Exploring Decimals and Tenths 1

Overview

Many common numeracy errors are the result of lack of understanding of the decimal point and the meaning of the numbers that follow it. This activity is designed for students to begin exploring and consolidating the meaning of decimal places as fractions. It uses a selection of diagrams, fraction circles and the place value chart as possible means to examine the first decimal place as signifying tenths.

These methods can be used in one session or over a number of sessions depending on the learners. Some adult learners need a variety of approaches and a lot of revisiting to really grasp the significance of decimal notation. For others these representations can be a valuable clarifying exercise.

The activity can follow '*Where are the Decimal Points*?' as this sequence would allow adult learners to begin with the decimals that they see around them on a daily basis and then explore the meaning of the decimal places as fractions of a whole. It could also follow directly from the '*Meaning of Fractions*' in the fractions section, depending on the learner.

It should be soon followed by *'Exploring Decimals and Tenths 2: Mixed Numbers'* and '*Exploring Decimals on Measuring Scales'.*

Skills and Knowledge

- Meaning of decimal place value
- Relationship between decimals and tenths

Preparation and Materials

- Make several copies of Activity Sheet 1: *The Tenths Grid* (spares will be useful later). [This could also be made into a projected image on OHT or PPT slide]
- Make several copies of Activity Sheet 2: *The Circle Template* and
- Make several copies of Activity Sheet 3: *Place Value Chart* (1 per small group of students)
- Photocopy Practice Sheet 1 (1 per student)

Optional Materials

See suggested procedure to make a selection from this list.

- One copy of Activity Sheet 1 or 2 from '*Where are the Decimal Points?*'
- Fraction Circle kits (1 per small group of students)
- Calculators (1 per small group of students)

Suggested Procedure

Introducing the first decimal place

If you are following the activity '*Where are the Decimal Points?*', write on the board all of the numbers in the story that had only one number after the decimal place.

You could ask the students to read them out to you from the story. As they do this emphasise how to say them correctly. For example:

- '*three point nine*'
- '*seven point six*'

Alternatively, you could write any selection of similar numbers on the board and ask students to read them aloud, with emphasis on the '*point'* between the whole number and decimal.

It may come naturally to students from other cultures to say 'three comma nine' instead of 'three point nine', because this is how they would have written it in their home country. (See note below).
If this happens, explain to them that it is part of our language/culture to call it 'point' and encourage them to make the switch, but do this without telling them they are 'wrong'.

*Note: In countries **other than** Australia, USA, or UK and their colonies, a comma is used where Australians use the decimal point and where we use a comma to mark out thousands, they use the point. For example: 'Two dollars forty five cents' would be written '$2.45' and 'twelve thousand, five hundred dollars' would be written '$12.500'.*

Making the switch is difficult if you have grown up with the opposite usage. As teachers we should be aware that this will be an issue for many learners coming from other countries. It should be discussed during the lesson so that the difficulties they will face in making the change can be acknowledged. We should not tell students they are wrong, but that they will not be understood here if they do not make the change because this notation is part of our language and culture.

The meaning of the first decimal place

Highlight one of the numbers, e.g. 1.9 litres and explain that you are going to explore the meaning of the 9 in this number.

If these students have used the Fraction Circle Kits previously to explore the meaning of fractions then proceed first with the section '*Using Fraction Circles'* below. If they have **not** previously used fractions circles or you do not have them, begin with the section *'Using the Tenths Grid'* and follow up with circle diagrams as described below in *'Using a Second Shape'.*

Using fraction circles

Distribute the Fraction Circle Kits (1 per small group of students).

Revise the names of the fraction pieces by asking students to make single coloured circles as they did in the *'Meaning of Fractions'*

Now ask:

- *Do you know which of these fractions has the same meaning as the first decimal place?*
  [the $\frac{1}{10}$ pieces]
- *So show me what .9 of a whole thing would look like with these pieces.*
  [9 of the $\frac{1}{10}$ pieces]

Note: You may have to remind students that this 'whole' could be any whole thing or unit of measurement. When using circles, we could be thinking of a pizza or a cake cut into tenths (10 pieces)as well as a litre or a metre imagined as a circle.

Record on the board:

nine tenths = .9 = 0.9

Emphasise that these all mean the same thing. Encourage students to say the '*nine tenths*' aloud as well as saying *'point nine'*.

Ask students to model a few more decimals with the kits. For example: .7, 1.5

Ask:

- *What's another way of saying .5?* [.5 = $\frac{1}{2}$]

Using the tenths grid

Display a copy of the '*Tenths Grid*' (Activity Sheet 1) on the board, using OHT or PPt or distribute copies to students (1 between 2 or 3) and ask them to do the shading as you talk together.

Ask:

- *Suppose this whole rectangle grid represents one whole*
- *It could be a whole chocolate bar, or a unit of measurement like one litre or one degree on a thermometer.*
- *It has been divided into ten strips*
- *What fraction of the whole thing is each strip?*
- *Do you know how we could use this to show .9 of the whole thing?*
- *How many of these 10 strips would we have to shade in?*

Write on the board:

nine tenths .9 0.9

Emphasise that these all mean the same thing. Encourage students to say the '*nine tenths*' aloud as well as saying *'point nine'*.

Ask students to model a few more decimals with the kits. For example: .4, .2, .5

Ask:

- *What's another way of saying .5?* [.5 = $\frac{1}{2}$]

Using a second shape

It is a good idea for students to experience the one whole as a different shape; not always a rectangle or square. If students have not used the Fraction Circle kits previously, you can do this with circles on the board and copies of Activity Sheet 2, '*The Circle Template*'.

First draw a circle on the board and ask students to discuss how they could indicate .9 on it.

The two important facts to focus on are:

- the circles needs to be divided into 10 pieces which are of equal size
- nine of these should be shaded.

Display one copy of the '*The Circle Template*' and indicate it has been divided into 10 equal pieces. Ask students:

- *How many of these do we shade to show 0.9?*

Repeat with other blank copy of the template. Ask:

- *What do I shade for 0.3?*
- *What about .5?*

Emphasising tenths

On the board draw a rectangle or square with 5 divisions only, as shown. Shade in three of these.

Ask: *What decimal have I shaded?*

The important thing for students to realise is that this shaded area is not yet in tenths. So far it is in fifths. Hopefully you can prompt learners to suggest that each of the five pieces can be sub-divided into two to get tenths.

This visual means of changing the fractions is sufficient at this stage. The ins and outs of equivalent fractions are more likely to distract from the major focus. The important thing is that you need the practice in tenths before you can convert it to decimals. The Practice Sheets contain some examples marked in fifths rather than tenths to reinforce learners' awareness of this.

On a place value chart

If students have used some form of place value chart for whole numbers, then extending this to show the continuum for decimals can be valuable.

This would also be particularly useful if straws or sticks have been used to model addition and subtraction processes because they

If using drinking straws for place value, use single straws in the ones column, bundles of ten in the tens, bundles of ten tens in the hundreds. Straws cut in half are useful for this because they are light and cheap and not previously used in schools.

can be cut into ten pieces to demonstrate tenths at the same time as an extra column is added to the right of the chart.

Distribute copies of Activity Sheet 3, *The Place Value Chart* to students.

First review the use of the chart by asking students to model, or write, a few whole numbers as reminders of the different columns.

For example:

- *Write or model on the chart: 124, 32, 10, 6, 1*

Draw attention to the fact that as the numbers get smaller [100 → 10 →1] they shift to a column on the right. And that the numbers are being divided by ten each time they get smaller. For example:

Ask:

- *What is happening to the numbers at the top as we move to the right?*

You might like to remind students that this dividing by ten each time is the basis of our whole number system. It is called the 'decimal' number system because 'deci' is a prefix meaning ten. Decimal fractions are just an extension of this system to represent even smaller numbers.

Extending the chart to tenths

Reiterate that so far the columns go 100 → 10 →1 as you keep dividing by 10.

Ask:

- *What do you think will happen if we divide one by ten?*
- *Try it with a calculator if you are not sure*
  [1 ÷ 10 = .1 or 0.1]
- *Where do you think this would fit on the place value chart?*
  [create another column on the right as explained below]

Since the numbers keep get smaller as they shift to the right, the logical place for fractions of one to go is to the right of the 'ones' column [100 → 10 →1 → 1/10]

Demonstrate with a calculator that when you perform the calculation 1 divided by 10 the result is 0.1 or .1. Students could try this for themselves also.

Ask them to draw in a new column on the right and put a heading 'tenths'.

Draw attention to the placing of the decimal point between the 'ones' and the 'tenths' columns to show that you have crossed from whole numbers to parts of a whole, or fractions.

Ask them to write other decimal numbers into the chart. For example:

- *0.2 or .2* $.2 = \frac{2}{10}$
- *0.9 or .9* $0.9 = \frac{9}{10}$

tens	ones		tenths
		•	2
		•	9

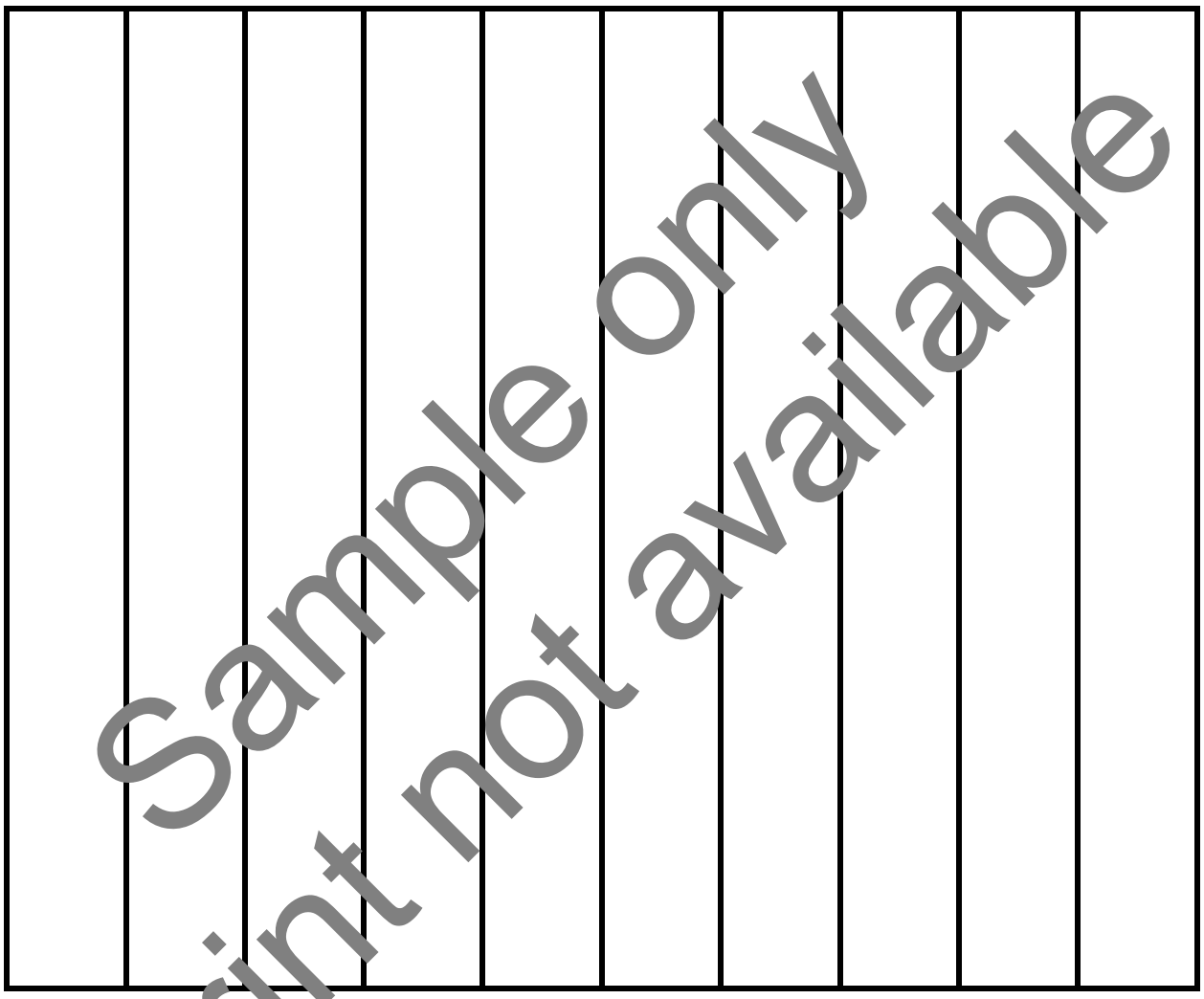
Modeling tenths with straws

If you have used straws to model the whole number place values you could ask:

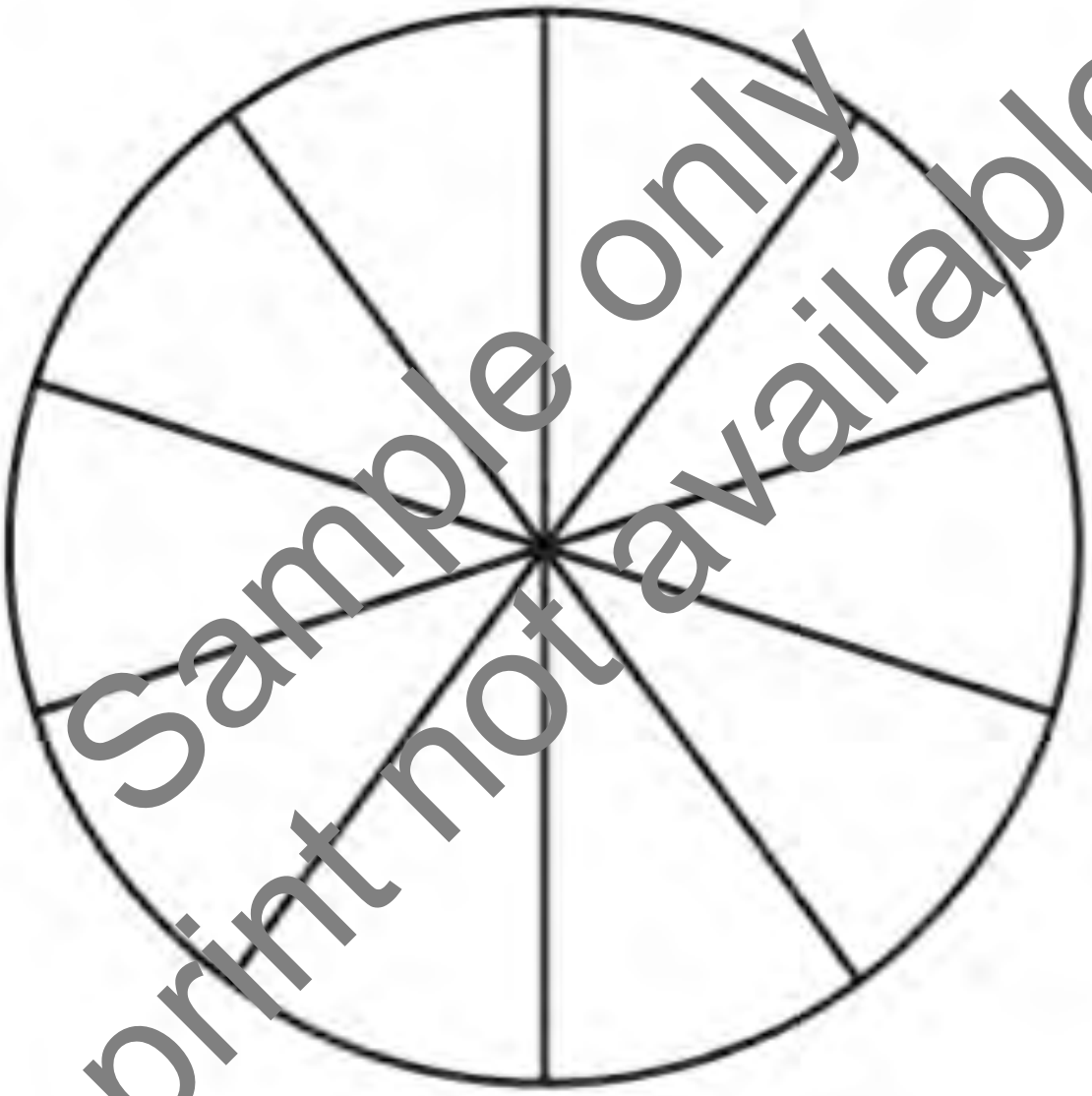
- *How could we use these to show tenths?*
  [cut one into ten pieces]
- *Where would they go on the chart?*
  [create another column on the right]

Students should now try **Practice Sheet 1** before proceeding to explore numbers containing both decimals and whole numbers in the next *activity 'Exploring Decimals and Tenths 2: Mixed Numbers'.*

Tenths grid



Circle template



Place Value Chart

hundreds	tens	ones

Exploring decimals and tenths 1

Practice Sheet 1

1. Fill in the gaps.

a. $\frac{1}{10}$ = one tenth = 0. _____

b. $\frac{2}{10}$ = _____ = _____

c. _____ = four tenths = _____

d. _____ = _____ = 0.8

e. $\frac{10}{10}$ = _____ = _____

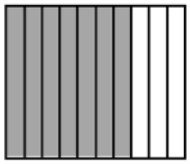
2. Write the fractions that are shaded in each of the grids.

a. Shaded area:

$\frac{\quad}{10}$ = 0. ____

b. Shaded area:

$\frac{\quad}{10}$ = 0. ____

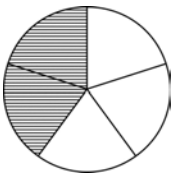


c. Shaded area:

$\frac{\quad}{10}$ = 0. ____

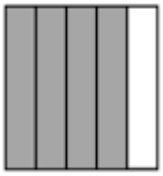
d. Shaded area:

$\frac{\quad}{10}$ = 0. ____



e. Shaded area:

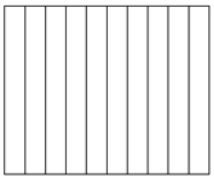
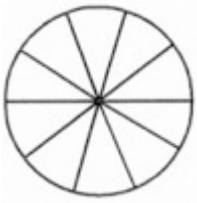
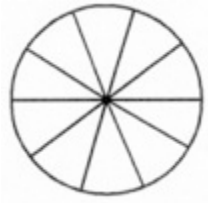
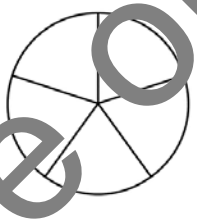
$\frac{\quad}{10}$ = 0. ____



f. Shaded area:

$\frac{\quad}{10}$ = 0. ____

3. Shade the fraction in on the grid or circle.

 a. Shade in: $0.9 = \frac{\quad}{10}$	 b. Shade in: $\frac{8}{10} = 0.\_\_\_\_$	 c. Shade in: $\frac{10}{10} = \_\_\_\_$
 d. Shade in: $0.4 = \frac{\quad}{10}$	 e. Shade in: $0.6 = \frac{\quad}{10}$	 f. Shade in: $0.1 = \frac{\quad}{10}$

4. Write these numbers in the Place Value Chart below:

a. 900 b. 5[illegible] c. [illegible].4 d. 13 e. $\frac{3}{10}$ f. 0.9

	hundreds	tens	ones		tenths
a.				•	
b.				•	
c.				•	
d.				•	
e.				•	
f.				•	