

What's the Evidence?

Tools and strategies to support children and young people with dyscalculia

Key findings

- Dyscalculia is a specific learning difficulty affecting the ability to learn arithmetic.
- There is not yet agreement on the cause of dyscalculia, or how to diagnose it.
- Evidence suggests that individualised teaching programmes focusing on each child's abilities are likely to be the best way to improve mathematical ability.
- Use of multi-sensory teaching methods, building a child's confidence, high teacher expectation, and parental support may also be helpful.

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What were we asked?

We were asked what dyscalculia is, what interventions are used in schools to support children and young people with dyscalculia, and whether there is any evidence that these interventions are effective for improving education and social outcomes.

What did we do?

First we carried out a general Internet search for dyscalculia. We then searched NHS Evidence, Cochrane, TRIP, NICE, and PubMed databases. We looked for studies that evaluated the effectiveness of any intervention for children or young people with dyscalculia.

What did we find?

Terminology

There are various terms which are used to describe mathematical disabilities:

- Dyscalculia or developmental dyscalculia
- Specific disorder of arithmetical skills
- Mathematics disorder

- Specific learning disorder with impairments in mathematics
- Mathematical learning difficulty

All these terms have slightly different definitions and diagnostic criteria.

This evidence summary focuses on developmental dyscalculia in children. It is important to distinguish between developmental dyscalculia, which can be first noticed when a child develops mathematical knowledge, and 'acquired' dyscalculia, which occurs as a result of a brain injury or stroke.

What is dyscalculia?

Developmental dyscalculia is a specific learning difficulty. Children with specific mathematics difficulties, who perform at average levels in other areas of the curriculum, may be considered as having developmental dyscalculia.¹

Children with dyscalculia struggle to learn arithmetic. They may have difficulties understanding simple number concepts and making basic calculations. Children with dyscalculia may also lack a natural sense of

numbers, for example, knowing whether 9 is bigger or smaller than 3.²⁻⁴

Dyscalculia often occurs alongside other specific learning difficulties such as dyslexia, dyspraxia, or ADHD.^{4,5}

Diagnosing dyscalculia

Dyscalculia is not yet fully understood. It is generally agreed that there are many factors which can contribute to a child having dyscalculia, for example genetics, physical health, premature birth, early educational experiences, anxiety and/or self-image.^{1,6}

It is estimated that between 3% and 10% of the UK school-aged population have dyscalculia.^{1,4} However, despite several screening tests existing, there is no agreed assessment to diagnose dyscalculia.^{7,8}

What tools or strategies exist to support children and young people with dyscalculia?

The current tools and strategies to support children and young people with dyscalculia have a broadly similar focus. They all aim to improve specific arithmetical skills including being able to approximate, counting skills, recognising small quantities, understanding that things have a precise quantity associated with them, and that adding or taking things away alters quantities.^{1,6,9}

Teaching principles

It is recommended that teaching programmes should be based on an individual assessment, and should vary according to a child's specific abilities.^{1,6} Mathematics Recovery is one such programme, based on research and currently used in the UK.¹⁰

There is evidence to suggest the importance of building a child's confidence with maths. One way of doing this is to focus on developing strengths rather than highlighting weaknesses.¹

Research suggests that high teacher expectations are helpful in improving a child's mathematical ability. Parents can also play a role by helping a child to create a positive self-image as a successful mathematics learner, and to help reduce anxiety around maths.¹

Programmes and computer-assisted interventions

Multi-sensory methods of teaching can be helpful for improving aspects of mathematics.¹ Games are a good way of engaging children and young people. For example, board games with number tracks, such as snakes and ladders, were found to be effective for improving number recognition and understanding the relative magnitudes of numbers for young children.¹¹

There are a number of computer-based maths games which use images and movement to try and improve numeracy. Two games have been evaluated, 'Number Race' (www.thenumberrace.com), and 'Graphogame-Math'. Studies showed improvements in some aspects of children's numeracy using the games but not others when compared to no intervention.^{12,13} The use of computer games on their own is not generally recommended, but may be helpful in addition to face-to-face teaching.¹

Special Educational Needs Coordinator (SENCO)

The SENCO working at a child's school should be consulted about what support may be available.

Courses

There are some organisations which offer courses for teachers and parents. See below *Signposts to other information*.

Specialist schools

There are currently no schools which specialise in providing specific support for pupils with dyscalculia. However some schools which specifically cater for pupils with dyslexia may be well set up to support pupils with dyscalculia. See below *Signposts to other information*.

What do we think?

Dyscalculia is not fully understood, and experts in the field continue to debate the cause (or causes) of dyscalculia, and how to diagnose it.

However, the available evidence suggests that individualised teaching, multi-sensory teaching methods, building confidence, high teacher expectations, and parental support, are likely to help children with dyscalculia to improve numeracy.

Signposts to other information

- www.bda-dyslexia.org.uk
The British Dyslexia Association offer some information and support on dyscalculia, including training courses and webinars.
- www.dyscalculia.org.uk
Contains useful information and links to resources.

- www.dyslexiaaction.org.uk
Provides training and professional development, mostly focussed on dyslexia but does also include dyscalculia.
- www.crested.org.uk
CRESTeD maintain a register of schools and teaching centres which meet their criteria for teaching pupils with Specific Learning Difficulties (including dyscalculia).
- www.mathematicalbrain.com
A website by Brian Butterworth, a neuroscientist working in dyscalculia research.
- www.gl-assessment.co.uk
For use by schools, includes a dyscalculia screening tool.
- www.stevechinn.co.uk
A website by Steve Chinn, a leading UK expert in dyscalculia.
- www.dyscalculia-maths-difficulties.org.uk
An annual UK conference, the 'Knowledge Centre' tab contains some helpful resources.
- The Elephant in the Classroom: Helping Children Learn and Love Maths, a book by Jo Boaler.
Offers practical advice for parents to help children with maths at home, and for teachers to teach maths well.

We would like to hear your feedback on this summary – please email us at pencru@exeter.ac.uk if you have any comments or questions.

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Note: the views expressed here are those of the Peninsula Cerebra Research Unit (PenCRU) at the University of Exeter Medical School and do not represent the views of the Cerebra charity, or any other parties mentioned. We strongly recommend seeking medical advice before undertaking any treatments/therapies not prescribed within the NHS.