Purposes of learning mathematics

Competencies

The five areas of competence within the Eurydice report can be summarised as:

- mastering basic skills and procedures;
- understanding mathematical concepts and principles;
- applying mathematics in real-life contexts;
- communicating about mathematics;
- reasoning mathematically.

The full report is available from Mathematics Education in Europe: Common Challenges and National Policies)

Teaching approaches and purposes

When considering the topic of 'fractions and decimals' an imaginative teacher may include a combination of:

- Exercises to develop fluency with multiplication or division algorithms (a skill focus)
- Discussions concerning the meaning of place value and its links with fractional notation (a concept focus)
- 'rich' calculator-based investigative activities or real problems to solve (a strategy focus)
- Discussion on the uses and abuses of fractions and decimals in the media (a social context focus)
- Discussions on the types and purposes of the learning activities used (for awareness of the nature and values of the educational system)

It is of course possible to design a single educational activity that fulfils a variety of purposes.

(Swan, 2006)

Examples

A Area and perimeter

Example 1**:** Calculate the area and perimeter of a rectangle (e.g. 5cm by 7cm).

Example 2**:** Find a rectangle with a given area ($35cm^2$) and perimeter (24cm).

B Straight line graphs

Example 1: Write down an equation of the form y = mx + c and plot a graph.

Example 2: Try to find an equation that fits a given graph.

(Taken from Maths4Life materials, DfES)

For further thought.

Cai and Howson (2013) in considering the globalisation of mathematics education write:

Across the nations, mathematics is in the central place in school curricula. We can justify the need to study mathematics in school from different perspectives (Christiansen, Howson, & Otte, 1986; Romberg, 2002). There was a reasonable convergence of views until the 1960s; a view which was widely based on the assumption that different courses were needed for the students in different types of schools. Then, the coming of the new mathematics brought new ideas on what the aims of mathematics teaching should be, particularly for students in schools with "high ability," and this led to a wide divergence of views on what the school curricu- lum should contain. In recent years, some of the reform material has been accepted into the curriculum and some has been rejected, leading towards more commonly accepted learning goals in school mathematics. In addition to developing tradition- ally accepted mathematical knowledge and skills through mathematics instruction, increasing emphasis has been placed on developing students' higher-order thinking skills. Although there are no commonly accepted definitions of such skills, the fre- quently cited list to be found in Resnick (1987) might help. According to Resnick, higher-order thinking:

1. Is *non-algorithmic*. That is, the path of action is not fully specified in advance.
2. Tends to be *complex*. The total path is not "visible" (mentally speaking) from any single vantage point.
3. Often yields *multiple solutions*, each with costs and benefits, rather than unique solutions.
4. Involves *nuanced judgment* and interpretation.
5. Involves the application of *multiple criteria*, which sometimes conflict with one another.
6. Often involves *uncertainty*; not everything that bears on the task at hand is known.
7. Involves *self-regulation* of the thinking process.
8. Involves *imposing meaning*, finding structure in apparent disorder.
9. Is *effortful*; considerable mental work is involved in the kinds of elaborations and judgments required. This list clearly shows that higher-order thinking skills involve the abilities to

think flexibly so as to make sound decisions in complex and uncertain problem situ- ations. In addition, such skills involve self-monitoring one's own thinking—meta- cognitive skills. In particular, ideally, mathematics instruction should provide students with opportunities to: (a) think about things from different points of view, (b) step back to look at things again, and (c) consciously think about what they are doing and why they are doing it. Resnick's list does not include the ability to collaborate with others, but being able to work together with others is also an essential higher-order thinking skill. Collaborative work encourages students to think together about ideas and problems as well as to challenge each other's ideas and ask for clarification.

Cai, J & Howson, G. (2013). Toward and International Mathematics Curriculum. In K. Clements et al. (Eds.), *Third International Handbook of Mathematics Education* (pp, 949-974). New York: Springer.