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Maths is a mystery

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Dyscalculia, like dyslexia, needs specialist help. Brian Butterworth explains why, for some children, arithmetic just doesn't add up

There's a strong chance that there are pupils in your class who, whatever you do, cannot seem to grasp basic arithmetic. Their general intelligence may be quite normal, even high, but they just don't "get" numbers.

It is highly likely that these children have a specific congenital handicap that makes learning arithmetic extremely difficult and stressful. It is called developmental dyscalculia and, like dyslexia, it needs specialist help. Yet, although it has the same prevalence as dyslexia (6 per cent of children), it is far less widely recognised by teachers, parents, education authorities and politicians. Dyscalculic learners have difficulty in understanding simple number concepts and lack an intuitive grasp of numbers. They also find it hard to learn and remember arithmetic facts and procedures. Even if they produce a correct answer or use a correct method, they may do so mechanically and without confidence. They also depend much more on immature strategies, such as counting on their fingers, to solve problems that most children know by heart.

But dyscalculics also have a more fundamental problem, which reveals itself even in simple tasks such as estimating and counting small numbers of objects and selecting the larger of two numbers. The capacity to count, estimate and compare numbers is the foundation on which arithmetic is built, so if these capacities are impaired all number-related learning will be difficult.

We have recently discovered that these capacities depend on a specialised brain network in the parietal lobes that responds to the number of objects in a display, and when two numbers are compared. What is particularly interesting is that this network responds to the abstract representation of numbers: it responds to fives, for example, in the same way, whether it is presented as the digit 5, a word five, five dots, or five auditory tones. In more complex calculations, this network is linked to processes in the frontal lobes that deal with strategies for solving problems.

This system appears to be hardwired from birth, since infants can discriminate between one object and two objects, between two and three objects, and even between eight objects and 16 objects. Infants of five months can even do simple addition and subtraction. Of course, you cannot ask them: "What is one add one?", but you can take advantage of the fact that they look longer at the unexpected. So if you show the infant one doll, and then a second doll, disappearing behind a screen, they will look longer if there is only one doll when the screen is removed.

Currently, the search is on to find how the brains of dyscalculics differ from those of their peers, and which genes are responsible for building and shaping the specialised brain network.

However, we already know that dyscalculia is relatively easy to diagnose and differentiate from other causes of low numeracy. Because dyscalculic children have difficulty with tasks that depend little on education, such as estimating the number of objects in a display and selecting the larger of two numbers, it has been possible to develop a computerised dyscalculia screener. This uses millisecond time to assess estimation and comparison abilities, and then relates the child's average time and accuracy to children of the same age.

In a speech to the Confederation of British Industry before he became Prime Minister, Gordon Brown announced a new initiative in maths education called Every Child Counts. His "personal passion" is to improve numeracy, and although the national numeracy strategy has had its successes, with an extra 83,000 or 76 per cent of 11-year-olds reaching the expected level in 2006, this still means that 24 per cent do not. Mr Brown's solution is to provide the estimated 300,000 at-risk pupils with one-to-one tuition in maths, for 30 to 40 hours a year for those with greatest need.

This is an excellent policy as far as it goes, but it will not reach many of the failing pupils those with dyscalculia unless they are diagnosed and given specialist help.

Even with the introduction of Waves 2 and 3 of the National Numeracy Strategy, there is no formal guidance on how to treat dyscalculic learners. My colleagues and I have tried to develop guidelines that combine our current understanding of dyscalculia with best practice: one-to-one tuition, as Mr Brown proposed, but with specialised methods.

There is a pilot scheme to train teachers in the London Borough of Harrow, supported by John Lyon's Charity, part of the Harrow School Foundation. There is also the promise that technology-enhanced learning can create personalised learning for each dyscalculic child, even in the overstretched state sector. In principle, this computer technology could be as sensitive as a good teacher to the dyscalculic child's current needs.

These opportunities must be grasped if children who struggle to learn arithmetic are to stop feeling, in their words, "left out", "stupid" and "miserable", and teachers are to stop feeling powerless and guilty at being unable to help them."

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Resources

Butterworth, B. (2003). Dyscalculia Screener. London: nferNelson Publishing Company Ltd

For an independent evaluation of the Dyscalculia Screener, and a useful description of how it works, visit www.schoolzone.co.uk/resources/evaluations

Helping dyscalculics

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www.johnlyonscharity.org.uk was used in the Harrow project

Websites

www.standards.dcsf.gov.uk/primary/ faqs/inclusion/56233 www.mathematicalbrain.com

(This is the author's website. For articles on dyscalculia, use the search facility)

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