A Departmental Workshop

Fractions 2

This is a suggested plan for a professional development session. It has been written to support anyone wishing to lead such a session with a group of teachers and the green 'key points' sections are intended as a support specifically for such a facilitator in guiding discussions.

N.B. These workshops have been written to provide enough professional development activity and discussion for one session of approximately one hour with the option of further activity (as outlined in the 'Possible next steps' section at the end). This final section references the NCETM Secondary Mastery Professional Development Materials which can be found here www.ncetm.org.uk/secondarymasterypd

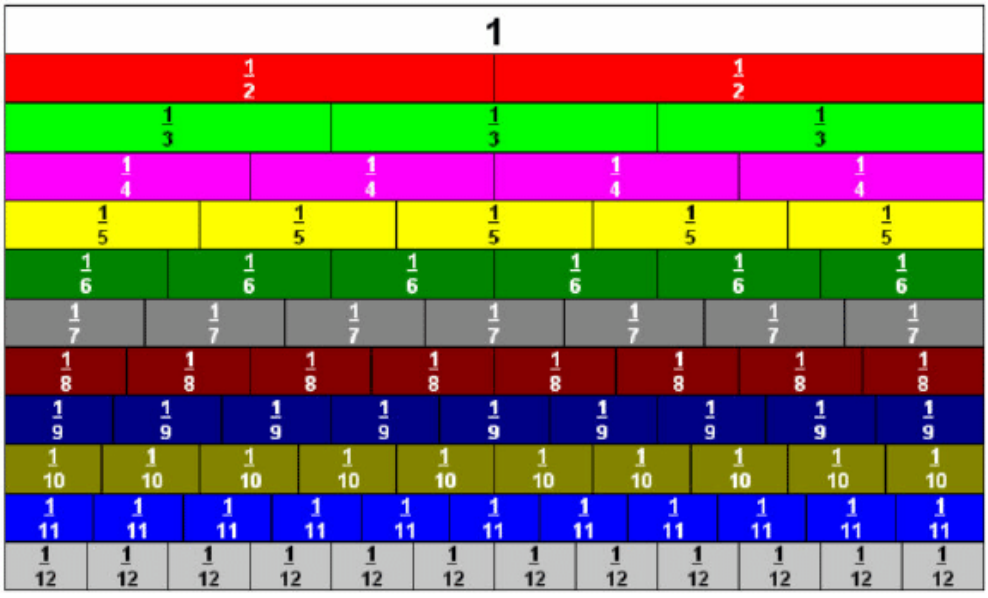
Overview
Understanding and using fractions is difficult for some students. Fractions have various different but connected meanings. They are numbers, but they are also operators on numbers. This workshop builds on the ideas introduced in the 'Fractions 1' workshop. It explores the concept of equivalence and how this underpins a deep understanding of addition and subtraction of fractions, and gives you the opportunity to work with other teachers and discuss:

- how to support students in having a deep and connected understanding of addition and subtraction of fractions
- what implications there might be for your future practice and curriculum development.

Activity 1:

Understanding the mathematical structures that underpin the addition and subtraction of fractions

Look at this image of a fraction wall (this and all other images available on the handout in the PowerPoint file). Consider some of the relationships and equivalences between fractions that it shows.

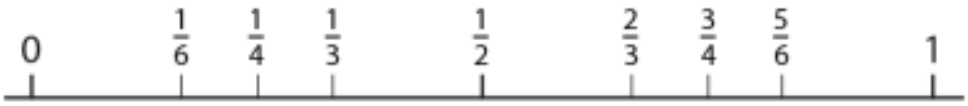


Key Point: Students need to understand that the same quantity can be expressed in different ways. For example, $\frac{1}{3} = \frac{2}{6} = \frac{4}{12}$. Visual representations of these relationships can be very helpful in supporting conceptual understanding.

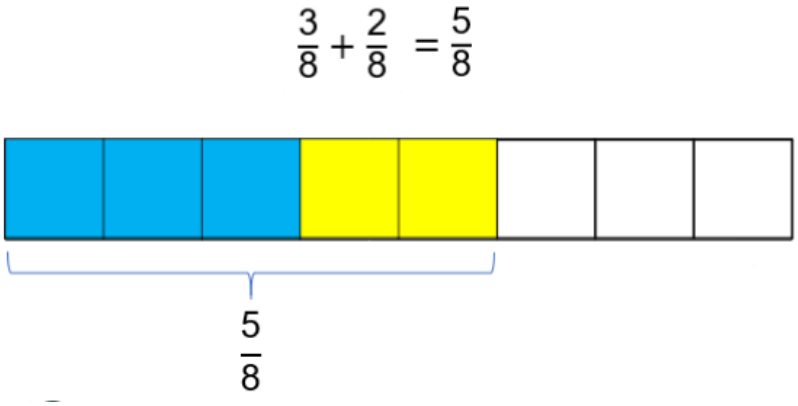
Students need to be able to think of $\frac{2}{6}$ as two lots of $\frac{1}{6}$ etc.

Discussion
It is helpful to use a range of visual representations to explore the relationships between numbers.

E.g. number lines:



Bar models:



- What other visual representations could help students understand relationships between fractions? Are some easier than others to access?

Key Point: Using a range of suitable visual representations can help students to see number structures and to understand relationships between numbers.

Activity 2

Understanding how to add and subtract fractions

Consider the question

$$\frac{2}{3}+\frac{1}{4}$$

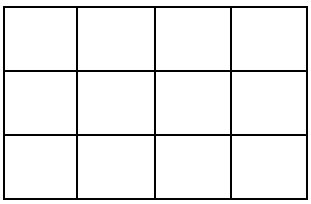
> **Key Point**: A key idea is that of 'unitising': adding quantities of the same 'unit'. Fractions can be added (or subtracted) when they are expressed as multiples of the same unit, in this case, $\frac{1}{12}$. This is what we are doing when we find a 'common denominator'.

$$=\frac{8}{12}+\frac{3}{12}$$

$$=\frac{11}{12}$$

Discussion

- How do your students understand that 2/3 and 8/12 are equivalent? Are they able to reason why the rule 'multiply the numerator and denominator by 4' works?
- How do you help your students to gain conceptual understanding rather than just trying to remember a procedure?
- How would you help them to understand why are we using twelfths here?
- How might a representation like this one help?



Activity 3

Here are some related questions. Consider the different challenges that they pose.

$$\frac{2}{3}-\frac{1}{4}$$

$$\frac{2}{3}+\frac{1}{2}$$

$$\frac{2}{3}+\frac{1}{6}$$

Key Points: Subtraction of fractions works in exactly the same way as addition.

Careful choice of examples will help students to make sensible choices about which fraction equivalences (common denominators) to use.

In the first example above, the lowest common denominator (LCD) of the fractions is 12 (because 12 is the lowest common multiple of 3 and 4).

In the second example, 12 is a common denominator, but it is not the lowest. The LCD is 6. So although we could use 12, it is more efficient to use 6.

In the third example, we can use the fact that one denominator is a multiple of the other. The LCD is 6.

Discussion

- What strategies could you suggest to students to 'check' their solutions?
- How does the choice of examples you offer affect what students learn?

Possible next steps

This session may have surfaced some more long-term developments that you and your department (or group of teachers you are working with) wish to take. This section offers a way of doing this at some point in a future session or series of sessions.

Have a look at *'Core Concept 2.1: Arithmetic procedures'* from the NCETM Secondary Mastery Professional Development Materials Theme 2

In particular, look at the key ideas in:

2.1.3 *'Know, understand and use fluently a range of calculation strategies for addition and subtraction of fractions'*

2.1.4 *'Know, understand and use fluently a range of calculation strategies for multiplication and division of fractions* (pages 11, 12 and 24 – 30).

Discuss:

- how these ideas might influence your own teaching of fractions in Key Stage 3
- how these ideas might support developments in your scheme of work.

There is also further guidance about the use of representations at KS3.