

Support for Maths Difficulties at Sheffield Dyslexia Centre (SDC)

Dyslexia is a specific learning difficulty which affects the acquisition of literacy skills. However, for a large proportion of dyslexic students there are also issues surrounding mathematics.

At SDC, we see students who present with a range of difficulties. Some have a sound grasp of the concepts but problems with the mechanics of maths, and some whose grasp of the concepts themselves is weak but may or may not be able to perform calculations accurately.

We support students mainly within Key Stages 2 and 3 or those studying for GCSE- either for the first time or older students who have previously been unsuccessful in this exam.

Weak short term/working auditory memory, a significant feature of dyslexia is an important factor contributing to difficulties in maths. Short term memory allows an individual to receive information and retrieve it again within a short period of time. Working memory involves taking that information, working with it and retrieving it in a changed order or state.

The inability to process information at speed is also a significant factor in maths difficulties. There is often confusion between the inability to do maths and the ability to do maths quickly.

WHAT DO WE DO?

This depends on the age, ability and needs of each student.

An appropriate level of assessment is undertaken to investigate present levels of achievement and underlying conceptual understanding and to identify specific areas of concern.

1:1 specialist teaching is then delivered following these underlying principles:

1) “Maths is about understanding not remembering”: The essence of maths is the development of conceptual awareness and acquisition of skills in order to problem-solve, not the instant recall of number facts or speed of obtaining “the answer”. Rote learning of facts is an inappropriate strategy for our students.

2) The importance of the four operations of addition, subtraction, multiplication and division: These underpin all other mathematical processes and the conceptual understanding and the ability to successfully perform calculations of each, are vital for successful mathematical progress.

We teach these four operations described by six stories- one each for addition and multiplication, and removal and difference stories for subtraction and sharing and grouping stories for division.

3) Use of multisensory teaching/learning methods: Based on the same principles as our literacy teaching, each student progresses at their own pace, with the use of a range of concrete materials at all stages to illustrate the concepts involved.

4) Use of written, extended vertical calculation methods: Individuals with weak working memory will always struggle with mental maths methods. The extended written methods used at SDC record all the steps others would hold in their short- term memory. The vertical nature of column methods (as compared to the use of number lines or other horizontal methods) also reduces the load on working memory, whilst requiring and supporting good understanding of place value and prove to be the most successful for our students.

6) Our role in a child’s maths education: We **do not** intend to replace the maths teaching being received at school which would be impracticable in the time available. Our role is to underpin learning at school with the conceptual understanding and specific skills taught in the most appropriate manner for their specific learning difficulty - in order for them to more fully access their school maths lessons. This works most successfully when the student is encouraged to use the methods that they have been taught at SDC, within the classroom.

(School Staff members are very welcome to observe lessons at SDC – with the approval of parent and student.)

HOW / WHAT DO WE TEACH?

Place Value

A sound understanding of place value is vital for maths development. Using Dienes (Base 10) and extended materials, we encourage work with (initially whole) numbers up to millions.

Addition and Subtraction:

Students are encouraged to use their fingers for counting on, for addition and subtraction, using consistent finger shapes.

Each calculation is considered in “story” form to ensure complete understanding. Column addition and subtraction are introduced as soon as the numbers involved are larger than can be calculated on fingers alone. At each stage, the use of concrete materials, in particular Dienes (Base 10), is used to illustrate the processes being undertaken.

Careful use of language is important. For example, in addition, it is important that we are NOT “carrying one” but placing the resulting 10, 100 etc into the correct column.

Similarly, in subtraction with regrouping, we are “breaking up”, “swapping” or “changing”, a ten rod into ten separate units, not “borrowing” from the next column.

Multiplication and Division:

It is important that multiplication, as a concept, is understood and storytelling to ensure understanding is vitally important. For this reason, 3×4 (3 boxes with 4 bananas in each) and 4×3 (4 boxes with 3 bananas in each) are not the same – because the stories are different, although it is useful to know they result in the same total.

Multiplication is viewed in terms of rectangles (Cuisenaire blocks are extremely helpful for this), table patterns are investigated, and the 10×10 table square is introduced.

We **discourage** the rote learning of multiplication tables as we have found it to be a stressful and largely unproductive activity for the students we see. There is no doubt that a student who can easily recall table (and other number facts) will be able to perform certain mathematical processes more quickly and will certainly be better at mental maths. However, quicker maths is not necessarily better maths! We have students who have performed exceptionally well (including to University level and beyond) who have never had instant recall of their table facts.

Often those who come to us have spent countless hours learning their tables- sometimes retaining them long enough for the resulting test at school, only to forget most of them again as quickly. Even those who can remember them in isolation, find that when concentrating on a calculation, cannot juggle all the necessary information, and something has to give! This all causes considerable, but unnecessary, stress.

It is of course important that table facts are readily available. Therefore, access to a 10 x 10 table square is vital whilst undertaking any maths work, including work with factors, fractions, algebra etc. where others would use their remembered table knowledge.

Students are shown how to construct this table from patterns, so that this is available (with the provision of 1cm squared paper -a recognised “Reasonable Adjustment”) in exam situations. With practice, the table square can usually be reproduced in fewer than 4 minutes.

A traditional – but extended –written form of long multiplication is introduced from the beginning. This describes the processes undertaken with the maths materials (usually a mixture of Dienes and Cuisenaire) in terms of rectangles. It may appear a little “long winded” but as it relies on the understanding of all that is happening and not on half-remembered methods, it proves far more successful over time. The recording of each step replaces the holding and manipulating of numbers in memory.

Before the introduction of formal division methods, work is undertaken to ensure that, $12 \div 3$ can be read as 12 shared into 3 groups OR 12 split into groups of 3. Again, an extended written calculation is taught, with all the steps recorded.

Each of the four written calculation methods, as taught at SDC, can be used for examples involving numbers of any magnitude, so will last throughout the students’ maths careers, supported only by the use of fingers for addition and subtraction and the table square for multiplication and division- with no learned number facts required.

FURTHER WORK:

For most students, support from SDC should be viewed as a short- term intervention rather than long term on-going support. Once a student has a strong understanding of the concepts, and sound calculation methods, for each of the four basic operations, this may be sufficient for them to thrive within their school classroom. Any further work depends on the age and school level of the student.

If a student continues with SDC tuition once their grasp of the four operations is established, they usually progress to work on “bits” of numbers i.e. decimals, fractions and percentages.

At GCSE level, the tuition continues- in accordance to the exam syllabus- in a similar vein with the introduction of methods designed to support working memory and processing speed. Work will also involve interpretation of, and application of these methods to, exam style questions.

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