

Using ICT to improve the Teaching of Difficult Concepts in Mathematics

This aims to engage teachers and mathematics consultants in a piece of action research intended to explore the potential of using ICT to improve the teaching of 'difficult topics in mathematics. It will be important that participants identify suitable areas for themselves – after all, it is they who will be developing ICT approaches to tackle difficult teaching areas, so the problems need to be real ones, encountered (and hopefully overcome) in their own classrooms. However, rather than present participants with a blank page, we will start by identifying here some possible areas to work on. The difficulty here is that there is no shortage of competing theories, emphasizing different aspects of the learning process. Rather than engage too deeply with any one of these theories, we will simply state here that one important theoretical orientation for the project is a cognitive one; we will be primarily concerned with the relationships between mathematical ideas, and how these can be mediated by the use of ICT. We will be asking questions like, what are the common sticking points in childrens' mathematical learning and Can ICT provide a visualisation that helps children make sense of difficult mathematical ideas? Conversely, we will be rather less concerned with other factors, such as the emotional and social aspects of mathematical learning.

As a next step, then, we need to develop a working model of the way that a learner structures and organizes mathematical ideas. The obvious impossibility of this task should not put us off. Although we are indeed unlikely to generate an accurate' picture of what mathematical learning really is, we do need at least a broad notion of what mathematical learning is like. We will now present three different pictures of mathematical learning, and consider their implications for the tracking down of difficult concepts.

At a crude level, we could say that mathematical learning is hierarchical, with more difficult concepts building upon easier ones. Therefore, on this simplest of pictures (see Diagram 1), the harder the maths, the more difficult the concept, and the most difficult concepts are those at the highest National Curriculum levels or examination grades.

ICT and Mathematical Learning

This project will investigate some of the ways in which an appropriate use of ICT can support mathematical learning. It is worth, then, reminding ourselves of the contribution that ICT can

make in the mathematics classroom. The Strategys' ICT across the Curriculum (ICTAC) materials identify four key areas: Using data and information sources organizing and investigating Analysing and automating processes Models and modelling. Examples of each of these are provided in the ICTAC resources. These approaches share at least one common feature: ICT can be used to turn mathematical ideas into (virtual) objects that can be manipulated and explored.

This potential to use ICT to 'lose the perceptual gap' has remained largely untapped during the last quarter-century of computer use in school mathematics. Too many mathematical learning packages are still based on unspoken assumptions like:

'Mathematics is basically boring, and the only way to get students to do the necessary drill and practice is to dress up an exercise on algebra as an intergalactic space adventure',

Or:

'Mathematics learning is a question of making steady progress through a fixed curriculum, with regular monitoring of progress and additional practice in areas where it is needed. The computer is the ideal means of managing and automating this process.'