

## Dyscalculia

### Overview description

Dyscalculia is a term that is related to mathematics and, in particular, to skills associated with arithmetic and numeracy. Numeracy is defined as a set of mathematical skills you can use in everyday life whilst arithmetic is the branch of mathematics that deals with addition, subtraction, division and multiplication.

Competency in numeracy is described as the ability to execute standard number operations correctly, consistently and fluently, and there are many different skills needed in order to become numerate. These include the ability to estimate and calculate using a range of strategies, with an understanding of these concepts both mentally and on paper.

Children acquire numeracy skills at different ages and at differing rates, and as a result, start school with varying levels of numeracy. After a period of teaching, some children demonstrate difficulty learning to understand and manipulate number. Over time, these difficulties can be persistent, and lead to considerable distress and loss of interest in learning.

Mathematics difficulties are best thought of as a **continuum**, not a distinct category, with (developmental) dyscalculia at the extreme end.

### Definition and characteristics of Dyscalculia

The term dyscalculia (sometimes referred to as developmental dyscalculia and abbreviated to DD) was described by the Department for Education and Science in 2001 as 'a specific learning difficulty affecting the ability to acquire arithmetical skills'.

It is currently described as a 'specific and persistent difficulty in understanding numbers which can lead to a diverse range of difficulties' and 'unexpected in relation to age, level of education and experience and occurs across all ages and abilities' by the British Dyslexia Association (2019).

The development of mathematical skills is hierarchical and cumulative, i.e. you need to grasp certain skills and concepts before you can learn others; gaps in learning can have a significant impact.

Some children have difficulties learning maths/numeracy skills for reasons other than inadequate educational experiences and/or general learning difficulties. While children and young people can struggle with maths and numbers, this does not always mean that they have dyscalculia.

## Definition and characteristics of Dyscalculia continued

**Maths learning difficulties is an umbrella term used to describe problems with learning and applying mathematical facts and procedures.**

However, the exact nature of the difficulties may vary for each individual.

Some learners who do not meet the criteria for dyscalculia, (i.e. difficulties with subitising, number sense, magnitude and ordering) but still have severe and persistent difficulties with maths despite targeted intervention could still be described as having specific learning difficulties with maths.

Dyscalculia is regarded as distinguishable from general mathematical difficulties due to the severity of difficulties with:

- number sense: the ability to understand and use number and the number system (i.e. ordering);
- subitising: instant recognition of the number of items in a small group without counting;
- symbolic and non-symbolic magnitude: ability to discriminate quantity pictorially or in symbols (i.e. maths words and digits).

Dyscalculic learners may:

- have difficulty understanding simple number concepts;
- lack an intuitive grasp of numbers;
- have on-going problems learning number facts and procedures, performing fluent calculations, and interpreting numerical information.

Even if they produce a correct answer or use a correct method, they may do so mechanically and without confidence.

Developmental Dyscalculia is:

- a **persistent** difficulty in understanding and acquiring skills related to arithmetic and basic number sense **despite targeted intervention**;
- an unexpected difficulty in maths that cannot be explained by external factors;
- diverse in character and occurs across all ages and abilities;
- a specific learning difficulty for mathematics, especially arithmetic;
- often co-occurring with other learning difficulties and neuro-developmental difficulties.

Acquired dyscalculia can arise as a result of traumatic or acquired brain injury (sometimes this is referred to as acalculia).

Factors that can have an effect on learning maths/numeracy can include:

- environmental: for example, lack of appropriate learning opportunities;
- emotional: for example, maths self-concept, maths anxiety;
- cognitive challenges: for example, slow processing speed, difficulties with working memory, visual processing, language processing;
- academic difficulties: for example, poor literacy;
- speech and language: delayed receptive and expressive language skills;
- physical and sensory: for example, visual and hearing impairment, poor fine motor skills.

This list is not exhaustive but indicates a range of difficulties that can impact on maths performance. It is important not to underestimate the impact these difficulties can have.

## Assessment and Intervention

Assessment of dyscalculia is a process, not an event and should happen over time, considering a child/young person's patterns of strength and needs through the Assess – Plan – Do – Review cycle.

Research has concluded that maths interventions should be individualised, involve systematic teaching of problem-solving skills and be based on assessments of a child's specific strengths and weaknesses within mathematics so that each individual child's needs are targeted effectively.

**The assessment of numeracy difficulties is a process rather than a one-off event, and without evidence of appropriately personalised / targeted intervention by schools, dyscalculia cannot subsequently be confidently identified.**

For those children whose numeracy difficulties are persistent and not responsive to the evidence-based interventions delivered over time, following the Assess – Plan – Do – Review model, more specific assessments of strength and needs and personalised interventions (based on these assessments) may be required (as is outlined in statutory guidance).

A range of assessments pertaining to **number concepts, fluency, working memory** and **visual processing speed** may be completed by Specialist Teachers and/or Educational Psychologists as part of identifying strategies for teaching staff or to identify best practice and evidence-based intervention.

Tests explore cognitive functioning and might be used to find out if children and young people with numeracy difficulties also have difficulties with cognitive processes such as memory, language, visual-spatial and information processing. Cognitive assessments can be useful for overall educational planning and to ensure

that there is the appropriate level of intellectual challenge in lessons. However, cognitive assessments do not provide the information needed to plan numeracy interventions and or predict progress in numeracy.

### **Intervention**

Reasonable adjustments need to be in place to address any numeracy difficulties. These can include:

- visual resources;
- concrete resources and manipulatives;
- alternative methods of reading (e.g. reading pens, readers);
- alternative methods of recording (e.g. scribes, touch typing, voice-activated software);
- special arrangements to support verbal working memory and processing speed difficulties (e.g. additional time, avoiding unnecessary copying).

An accurate assessment of numeracy skills and/or other underlying difficulties is required to identify the specific areas to address. The content of an intervention will depend on the areas of numeracy causing concern and their associated pre-requisite skills.

Research shows that teaching and interventions are most effective when the following are included:

- a structured approach using task analysis that promotes the **teaching of one new skill at a time**, so ensuring that skills are taught in a hierarchical sequence, and that includes mixing old and new learning, which minimises forgetting; e.g. **Precision Monitoring**;
- ensuring children and young people are fully informed about the purpose of interventions, their achievements and rate of progress.
- utilising appropriately trained teaching assistants to implement well-founded interventions;
- **CPA** (Concrete, Pictorial, Abstract) is a core feature of supporting children and young people with numeracy difficulties.
- **distributed practice**, i.e. short, frequent teaching sessions (a little but often approach), that incorporate practise of identified skills, as this addresses any identified working memory deficits.
- teaching of skills to promote fluency and generalisation, as well as accuracy, by ensuring that there are **sufficient opportunities for the practise of skills before moving on**;
- ensuring children and young people are fully informed about the purpose of interventions, their achievements and rate of progress.
- **peer assisted learning**

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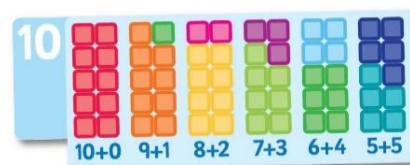
For Early  
Years

In the early years children often show variations in the acquisition of mathematic skills and this does not necessarily mean that they will have specific learning difficulties as they mature. To support mathematic skills in the early years, it is important to create meaningful, motivating and exciting opportunities and experiences to develop a love and interest in number, shape and measure.

Consider how you use working walls for children to access information needed to support their learning e.g. a pegged number line for children to remove and experiment with sequencing, adding and subtracting numbers.

Have resources readily available within continuous provision for children to access independently in their play and learning such as counting teddies, number lines, and multilink.

Children will also benefit from create ways of rote learning maths 'facts'. For example, learning number bonds through songs, rhymes, actions and visual prompts.



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It is important to consider that often at this stage students are required to study more intensively, to produce longer and more complex pieces of work, to independently organise their study and revision schedules and to use their math skills more within the community or to manage their home lives.

Therefore, it is important to teach the student strategies to manage their dyscalculia or difficulties with math including problem solving skills, planning and organisational skills.

- Teach meta-cognitive skills i.e. 'knowing about knowing'. E.g. <https://www.highspeedtraining.co.uk/hub/metacognition-in-the-classroom/>
- Teach organisational skills: at this stage, it is often expected that students will have developed good organisational skills, however this may not always be the case. For example, teach them to use colour coding/pictures/diagrams, demonstrate how to use planners and filing systems and use IT short cuts such as recording devices, apps etc.
- Continue to teach numeracy techniques and study skills: encourage students to take time to use their math skills in the community, offer access to apps that will support them to use their skills
- Provide exam access arrangements: ensure that these are up to date and that students have appropriate opportunities using the access arrangements before their exams.

## Evidence-base/References

British Dyslexia Association (2019). *Neurodiversity and cooccurring difficulties – dyscalculia and maths difficulties*.

<https://www.bdadyslexia.org.uk/dyslexia/neurodiversity-and-co-occurring-differences/dyscalculia-and-maths-difficulties>.

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Carlos O. Calderón-Tena (2016) Mathematical development: the role of broad cognitive processes, *Educational Psychology in Practice*, 32:2, 107-121

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Geary, D.C. (2004). Mathematics and learning disabilities. *Journal of Learning Disabilities*, 37, 4-15.

Gifford, S., (2018) *Subitising*. <https://nrich.mathematics.org/14004>

iSpLD Assessment Standards Committee (2019). *SASC Guidance on assessment of Dyscalculia and Maths Difficulties within other Specific Learning Difficulties*.

## Useful Links and Resources

- Dyscalculia Pocketbook 2015 by Judy Hornigold
- Maths Learning Difficulties, Dyslexia and Dyscalculia: Second Edition (Dyslexia Essentials) Paperback – Illustrated, 18 Oct. 2018
- The Dyscalculia Toolkit: Supporting learning Difficulties in Maths by Ronit Bird, 2017.
- Understanding Dyscalculia and Numeracy Difficulties: A Guide for Parents, Teachers and Other Professionals by Patricia Babbie and Jane Emerson, 2015.

The above predominantly draws on the information included in the document **‘Guidance on identifying dyscalculia and supporting children and young people (CYPs) who have persistent difficulties in acquiring numeracy skills’** issued by the Integrated Service for Learning (Hertfordshire Local Authority).

- <https://mathsnoproblem.com/blog/author/judyhornigold/>
- [www.stevechinn.co.uk](http://www.stevechinn.co.uk)
- <https://www.mathsexplained.co.uk>
- <https://www.dyscalculia.org/>
- [www.understood.org/en/learning-thinking-differences/child-learningdisabilities/dyscalculia/what-is-dyscalculia](http://www.understood.org/en/learning-thinking-differences/child-learningdisabilities/dyscalculia/what-is-dyscalculia)