Dyslexia And Mathematics

A Guide for
Parents and Teachers

A Leaflet Produced For
Maths Year 2000

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Introduction

The BDA welcomes the government's initiative of the National Year of Numeracy, together with its National Numeracy Strategy. This leaflet is in response to interest of teachers and parents who are concerned about problems that some dyslexic children experience when learning mathematics.

Traditionally dyslexia has focused very much on literacy· the learning of the reading and writing processes. For some dyslexic children and adults difficulties also transfer into the learning of mathematics. It is well known that dyslexic people are as able as many others but that they need to learn in ways, which suit them best.

Too many dyslexic children are put in low sets for mathematics where they receive "more of the same". Such methodology is of little value to them. As a result, frustration and tension grow. Many highly able dyslexic children are in these sets through misdiagnosis. It is hoped that many of them will be helped directly through the National Numeracy Strategy but, for those who are not, alternative methods must be found.

We look forward to seeing both teachers and student teachers trained in the recognition of dyslexia within the area of mathematics as well as literacy.

At the end of this leaflet, there is a list of helpful books and addresses where both teachers and parents may get more information.

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What do we mean by "mathematics"?

Dyslexics often have difficulty with aspects of numeracy, for example, learning times table facts, yet they can be successful in mathematics. Mathematics is made up of many varied topics such as shape and space. It is not just numeracy.

Unfortunately, mathematics begins with numeracy and it is these early experiences of numbers that can be so influential in setting the attitudes to learning mathematics. If these initial problems can be addressed then there are no reasons why a dyslexic pupil cannot achieve good grades in GCSE and beyond.

Why should there be difficulties in numeracy?

It is not surprising that those who have difficulty in deciphering written words and learning patterns involving symbols should also have difficulty in learning the various facts, notations and symbols, which are used in mathematics. If teachers are aware of the potential learning barriers and if they can present the work in ways, which minimise these effects, then the dyslexic pupil can succeed in numeracy.

The Numeracy Strategy will have some benefits for dyslexic pupils, for example, it encourages pupils to extend known facts as with deriving 4 x facts by doubling 2 x facts. The structure allows for frequent returns to topics thus allowing revision opportunities. There are also areas and approaches, which will be less 'dyslexia friendly' such as the emphasis on rote learning basic facts and the general pace at which the Strategy moves along.

Possible Pointers

i. ***Speed of working***

   Is the person slower in doing simple + - x + calculations than might be expected from her/his age and intelligence?

ii. ***Addition and subtraction facts and multiplication tables***

   Does the person use finger counting (because recall from memory is slow, unreliable or not available)? Does the person have difficulty recalling times table facts other than 2 x, 10 x and 5 x? If asked for 7 x 2 do they start at 1 x 2 and count up to 7 x 2?

iii. ***Counting backwards and counting from a different starting point***

   If the person is asked, say, to count backwards in twos or threes from 30 or to say which number is back 5 places from 21, does she/he have any difficulty? Is she/he slower and more hesitant when counting on in tens from, say 13 (instead of 10)?

iv. Adding up a column of numbers

Is there a preference for doing several small sums rather than adding up the whole column? Does she/he lose track of the addition and keep re-starting? Does she/he use tallies?

v. Direction

Does she/he find the second of these questions harder or slower to do:-

> From 76 take away 35   Take away 42 from 85

Is there a general tendency to start in the wrong place?

vi. Understanding the language of mathematics

Numeracy has a broader and more varied range of language than, say algebra. For example there are several words that can be used to imply add or subtract. In addition to this, these words may also have everyday meanings such as take away. Even worse, for those learners who seek the security of consistency, the same word can be used to imply more than one operation. For example, it is possible to use 'more' to imply
subtraction as well as addition. Dyslexic learners may show these confusions.

vii. Memorising the order in which to carry out procedures

Dyslexic pupils may show more difficulty in sequencing a procedure such as long division than non-dyslexics (though many people find this particular procedure bewildering).

viii. Understanding place value

Some dyslexics do not readily pick up the idea of place value, particularly when there are zeros in a number (20,040). They may also take longer to absorb the patterns of multiplying and dividing by 10, 1OO, 1,000 etc.

ix. Problems with copying

When under pressure to work too quickly, dyslexics may have problems in copying accurately from a board or paper. They may mix up lines of work, by taking part from one line and part from another line. This problem will be exacerbated by work, which has been poorly designed or written.

x. Notation

Some dyslexics may have difficulty if a new piece of notation is introduced, for instance an algebraic symbol, such as 'x', a geometric term such as 'obtuse angle', a trigonometric term such as 'cosine', the use of a colon to express ratio, or the use of the symbols > and < to mean 'greater than' and 'less than'. Fractional and decimal notation may also prove difficult.

Ways of helping

The suggestions, which follow, are not intended as firm guidelines but should be adapted in the light of individual needs. Not all dyslexics have the same pattern of difficulties, nor the same ways of absorbing
information.

a) Some older dyslexics may be interested in the origins of the number system and some may enjoy discussing why numbers are important in ordinary living. They can be shown that the decimal system is more convenient than the Roman system (I, II, III, IV, V etc.) and that there can be systems, which use base 2, base 3 etc. instead of base 10. Concrete examples are often very helpful if used in conjunction with the written symbols they represent. For example if base ten blocks or coins are used the operations of adding, taking away, etc. can be demonstrated in concrete terms, and this is easier for dyslexics than having to deal with 2·dimensional, abstract symbols on a blackboard or paper. As with the teaching of literacy, the approach should be multisensory: the blocks and coins should be examined visually, touched, and moved about in space.

b) If dyslexics attempt to learn tables by rote this will take an enormous amount of effort for relatively little success. If possible, they should be encouraged to let their strong reasoning power compensate for their
relatively weak immediate memory. For example, it is unnecessary to memorise separately $7 \times 8 = 56$, $8 \times 7 = 56$, $56 = 8 \times 7$ and $56 = 7 \times 8$. They can be encouraged to make use of regularities in the number system, in particular those, which are found in the $2 \times$, $5 \times$, and the $10 \times$ table facts. Work from what the learner knows to take him/her to what they do not know. For example, if $2 \times 6 = 12$ then $3 \times 6 = 12 + 6$, or 4×7 is $2 \times 7 \times 2$ $(2 \times 7 = 14$ then $14 \times 2 = 28)$ or $9 \times$ facts can be estimated as $10 \times$ facts and then adjusted to be the accurate answer $(10 \times 7 = 70 : 70 - 7 = 63 : 9 \times 7 = 63$: this is a good pattern to learn).

c) Dyslexics need to know enough about how the number system works to enable them to estimate the approximate order of magnitude that is needed in a given sum. Once they can do this, there is every reason for
encouraging them to use calculators· but it is important that they should be sufficiently good at estimating that they can tell if they have entered something into the calculator wrongly.

d) When they are given mathematical problems they need practice in being able to tell which operation is needed (addition, multiplication, etc.). Thus if 4 boys have 5 sweets each and it is asked how many

sweets there are altogether, they need to be aware, before doing any calculation, that multiplication is what is needed: if John walks for 8 metres and Jane walks 6 metres more than John and it is asked how far Jane has walked they need to be aware that this is a matter for addition. The skill of interpreting the special language of maths word problems needs to be taught carefully. The Numeracy Strategy suggests that learners be allowed to make up their own word problems from number statements. Doing this can help the dyslexic understand how the language is structured.

e) They should not be discouraged from using their own special strategies.

For example, if no calculator is available, or to check that one has used the calculator correctly, it is appropriate to think as follows:

'9 x 7, don't know: but 10 x 7 = 70, so 9 x 7 = 70 - 7, that is 63'

or   '17 - 9, don't know: but 17 - 10 = 7, so 17 - 9 is 7 + 1, that is 8'

f) Anxiety has a huge effect on learning maths. Dyslexics (and indeed many non-dyslexics) can feel that maths exposes them to failure. A typical reaction is not to attempt a question rather than try and possibly get it wrong. Dyslexics tend to be slower at maths (though not all) due to contributing factors such as poorer short-term memory, slower writing speeds and weaker knowledge of basic facts.

g) Computers can be extremely helpful. However, it should be remembered that the majority of computer programs available under the title of 'mathematics' aim at reinforcing numeracy skills; fewer are designed for mathematical concepts. For example, at a simple level, a child may repeatedly perform multiplication correctly (by remembering the answers) which is a numeracy skill but not know what multiplication is or does and what he/she achieves by doing it. Which would be to understand the concept. Many programs provide multiplication practice but fewer attempt to illustrate and explain multiplication.

Generally, the computer can help in the following ways:

- it is associated with enjoyment

- it provides a welcome change in presentation

- it does not criticise, nor condemn

- it has endless patience

- it can provide extensive practice in numeracy skills

- it can do many basic calculations, especially using spreadsheets, graph and statistics programs

- it can improve presentation

Programs need to be selected with care, taking into account the pupil's age, the presentation of the program and the level(s) and topics of work available.

A final word on helping

Above all, it is important to be *positive.* Since many dyslexics are strong at appreciating and understanding relationships this means that, once they have grasped the basics, they may well find mathematics exciting and enjoyable. In more advanced mathematics, an important skill is creativity, and this too is something at which dyslexics may shine.

Further reading

BDA booklet C15 Maths Support with ICT

Dyslexia and Mathematics: ed. Miles T R & Miles E: Routledge

Mathematics for Dyslexics: A Teaching Handbook: 2nd edition: Chinn S J and Ashcroft J R: Whurr 1998

Maths and Dyslexics: Henderson A: St. David's College, Llandudno
Maths for the Dyslexic· A Practical Guide: Henderson A: David Fulton Publishers

Specific Learning Difficulties in Mathematics: a classroom approach: Olwen el-Naggar: NASEN

Sum Hope: Chinn S: Souvenir Press

What to do when you can't learn Times Tables: Chinn S: Egon Publishing
What to do when you can't add and subtract: Chinn S: Egon Publishing
The Mathematical Brain: Butterworth B: Macmillan: London

Mahesh Sharma courses, videos and books: Mrs P Brazil:

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Tests for teachers

An assessment pack: Basic Skills Agency

Group Maths Test: Young D : Hodder and Stoughton
Mathematics 7 . 11 tests: NFER

Maths links tests of mastery: NASEN

Vernon Graded Arithmetic-Mathematics Test: Hodder and Stoughton
WRAT·3 maths, reading and spelling: The Dyslexia Institute