Unitising and re-unitising of fractions

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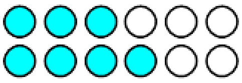
Jonathan Fisher (2010)

Unitising is about selecting a unit of measurement with which to measure or interpret other quantities. Unitising is a strategy that can be used to work out another quantity that relates to the unit selected. It involves the understanding of partitioning and equivalence of fractions to develop flexible thinking about fraction situations. This flexibility can in turn support further understanding about equivalence and fractions as rational numbers (in particular quotients – the result of division).

Unitising can be defined as the assignment of a unit of measure to a given quantity or "chunks" that make up a given quantity (Lamon, 2007).

For example 

The shaded part could represent 7 (circles), or 3 1/2 (columns), or 7/12 (of a dozen), 1 3/4 (bundles of 4), or 1 1/6 (bundles of 6 or rows) depending on what "chunk" or unit you use as your reference whole or unit. All the answers above can be argued as correct and for each the unit (or chunk) is different.

How many shaded		Chunk
7	7/1	circles
3 1/2	7/2	columns
7/12	7/12	dozens
1 3/4	7/4	bundles of 4
1 1/6	7/6	bundles of 6 or rows

Another example could be the unit of measurement for a case of 36 soft drinks. The unit could be the case, a dozen, six-pack, or the individual bottles. Depending on what unit of measure is selected, the overall quantity of that measure can be different.

Questions that involve unitising require students to identify (or decide) the unit of measurement, and use this to explore how many of those make up the total. They can be Number and Algebra fraction type problems (e.g., NM0134, NM0157) or Measurement type problems involving repeated units (see MS2073 and MS2074).

Although the overall total quantity may not change (it can in some unitising problems) the size of the unit and the number of them that make up the total can change. The unit of measurement used determines the number (or count) of that unit that make up the total.

For example, using Cuisenaire rods,

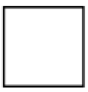
 If pink was 1/3 (unit of measurement), what is

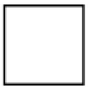
 ... brown? [2/3]

 ... red? [1/6]

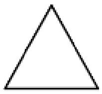
 ... green? [1/2]

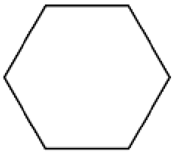
Other examples of unitising questions could be

If  is 1/2 what is  ? or

If  is 3/5 what is  ?

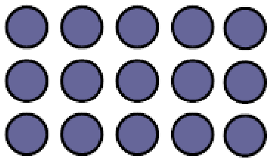
And further fraction questions that involve unitising can also be:

If  is 1/6 draw the whole.

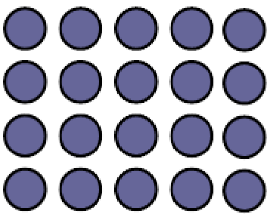
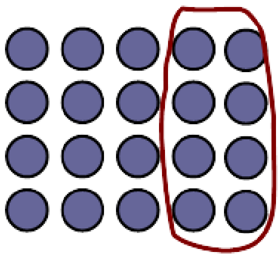
If  is 6/20 what is 1/20?

The questions require that students identify what the unit of measurement that the quantity is to be measured with, e.g., the second question involves finding 1/20 of the shape, by recognising that 6 of these "chunks" (units of measurement) make up the whole shape (which is 6/20). They may even need to re-unitise (select another unit) to better suit solving the problem.

For example

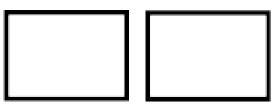
3/ 4 of all the counters is  . What is 2/5?

Here it would be difficult to go directly from the diagram to solve for 2/5 because the diagram shows 3/4 not one whole (students might try to argue the answer is 6 counters). One way to solve this is to use quarter-sized "chunks" to build up to one whole, and then use fifth-sized "chunks" to find 2/5.

→  4/4 (whole)  2/5 – 8 counters

In the questions above the unit of measurement is given explicitly and the other quantities are asked for. Either way the solution relates to what unit of measurement (chunk) is being used to work out the total (or object), e.g., "use this to work out that". However, this is not always the case. Sometimes the unit is implicit and the students need to work it out before answering the questions about the overall quantity. Even simple partitioning questions can encourage students to explore unitising.

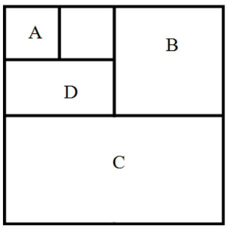
Example: Show how to share the 2 square pizzas equally between 3 people.



How much pizza does each person get?

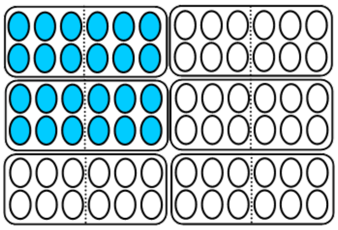
Here the answer could be either 2/3 of a pizza or 1/3 of the pizza – both correct answers, depending upon what unit of measurement is selected. In this question the unit of measurement is not explicit and is decided by the students–either one pizza or all the pizza (two pizzas).

Another type of unitising problem could be:



For example: what fraction of the whole large square is
A? 1/16
B? 1/4 or 4/16 or 2/8 (using D as eighths)
C? 1/2 or 2/4 (using B as quarters) or 4/8 (D) or 8/16 (A)
D? 1/8 or 2/16 (A) or various other descriptions half of a quarter, etc

Another fraction type question can involve unitising and re-unitising (where students apply different units of measure to answer the questions).
There are 6 eggs in a half-dozen, and 12 in a dozen.



Students could be asked what fraction is shaded and respond differently:

- 4/12 [half dozen]
- 2/6 [dozen]
- 24/72 [eggs]

A further example of changing the unit of measurement (re-unitising) is a pallet with 10 boxes - each with 4 packs of 6 bottles. Here the units of measurement could be the individual bottles, 6-pack, dozen bottles (2 6-packs), a box, or a pallet, etc, and therefore the name of the fraction shaded (or indicated) varies depending on the unit of measurement specified.

Re-unitising questions encourage students to see "other "ways' of unitising or re-unitising the set of counters (or a region). Ultimately supporting students to become flexible thinkers with regard to exploring and visualising with different units, and to be able to select the best unit to work out the quantity.

Resource List

- Five dolls
- Five swimmers
- Area of the section II
- Cuisenaires and fractions
- Parts and wholes
- Parts, wholes and other parts
- What's the whole unit?
- Sending envelopes