Review by Wendy Moore

**Book Review:**

The Dyscalculia Toolkit: Supporting Learning Difficulties in Maths (3rd Edition)

**Author:** Ronit Bird, publisher: Sage

The Dyscalculia Toolkit is a practical resource (book and companion website) that can help teachers and tutors of students from 6 to 14 years to understand and ameliorate the obstacles that may impede a student’s progress in mathematics. Students with dyscalculia are likely to have persistent problems with counting, quantity estimation, recalling basic facts, telling the time, learning times tables, and learning and applying formulae and rules (Soares & Patel, 2015). It is critical that schools and systems appreciate that all students, including those with mathematical learning difficulties, benefit from high expectations, a challenging curriculum, and effective instruction (Wadlington & Wadlington, 2008). In this spirit, The Dyscalculia Toolkit has a very clear purpose, which I will describe through the lens of the response to intervention model of support for students with learning difficulties.

**The Why and the How of Dyscalculia Intervention**

The response to intervention (RTI) model is powerful because it avoids questions about the causes of learning difficulties such as dyscalculia, and focuses instead on optimising progress through early and appropriately targeted instruction. The model assumes that students will be provided with up to three tiers of support, each of increasing intensity and specificity (Lembke, Hampton & Beyers, 2012). Dyscalculic students will likely require all three tiers to overcome their problems with understanding underlying concepts in arithmetic. The Dyscalculia Toolkit is appropriate for two of these three tiers.

The RTI model assumes that an effective and appropriately differentiated instructional program that explicitly teaches core skills and knowledge is available to every student in his or her mainstream classroom (Lembke et al., 2012). These are Tier 1 programs, and they are the bedrock of effective instruction for all students, including those with learning difficulties. Some systems and schools choose to make use of commercial mathematics programs for this purpose; others assume teachers will undertake this planning based on state or sector-wide curriculum documents. Either way, according to Wadlington and Wadlington (2008), four important principles should be applied: teachers should explain the need for practical life skills that rely on mathematical understandings so that learning has a clear purpose; teachers should acknowledge that some students experience maths anxiety, and ensure that the classroom is a safe and supportive learning environment; concrete materials should be employed as required before mathematical abstractions are presented; and effective lesson structures should be routinely used, including clear lesson objectives, step by step modelling of skills and concepts, and the generous application of guided practice and review.

The Dyscalculia Toolkit does not provide a Tier 1 learning program; the focus of this resource is much narrower than a comprehensive mathematics curriculum. Its focus is on the areas in which students with dyscalculia need the most intensive support, namely the basic arithmetical processes of number and calculation. However, many classroom teachers feel ill equipped to support students with mathematical learning difficulties and would benefit from familiarity with the main challenges that dyscalculic students experience during mathematics instruction. The insights provided by the toolkit can assist teachers in their planning and interpretation of the whole class mathematics program, including for differentiation and re-teaching within the mainstream class.

Tier 2 interventions, which complement and supplement effective classroom programs, provide additional, regular tutoring for small groups of students who have not shown expected progress (Soares & Patel, 2015). Effectively applied, Tier 2 interventions allow most students with learning difficulties to make real progress and maintain their connection to the
mainstream class program (Monei & Pedro, 2017). Ideally, Tier 2 programs should run four to five times per week, for about 20 to 40 minutes per session (Lembke et al., 2012). Tier 3 interventions provide individual, targeted and sustained support for students with severe and ongoing learning difficulties who have made limited progress despite effective Tier 1 and Tier 2 programs. Individual interventions may indeed provide the most effective contexts of all for students with dyscalculia (Ise & Schulte-Körne, cited in Butterworth et al., 2011). The Dyscalculia Toolkit provides useful suggestions and resources to allow tutors or classroom teachers to develop effective Tier 2 or Tier 3 interventions for students with mathematical learning difficulties.

There are two main approaches to providing Tier 2 and Tier 3 support for students with dyscalculia (Lembke et al., 2012). One is a structured program approach, often using an evidence-based commercial package. The Maths Mastery series, developed in Australia by Rhonda Farkota and described in this issue, is an example of a set of scripted programs based on the principles of explicit instruction. Lembke and colleagues note that such programs, implemented with fidelity, can be highly effective in improving outcomes for low performing groups.

An alternative is a more individualised, problem-based approach which is diagnostic in design and implementation. Such an approach can target particular areas of need and focus on ensuring the development of key conceptual understandings. The approach advocated in The Dyscalculia Toolkit is clearly of this second type, with a strong emphasis on diagnosis and selection of appropriate activities which are aligned to the student's area of need. The activities that are presented in the toolkit are adult-led activities and games; almost all make use of concrete materials, at least in the early stages, as a means of developing and strengthening the student’s understanding of arithmetical concepts.

Does evidence support this approach?

The Dyscalculia Toolkit is a collection of practical resources to support the teaching of number sense, basic fact recall and fundamental calculation strategies, designed for non-specialist teachers and tutors. The bulk of the toolkit consists of activity and game suggestions, tips and proformas for making resources, and suggestions for how they might best be sequenced and used. Bird’s approach is to clarify the inadequate understandings that many students hold in four key areas, and to suggest ways to ensure that students develop both recall of facts and strategies and appropriate reasoning skills to allow them to calculate efficiently where they cannot recall. This approach is supported by existing research studies involving students with mathematical difficulties.

Rubinsten (2007) and Butterworth et al. (2011) describe a number of studies that support the efficacy of interventions which ensure a thorough emphasis on very basic number sense in a range of subtly different contexts, including games. Monei and Pedro’s (2017) meta-analysis of interventions for students with dyscalculia also supports the focus on basic number sense, strategy development and frequent practice. Rubinsten (2007) offers support from neuroanatomical studies for rote learning of key number facts rather than calculation practice to circumvent persistent limitations in the ability of dyscalculic students to learn efficient computational skills. In The Dyscalculia Toolkit, Bird emphasises both: rote learning of key facts, and thorough mastery of simple mathematical reasoning underpinning calculation.

There is a focus throughout the toolkit on the use of manipulatives and games. Butterworth et al. (2011) note that the benefits of using games and concrete materials to support interventions for mathematics are threefold: providing immediate feedback on performed actions, making activities meaningful, and improving motivation. In The Dyscalculia Toolkit, Bird is at pains to ensure that the activities she has developed are child-tested and enjoyable, although, as she notes, the games are always designed with serious conceptual learning and practice in mind. The resource is divided into four main sections, and these will be reviewed in turn.

Section 1: Early number and counting

Following a brief introduction about dyscalculia, Bird begins the first main section of her book by providing an overview of the very early difficulties experienced by dyscalculic children, many of which have been resolved by their normally developing peers prior to beginning school. These include difficulties with understanding how counting works, understanding the relative size of small numbers up to ten, recognizing the size of very small collections at a glance, and remembering simple small number bonds such as 2 + 3. She then moves quickly onto a comprehensive treatment of what to do about this.

Suggested activities include variations on games and activities that provide visual representations of number patterns using dot cards, counting pebbles, dice and dominoes. Another emphasis is the use of Cuisenaire rods to establish a sense of the relative size of small numbers and to teach number bonds and the commutative property of addition (3+5 = 5+3) without the need for counting. These suggestions are supported by photocopiable materials (both in the book itself and on the companion website, to which purchasers of the book receive access). Bird’s explanations carefully interweave the how with the why, so the reader is left in no doubt about the importance of the strategies and the understandings being taught. Indeed, the author’s claim that the resource is as suitable for parents or untrained tutors as it is for classroom teachers rings true because of the attention paid to the explanation of early arithmetical concepts. The instructions are helpfully specific, as this example using Cuisenaire rods demonstrates:

Identify objects for the pupils to measure, e.g. a book or a chair. Pupils must first guess, and then measure, how many whole orange rods they can fit along the length or height, i.e. up to a metre.
numbers because they fail to understand the three-column groupings of the decimal system: three columns of ones (ones, tens and hundreds), three columns of thousands (one thousand, ten thousand, one hundred thousand), three columns of millions (one million, ten million, one hundred million), and so on. As a result they omit or add ‘columns’ in the form of zeroes when they read and write numbers, assuming that each column has its own unique name.

Like the other sections, this part has links to the companion website which provides proformas for reproduction, as well as useful short videos developed by the author which demonstrate teaching points and games. Access to the companion website requires a registration key that comes with the book. As I chose the google play (electronic) version of the toolkit, I needed to email the publishers for an access code. This process was somewhat slow, but access was simple once the code arrived some days later.

Section 4: Times tables for multiplication and division

The last section of the toolkit deals with strategies for quickly accessing multiplication and division facts. The focus is on ensuring that students understand principles and can use strategies to find answers that they might never recall by rote. This means that students are encouraged to memorise key facts, and reason from this limited set of known facts to obtain related facts. Again, learning activities, proformas and games are all provided. The author makes clear that difficulty with remembering tables should not be allowed to interfere with a dyscalculic student’s ability to use reasoning to address more complex mathematical problems.

Summary

The Dysscalculia Toolkit is one of a number of books and resources written by this experienced numeracy teacher and consultant. Key areas of difficulty are briefly outlined, and carefully developed activities are provided for teachers and tutors planning Tier 2 and Tier 3 interventions for their students. The focus of the toolkit is on providing instructional strategies and resources, not on screening, progress monitoring or assessment. While a rudimentary tracking sheet is provided, decisions about the selection of starting points, the pace of introduction of new concepts, and the balance between the areas of focus are left firmly in the hands of the resource user. For teachers and tutors who know that students are having unexpected difficulties, it provides an excellent starting point for focused, diagnostic intervention. More information about this resource can be found at http://www.ronitbird.com.

References