

# Understanding Fractions

**Stage: 1 and 2**

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## Introduction

At NRICH, our aim is to offer rich tasks which develop deep understanding of mathematical concepts rather than contexts which promote shallow engagement with the underlying mathematics. Of course, by their very nature, rich tasks will also provide opportunities for children to work like a mathematician and so help them develop their problem-solving skills alongside this conceptual understanding. Such tasks also provide valuable opportunities for you to assess where children have got to in their thinking and so support the next steps on their learning journey.

The new National Curriculum in England becomes statutory in September 2014 and in terms of fractions, it is more demanding compared with the current curriculum. To support children in meeting these higher demands for fractions it is important to make sure they have lots of practical and varied experience using objects, shapes and quantities, have experience of rich tasks that stimulate and challenge their thinking and are given models and images rather than 'tricks' to support their growing understanding of fractions.

In this article, we offer links to rich tasks (found in our [Fractions feature](#)) which will help develop the underlying concepts associated with fractions and some suggestions for models and images that help support ideas around fractions.

## Why do children find fractions difficult?

Difficulties with fractions often stem from the fact that they are different from natural numbers in that they are relative rather than a fixed amount - the same fraction might refer to different quantities and different fractions may be equivalent (Nunes, 2006). Would you rather have one quarter of £20 or half of £5? The fact that a half is the bigger fraction does not necessarily mean that the amount you end up with will be bigger. The question should always be, 'fraction of what?'; 'what is the whole?'. Fractions can refer to objects, quantities or shapes, thus extending their complexity.

In order to be able to develop their understanding and then generalise about fractions, children need to explore many representations and uses over a significant period of time. In the Early Years, learners will have learnt to generalise the concept of three by having lots of experience of the three-ness of three, yet with fractions we may find in school that their experience is limited to pizzas, sticky paper and chocolate! Do the children have experience of objects, shapes and amounts in equal

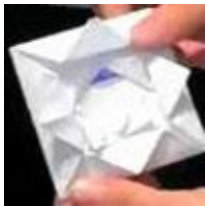
measure and do they have experience of the whole being something other than 'one'?

## What might a fraction be?

### 1. Part of a shape or shapes



The activity [Halving](#) is a good place to start exploring the relationship between the part and the whole. Children are invited to halve paper squares of a particular size in different ways. Each time, they are encouraged to explain how they know it is a half. This can lead into a discussion about the link with area - half of the square is not a particular shape but an amount of space. In his article [Early Fraction Development](#), Bernard describes how he explored the general idea of half a rectangle with some children. Using different sized pieces of paper leads learners to conclude that the same fraction (one half in this case) can refer to different amounts of paper.



[Fractional Triangles](#) also encourages children to explore the part-whole relationship but goes beyond halves to include finding quarters, thirds, sixths and ninths. [Bryony's Triangle](#) is a wonderful example of a rich task that brings together development of the part-whole concept and reasoning. (Incidentally, it is worth using thin card for this activity.)

Although all these tasks use paper as the medium, of course it is important that children have experience of a range of resources. How would they halve a lump of playdough? How would they halve a weight?



And how often do we vary the 'whole'? Is it always 'one'? What about sharing two pizzas between three? In the NRICH task [Chocolate](#), the 'whole' is one, two or three bars of chocolate. Learners have to make a decision about the best table to stand at if the chocolate on it is shared between everyone at that table. Encouraging children to record their ideas themselves helps us 'see' their thinking and assess what they are doing.

## 2. Part of a set of discrete objects



[Making Longer, Making Shorter](#) builds on part-whole understanding but this time in the context of discrete objects - cubes. You can encourage further exploration of this idea by giving children a handful of items such as counters, beads or acorns and asking them to show you half in as many different ways as they can.

## 3. Position on a number line: a number in its own right

Here the 'whole' is one unit on the number line. Children need to understand that even though one half may look like a fixed amount it is still in fact one half of a 'whole': in this case the 'whole' is one unit.

### **Getting started**

#### Fractions as a form of division

In her research, Nunes (2006) suggests that sharing situations can be used as a starting point for children's understanding of fractions since she found that primary school children have some insights into fractions when solving division problems:

*They understand the relative nature of fractions: if one child gets half of a big cake and the other gets half of a small one, they do not receive the same amount. They also realise, for example, that you can share something by cutting it in different ways: this makes it 'different fractions but not different amounts'. Finally, they understand the inverse relation between the denominator and the quantity: the more people there are sharing something, the less each one will get.*

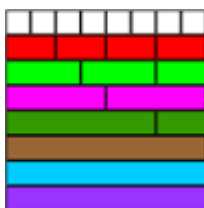
The activity [Fair Feast](#) offers the context of sharing a picnic and could form the basis of an initial exploratory task.

#### Talking about fractions: using the language

It is important that children build up a vocabulary with which to talk about fractions. Of course this is a gradual process, but greatly helped by you modeling appropriate language wherever possible and drawing attention to good use of specific vocabulary by children themselves. You could encourage children to write a class definition for your 'working wall' and see if this can be improved on over the time spent on fractions. The article [Developing a Classroom Culture That Supports A Problem-solving Approach to Mathematics](#) offers several practical ideas to help your classroom become a classroom that is based on talk.

### **Digging deeper**

#### Equivalence



The idea of equivalence is a key one to introduce as children's understanding of fractions develops. When tackling equivalence, it is important to give children the opportunity to record in their own way which helps you to see their thinking. (See our [Recording Mathematics feature](#) for further information about recording generally.) [Fractional Wall](#) offers a visual stimulus to help learners grapple with equivalence. The higher-level challenge [Fractions Jigsaw](#) offers an opportunity to find equivalent fractions and carry out some simple additions and subtractions of fractions in a context that may challenge and motivate learners.

### Multiplying fractions using the array

When it comes to calculation of fractions, the danger is that we introduce rules to be memorised and suddenly the conceptual development appears no longer to be valued. However, in the article [Models in Mind](#), Mike Askew demonstrates that the array is a powerful tool for thinking about multiplication of fractions, giving children a visual image to draw on, rather than relying on 'tricks'.

### **Summary**

The concept of fractions is a complex one and it takes time, combined with a rich range of experiences and appropriate mathematical models, for children to develop a deep and rigorous understanding. You may like to try out some of the resources we have recommended in this article to see how they can support the development of children's understanding of fractions. You may also want to look to see what the children's 'fraction diet' is like across the whole school and how it could be usefully strengthened to maximise the opportunities children have to develop a meaningful and thorough understanding of fractions.