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HELPING CHILDREN WITH LEARNING DIFFICULTIES IN MATHEMATICS

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Why do children have difficulty in learning mathematics?

The 'blame' for children having learning difficulties in mathematics is often put on the children themselves – they are not intelligent enough, or they are lazy or inattentive, or they are not motivated. Sometimes, it is the parents who are criticised, for not encouraging the children enough, or not disciplining them, or for not providing a good learning environment at home. Then, too, the subject of mathematics is itself often thought to be the problem, in that it is too difficult or too abstract for many children to understand.

However, as individual teachers have been able to show, even the so-called 'slow learners' in mathematics have often been able to make good progress in this subject when appropriate teaching materials and approaches have been found for them. We must therefore take as our first guiding principle that, given the right conditions, even 'slow learners' can be successful in learning mathematics. It then becomes our responsibility, as teachers, to try and find out what the right conditions might be.

Of course, some of the causes for children's difficulty in learning mathematics do not lie within the teacher's power to remedy. Physical deficits on the part of the child, extreme emotional disorders, very low general intelligence, and so on, may be difficult problems for the average teacher to try to handle. But there are many other causes which *are* open to remediation by teacher, or to preventive treatment in the first place, and it is these problems which need particular attention. What kinds of problems are these, and how can the teacher help the child to overcome them?

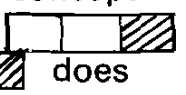
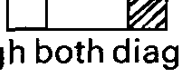
The problems themselves can perhaps be usefully classified under three main headings, namely intellectual problems on the part of the child, affective problems, and problems due to the

child's educational experience in mathematics. The following table outlines some of the main problem areas, and makes some general suggestions as to what the teacher can do to help in each case:

Type of Problem	Suggestions
A. Intellectual:	
• poor concentration	• arrange short activities, but train child's concentration by involving child actively, varying activity, and asking for 'reporting back' on activity
• poor memory	• arrange material in small 'chunks' • build in checks and reinforcement (little and often) • link new work to other ideas (number 'stories', etc.) • use memory aids – number fact 'ready reckoners', resource files, etc.
• cognitive immaturity	• plenty of concrete/practical work *but* relate to diagrammatic representations, then to symbols • train 'thinking skills' by discussion, question-and-answer games
• slowness in grasping ideas	• allow time • arrange material in small segments • link to other already-known ideas
• difficulty in organising knowledge and experience	• preface new work by overview of what's to come using diagrams, flow-charts • link to existing ideas (use diagrams) • help children build their own resource files

Type of Problem	Suggestions
• computational inaccuracy	• varied practice • build in instant answer checks • use number-fact aids • use calculators
• poor verbal, spatial ability	• experience required – different shapes, orientations, vocabulary in controlled settings • matching verbal descriptions with objects, pictures, actions • gradually introduce alternative verbal forms for same ideas and exercises
B. Affective:	
• poor motivation	• provide 'success' experiences
• anxiety	• small segments of work
• low self-concept	• vary type of work, type of exercise • frequent reinforcement • simple project work, investigations • use group and team work
C. Educational:	
• lack of appropriate background knowledge	• identify existing knowledge • diagnostic testing, question-and-answer games etc. • build *essential* ideas only into new topic programme

Type of Problem	Suggestions
• insufficient concrete, practical experience	• introduce range of concrete and practical experiences • allow *time* for adequate practical experience
• too-early commencement of symbol-work	• link concrete experience to diagrammatic representation (children draw diagrams to show what they do) • link concrete experience and diagrams to verbal description and then to symbols • allow children to use materials, diagrams at all times (they will stop when they don't need them!)
• lack of variety in examples and activities	• use varied materials (pupils, the classroom, buttons, straw, leaves, paper strips, water, sand, etc, etc.)
• overemphasis on mechanical work	• vary types of exercise
• insufficient practice	• vary activities (fact recall, skill practice, discussion, games, practical work, problem-solving, exploration, investigation, experiments, data-collection, creativity, projects, information retrieval)
• too-extensive syllabus	• identify crucial fundamental ideas in mathematics • concentrate teaching/learning activities on these ideas only • remember, it isn't the teacher who has to 'get through the syllabus', it's the children who have to learn (properly) what's important in maths

Type of Problem	Suggestions
• commencing new step before mastery of old	• check mastery, by *short* evaluations • leave short time before new work commenced (some ideas need *time* to become accepted) • build in aspects of old work into new topic (revise in new context)
• poor grading of work and examples	• attend to order of presentation of examples, ideas • increase difficulty level or level of complexity in very small steps
• poor mathematics language	• pay careful attention to meaning of mathematical words, symbols • continual reinforcement of meaning by question-and-answer, reference to concrete experience, diagrams, etc • discussion of mathematical ideas, examples, exercises, methods children use
• use of limited rules	• avoid suggesting rules like 'you always divide the big number by the small', 'multiplying makes bigger', and so on • include examples dividing a small number by a bigger number, etc., even if the children can only write 'less than 1' as the answer (eg. 'share 1 cake between 5 children. How much cake will each child get?) • include non-examples of concepts as well as examples (eg.  shows 1/3, but  does not, even though both diagrams are divided into 3 parts)

What can the teacher do to help children with learning difficulties in mathematics?

Clearly, the first thing that can be done is to pay careful attention to the causes outlined above, since this will help teachers to focus upon important aspects of the teaching of mathematics which may not have been an explicit focal point for attention before. Many of the problems indicated may suggest their own remedies. For example, insufficient practice would suggest that children may need to be given more examples to do. However, before doing this, the teacher needs to make sure that the child does understand the exercises, and knows how to solve them.

If the child does not understand, then practice is of very little use; and if the child is doing something incorrectly, then further practice will probably serve merely to reinforce and strengthen the error – not quite what the teacher had in mind! Then, too, 'practice' should not be taken to mean that the child needs to do pages and pages of 'sums'. Such an approach *might* result in the child's learning the particular facts or skills, but is very likely also to result in the child's coming to dislike mathematics intensely, with a resulting increase in problems of motivation. Consequently, care needs to be taken to ensure that the child does understand how to do a particular kind of problem, and then practice in solving that kind of problem needs to be presented in as many varied (and interesting) ways as possible. For example, practising the addition facts can be done by means of games such as 'snap', 'dominoes', 'bingo', and a variety of board games, as well as by activities and exercises such as those shown in Figure 1. Similarly, the other problem areas can be addressed by some of the methods suggested in the above table.

Secondly, of course, the whole model of instruction which teachers adopt many require review. Is 'instruction', for example, the same thing as (child-centred) 'teaching'? And if not, is one model perhaps more appropriate to handle the above problems and their suggested methods of solution? A glance at the table below may indicate substantial differences between the two approaches which may be worth considerable thought, especially in the light of the kinds of suggestion made above:

Instruction		Teaching (Child-Centred)	
Step	**Action by**	**Step**	**Action by**
Demonstration	Teacher	Experience	Child
Explanation	Teacher	Discussion Elucidation	Child/Teacher
Memorising	Child	Practice	Child
Practice	Child	Reinterpretation	Child/Teacher
		Application Memorising	Child

The value of the child-centred approach lies not only in its power to provide an appropriate context in which to carry out many of the suggestions indicated above for helping children with learning difficulties in mathematics. It also provides for the active involvement of the child at all stages of the teaching-learning process, a situation which improves the quality of the child's learning, puts the child more in control of his or her own learning activities, and provides the teacher with on-going feedback concerning the child's progress and problems. It must remain for teachers to decide whether this is a model worth adopting, and for teachers, curriculum developers, and other mathematics educators together, to work out ways of translating the model into effective classroom practice.

Figure 1: Practice Examples for Addition
(Instructions can be given verbally)

Example A (Self-checking)

Do these additions. Change each answer in turn into a letter, using the code below. What message do you get?

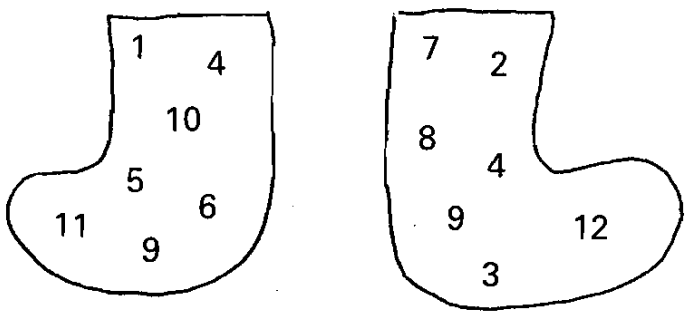
1.	8+7	5.	4+7	9.	9+9
2.	9+3	6.	8+8	10.	6+9
3.	6+8	7.	9+8	11.	7+3
4.	9+7	8.	7+6	12.	4+5

CODE:

9	10	11	12	13	14	15	16	17	18
S	U	A	'	E	M	I	(space)	G	N

Example B

Find pairs of numbers, one from each sock, which will add to make 13.



(Draw a line from each number to its 'partner').

Example C (Self-checking)

Start from 7, follow the arrows and fill in the missing numbers.