"Isn't it obvious?" – a personal view of mathematics and special needs

Between 1910 and 1913 Bertrand Russell and A.N. Wilson published a mammoth three volume affair called "Principia Mathematica". It was an attempt to put all of mathematics then known on a sound logical base. One might suppose that such a work would contain theorems unrecognisable to most people. For certain, the content would certainly be incomprehensible – yet notwithstanding that, on page 83 of the <u>second</u> volume they finally get round to proving that 1 + 1 = 2. *(Yes, you haven't misread that.)*

Now there's something very odd going on here. We wouldn't be surprised that a piece of mathematics that looked impossibly complex then to be judged "simple" by a great mathematician. But here we have exactly the reverse - the simplest piece of mathematics that we could imagine being demonstrated to be " (almost) impossibly complex" by the greatest logician of the twentieth century. How could one possibly go about proving one plus one equals two, and taking more than one volume of tightly packed mathematics to get there – believe me, this is no two line affair?

The answer lies partly in our own brains. It would seem that some aspects are "hard-wired" into us and are so self-evident that no proof is necessary. We just accept it. The mathematics does not concern us.

Consider a slightly more complex situation. A parent sends a child to the larder to get a dozen eggs, but the child returns with only ten. When the mistake is pointed out, does the child return the ten eggs and then bring twelve? Well, possibly – it depends on the age of the child. Certainly "counting on" is an acquired skill – it isn't hard wired into us. Children acquire an intuitive feel for "counting on " sometime in the early years of school.

For higher level mathematics we often adopt strategies for giving us the solution. Perhaps a few people know that the first differential of x^3 is $3x^2$ by some rule of thumb – "we bring the 3 to the front and reduce the index by one" but fewer will know quite why this strategy works.

In teaching mathematics to students with additional needs we need to distinguish between genuine understanding and the use of a strategy that works "most times". A student might correctly identify the "mirror image" of a shape on four occasions then be completely wrong on the fifth. Why? Because the student was simply adopting an erroneous strategy – perhaps matching colours or counting squares for no better reason than it seemed to give the "right" answer.

Finally we should not be frustrated by the lack of understanding. You might think your home p.c. is wonderful, but take the cover off, swap over a couple of wires at random, and it would probably blow a fuse when next switched on.

The incredible aspect of the brain is that it continues to work at all even when it has suffered major damage – because it has designed into it a multiplicity of redundant circuits – continually finding alternative paths to complete the task – just like the Terminator at the end of "…Judgement Day".

But hiccups can occur. So some aspect of mathematics that seems so obvious to us, like identifying mirror reflections or "counting on" might remain hidden to a student with special needs. That's no different to our correctly hard-wired brains never appreciating that one plus one equals two is <u>not</u> a self evident truth.

Robert Goodhand
18th March 1999