of a dollar]
- *How would it be written as a decimal?*
  [Ten cents could be .10 or 0.10 or even .1 of a dollar]

Repeat the process of writing individual amounts as decimals and fractions until the students feel comfortable with idea of hundredths in fraction and decimal form.

Note: Some students who write .1 may realise that it is equivalent to $\frac{1}{10}$. *Depending on students' stages of knowledge and understanding, you may want to demonstrate that there are ten 10 cent coins in 1 dollar, so yes 10 cents is* $\frac{1}{10}$. *However, don't let this distract from the important message that the cents can be expressed as hundredths. Guard also against some students using this moment to talk about 'cancelling' fractions.*

Give a blank sheet of paper and texta to each group.

Using spoken instructions, ask students to write the amounts of money that you read out as decimals on the paper – they should spread them out to leave room to model with the coins afterwards.

1. *'One dollar and fifty cents'*
2. *'One dollar, twenty-five'*
3. *'One dollar and five cents'*
4. *'One dollar and fifteen cents'*
5. *'Five dollars and ten cents'*
6. *'Fifty cents'*

When they are doing this, circulate and ensure that decimal points are being used rather than commas (see previous activities for comments about this).

For the next step, ask the groups:

- *Make each of the amounts you have written with money.*

Finally, you read the original amounts aloud again and ask students if that is what they have made for each of their numbers.

Get the small groups to compare the way they have written the decimals for each, clarifying the placing of zeros, and alternative ways that amounts such as 50 cents may be written as a decimal.

If there is any confusion repeat the exercise with other sets of numbers.

For example:

$1.10	*$1.30*	*$1.35*	*$1.15*	*$1.05*
$3.05	*$3.10*	*$3.50*	*$0.55*	

As a final variation on this theme, hold up some amounts of money yourself and ask the students to write them as decimals and as fractions.

For example:

- You hold up two 2 dollar coins and a 5 cent piece
  [Learners will write 4.05 and 4 $\frac{5}{100}$]
- You hold up a 1 dollar, a 2 dollar and a 10 cent piece
  [Learners will write 3.10 and 3 $\frac{10}{100}$]

Ordering other sets of decimals

Sets 3, 4 and 5 can be used to check that students now feel more confident ordering decimal numbers.

Distribute them one at a time. If students still find the task difficult the money can be used to model the numbers as above.

Practice Sheet 1 can be used for individual practice following these hands-on activities.

Follow up

The activity *'Exploring Decimals and Hundredths Further'* uses the visual representations of hundredths grids and the conceptual idea of the place value chart to build on the understanding promoted by this activity.

The game '*Dicing with Decimals 3*' is also an excellent activity to consolidate awareness of the second decimal place.

Exploring decimals and hundredths with money

Activity Sheet 1

Set 1 0.25	*Set 2* $2.25	*Set 3* 2.25	*Set 4* 1.05	*Set 5* 4.3
Set 1 0.05	*Set 2* $2.05	*Set 3* 2.05	*Set 4* 1.15	*Set 5* 4.35
Set 1 0.5	*Set 2* $2.5	*Set 3* 2.5	*Set 4* 1.50	*Set 5* 4.05
Set 1 0.50	*Set 2* $2.50	*Set 3* 2.50	*Set 4* 1.5	*Set 5* 4.5
Set 1 0.15	*Set 2* $2.15	*Set 3* 2.15	*Set 4* 1.2	*Set 5* 4.10
Set 1 0.5	*Set 2* $5	*Set 3* 5.0	*Set 4* 2.0	*Set 5* 4

Exploring decimals and hundredths with money

Activity Sheet 2

Exploring decimals and hundredths with money

Practice Sheet 1

Example: In the price $46.17

- the 4 means $40 (forty dollars)
- the 6 means $6 (six dollars)
- the 1 means $ 0.10 (10 cents)
- the 7 means $0.07 (7 cents)

Use these prices to fill in these tables

a) $25.90 b) $50.92 c) $905.2 d) $5[illegible]09 e) $90[illegible]

Price	Meaning of 2 in symbols	Meaning of 2 in words
a	*$20*	*Twenty dollars*
b		
c		
d		
e		

Price	Meaning of 5 in symbols	Meaning of 5 in words
a		
b		
c		
d		
e		

Price	Meaning of 9 in symbols	Meaning of 9 in words
a		
b		
c		
d		
e		