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## 1. Solving the dyscalculia problem

This book is about the methodologies that can be adopted in working with children with dyscalculia. It does not venture into the area of why some children have dyscalculia, nor does it deal with where the problem comes from. There are other titles available which focus on these issues.

We start from the point of view that most other books on this subject report: that irrespective of the origins of dyscalculia, the child with dyscalculic problems can be helped by a focus on particular methods of teaching and learning. A central element of this approach lies in knowing which aspects of maths the dyscalculic child is misunderstanding. For example, if the child has simply not grasped the concept of multiplication, then there is little point continuing with any other more advanced maths teaching, until this fundamental has been understood.

You may well be aware with each child what the basic problems are in terms of maths learning. Where this is so, the approaches laid down in this volume can guide you towards the most appropriate forms of teaching and learning for this situation. If however you are not sure of which bits of basic maths the child has understood, and which bits are not understood, then you may wish to consult *Tests for Dyscalculia*, also published in this series. It contains numerous straightforward tests which can be administered within the classroom and which will quickly reveal where the problems lie. *Tests for Dyscalculia* may suggest, for example, that work needs to be done on the concept of division. This volume reveals how the teaching and learning should be structured to overcome the dyscalculia.

Many children, students and adults now use the methods of teaching and methods of learning that we propose – and not all of them are dyscalculic. Many of the ideas that are at the heart of the First and Best approach have been proposed elsewhere by many others. We see our special contribution as having been:

- To make the approach more user friendly through providing our work as photocopiable masters and on computer disk.
- To combine these ideas, some of which were given to us by teachers, and some of which appeared in academic journals and books, into single, immediately usable, volumes.
- To introduce certain new issues rarely seen in traditional study skill materials, but which appear very obviously to work.

As many academic reports now tell us, reform of methods of teaching and learning can have an enormous part to play in raising pupil self-esteem. This development was first noticed by those involved in literacy skill improvement. Since then reports have been made in connection with many subjects, showing that this approach not only aids learning in whichever area it concentrates on, it also benefits pupils in general once reformed methods of teaching and learning are introduced. With study skills blossoming, the previously stifled pupil gains vitality in all areas of school work, and begins to enjoy enhanced self-esteem.

Nowhere is this more apparent than with the pupil who is struggling with maths. Give the child the understanding he or she undoubtedly seeks, and self-esteem rises dramatically. When this happens the pupil's whole life changes.

These programmes show to be a myth once and for all, the notion that changing a school's outlook on, and approach to, teaching and learning is too difficult and slow to undertake across a whole country. For the past ten years, our approach here with dyscalculia, in classes involving dyslexic children, and across schools in general, have shown that schools working

on their own, can change their approaches to teaching and learning and make a huge difference.

In this area the First and Best Teaching and Learning programme can claim to have made a unique contribution. *Success for All* in the United States, along with such UK based reforms as *IQEA*, all require considerable additional funding for extra teacher training and improved pupil-teacher ratios. While schools using the *Success for All* programme in the USA have been able to call on “Title 1” money, UK schools have often been left wondering how to gain access to school improvement programmes on their limited budgets.

By putting the essence of our programme in one photocopiable book we feel that we have helped UK schools to overcome their funding problem and gain access to a major reform programme with just one purchase.

As Robert Slavin of *Success for All* so clearly pointed out, “the key requirement for meaningful change in school reform is that whatever reform is adopted [it] must profoundly improve the daily instruction provided to children.... Research and experience in the US and elsewhere has shown that large scale change in teaching practice can be brought about through the development, evaluation and dissemination of proven, replicable programmes.”

The widespread dissemination of a comprehensive, copiable (and, through the computer disc, adaptable) programme shows that positive developments can be replicated on a large scale in the UK too. The lack of special funding is no longer a barrier.

An achievable aim for all teachers is now the rapid eradication of academic failure for all pupils. All teachers can make an estimate of the grades that their pupils will probably get in national exams. But it is also possible that all pupils can get at the very least a 10% higher mark in all exams, if the best methods of teaching and learning are used. 20% is more likely.

Such a target can be easily achieved. It has nothing to do with reforming the education system, as the materials are widely available and already in use in many schools. Additional help from the government will always be welcome, but for most schools the answer is now within reach.

This volume makes a particular contribution to the work undertaken by the First and Best research team, for this is believed to be the first single-volume photocopiable book to cover both methods of learning and methods of teaching maths for children with dyscalculia. The book is divided into four parts:

**Methods of Teaching.** This section for teachers is intended to be photocopied and shared with staff throughout your department. It can also be shared across departments – for example between the maths co-ordinator (or head of maths department) and the special needs co-ordinator. If you yourself find that the methods here are helpful and bring in the results we predict, that is obviously beneficial. But if you can copy the text and share it with colleagues who then also use it, that is better still.

**Sample policy statements on Methods of Teaching.** These are intended as a starting point for those who wish to codify the message of this volume into the structure of the school’s work.

**Methods of Learning.** We suggest that as part of your regular teaching, one session is set aside each week to work with the pupils on their methods of learning. Some schools will want to let individual teachers handle this, in others the timetable is arranged so that one member of staff works across the whole department. Where the latter is the case each project

needs to be explored and explained by the other members of staff in the department, so that they are fully aware of what is going on.

**Memory techniques.** A small project based on specific ways of improving memory.

Each part can be read in isolation, but is obviously intended to be part of the whole project.

I sincerely hope you find that this book makes a significant contribution to the teaching and learning processes of your school.

This book, and indeed the whole **Methods of Learning** and **Methods of Teaching** project, is dedicated to my three daughters, Catherine, Christie and Heather.

Tony Attwood

## 2. The Effective Teacher of Dyscalculic Children

Our research suggests that the most effective teachers of children with dyscalculia share a range of key characteristics as teachers.

Many of these characteristics are explored within this volume. But because it is the issue on which we are questioned more than any other, here is a brief summary of some of the more important features that effective teachers generally show.

### *Generally speaking effective teachers of children with dyscalculia:*

- Always move from instruction to restricted practice, in which it is hard for the pupil to make an error.
- Ask lots of specific questions to explore learning.
- Constantly change the methods of teaching to suit the situation.
- Correct all errors and give hints rather than straight answers.
- Encourage shared learning.
- Ensure that each small point has been mastered, rather than ploughing on through a major topic.
- Explain in small steps, one point at a time.
- Give lots of feedback which is always positive.
- Practise what has been learned with the pupils.
- Provide lots of examples.
- Provide rules and define points, coming back to these rules and points as the lesson progresses.
- Revise points as they go.
- Spend much more time than non-effective teachers demonstrating points.
- Spend much more time than non-effective teachers explaining points to pupils.
- Stick to the point and avoid wandering, either because of their own asides or through pupil interruption.
- Support pupils when introducing new concepts which may be confusing, allowing the pupils to discuss matters with each other as much as possible.
- Use visuals and key words as reminders of the whole skill or topic that has been taught.
- Work at a high speed, keeping a high energy level in each lesson at all times.
- Work in a multi-sensory approach – at least providing visuals alongside the explanation.
- Work in sequences, and ensure that the pupils know where the sequence starts and ends.
- Work with all pupils by arranging it that everyone can respond – at least in writing if not verbally. (Shared learning and group work obviously help).

### *Generally speaking effective teachers with dyscalculic children tend not to:*

- Ask pupils if they have understood (they test specifically for understanding).
- Ask the whole class if there are any questions (there might be, but the majority will be lost at this point). Errors in understanding are picked up through the testing and checking which is part of the complete lesson.
- Ask non-academic questions.
- Merely correct wrong answers from students – they move into explorations of the error.

It is these various factors that we have integrated in this book, working on the effective teaching methods that appear to benefit virtually every child with dyscalculia, and creating this approach to teaching and learning.

### 3. Methods of Teaching

#### 3.1. Can teaching of dyscalculic pupils be made more efficient?

We start from the premise that almost all children with dyscalculia can learn maths if the methods of teaching are changed to suit their particular needs?

But this raises an important point. There is no point reading about methods of teaching unless you believe it is possible to improve the efficiency of your teaching. That is to say, discussions of methods of teaching are about getting more teaching and learning out of the same teacher, the same resources and the same pupils, by changing the methods of teaching utilised.

The issue is rather like learning to swim. It is quite possible to learn to swim, and avoid drowning, without being much good at swimming. Someone who has studied swimming technique however might be able to show you how to swim in a much more efficient way – more output for less input. More result for less stress. Even an expert swimmer can improve – can squeeze that extra one hundredth of a second out of swimming a length. The same is true in teaching.

You might be having considerable success with some dyscalculic pupils in your school. What we suggest is that you could have even more success, if you changed some of the methods of teaching you use. But we know that if our suggestions involve your taking up many more teacher-hours with these pupils, you are likely to object that the time is not available. So, if the aim is to be more effective, without taking more time, you have to be more efficient. However, increasing efficiency is not a simple proposition.

The complexity of improving output was revealed in the famous Jastrow case in 1900 involving the introduction of the Hollerith tabulating machine into the US Census Bureau.

The inventor of what was in effect the first desk top computer suggested that the operators should enter about 500 records a day and this they duly did. If they ever exceeded this level of work, this caused high levels of stress among the workers. Worried by the stress levels the government insisted that the next batch of trainees should not be told how many cards they could process - and within two weeks of training this new group was processing over 2000 cards a day without any stress or other ill effects.

The point is that although we may feel as if we are doing everything we can, and feel that any extra work would be quite impossible, these feelings may not be a valid measurement of reality. It may be that we could each of us teach more effectively with less effort.

This view is supported by the realisation that although most teachers learn about alternative methods of teaching maths on INSET courses, some still stick to their own favoured methods. This is not because these methods produce better results but because these teachers are happier with their tried and trusted methods.

Efficiency is not a word often associated with schooling - but there really is no reason why it should not be so linked. Four classic texts on school improvement topics in general (Harris 1997, Bennett 1995, Fullan 1991 and Hopkins 1994) muster only a single index entry on the subject for the 1000+ pages of text between them. The education library at the University of Nottingham, one of the major international centres for the study of school improvement, contains five efficiency references - all regarding the installation of efficient heating systems in schools.

Because efficiency is so rarely mentioned in education we must ask, is there some reason why this concept might be invalid in the educational context? Just because those in business and industry talk in this way, it does not mean that it is an inappropriate notion for education.

In terms of economics and democracy, most of us would surely agree that the search for efficiency is as natural in education as anywhere else. Of the approximately £18 billion a year spent on education in the UK, 93% comes from public funds - our money as taxpayers. Even if it did not, and a suddenly generous Bill Gates funded education, we should surely still seek to be more efficient in schools, simply out of a professional desire to do our jobs to the best of our ability.

Thus on the face of it efficiency ought to be a valid concept in education. Let us try to give an example of how it might work in a school.

The head of maths might note that it currently takes ten hours to teach the principle of multiplication to a group of children who have particular difficulties with maths. The desired outcome, where every pupil gains 90% or above on a test at the end of the ten hours, is achieved in 95% of cases. Why does the teacher not ask whether, with a different approach, these same pupils could reach the same level of understanding in five hours? If so, the speed at which these possibly dyscalculic pupils catch up with their more mathematically able colleagues could be doubled.

Opponents in the school might argue that the “five hour” programme was too intense, that the “ten hour” pupils had more fun, or learned to love the subject more. The “five hour” programme (it might be argued) gave the same knowledge but the pupils hated the work. This is an unlikely scenario but if true, we would need to redefine our aims. We should seek the most efficient way of teaching the topic so that the pupils not only gain a certain level of knowledge and the ability to use it in certain conditions, but could also express a certain measure of joy in the lessons (as measured on our patented joyometer). We would then seek the most efficient way of delivering the whole package. If we could do it in seven hours and retain the joy, then that teaching programme is more efficient than the ten hour programme, and we would adopt it.

If we could make all teaching just ten percent more efficient (i.e. achieving the same results using only nine hours instead of ten), it would be equivalent to adding another maths or special needs teacher to every secondary school in the UK. This is equivalent to increasing the UK school budget by over £300 million per annum!

Of course I might ask, what am I going to do with my spare hours? Possible answers include teaching in greater depth to ensure all pupils become competent at maths, all dyscalculia is overcome, and so on. It seems a fairly good objective.

How do we actually increase classroom efficiency? Clearly we should not lose sight of the fact that we are working with people. The school does not become a machine. Nevertheless, it is inescapable that both effective teachers and effective departments (both maths and special needs) are more efficient in the process of teaching and learning. Because they do it better, teachers gain more satisfaction for a job well done, and at this point stress levels decline. Through this process, the learning experiences of the pupils are expanded and, as we all know, a wide range of experiences is itself beneficial from the teaching and learning point of view.

We therefore now turn to various high efficiency methods of teaching maths to dyscalculic pupils.