Learning Difficulties Australia | Volume 49, No 2, Winter 2017

Bulletin

The Counting Trap

LDA Contacts

CORRESPONDENCE ADDRESS
PO BOX 4013
Box Hill South VIC 3128

ADMINISTRATION & MEMBERSHIP
Kerrie McMahon ldaquery@bigpond.net.au

GENERAL ENQUIRIES
Lorraine Hammond ldaquery@bigpond.net.au

AUSTRALIAN JOURNAL OF LEARNING DIFFICULTIES
c/- Wendy Moore pubs.media@ldaustralia.org

BULLETIN AND eNEWS EDITOR
Wendy Moore pubs.media@ldaustralia.org

WEBSITE EDITOR
Pye Twaddell thelearn@bigpond.net.au

LDA MISSION

Learning Difficulties Australia is an association of teachers and other professionals dedicated to assisting students with learning difficulties through effective teaching practices based on scientific research, both in the classroom and through individualised instruction.

THE BULLETIN

The Bulletin is produced by the Bulletin Team at Learning Difficulties Australia. Members of the team are Wendy Moore, Alison McMurtrie, Nicole Todd, Roslyn Neilson, Tanya Forbes, Pamela Snow and Molly de Lemos. We welcome the submission of articles from LDA members and others with an interest in learning difficulties for possible inclusion in upcoming editions of this Bulletin.

Please submit articles, correspondence about the Bulletin, or letters for publication to the editor (pubs.media@ldaustralia.org). For questions about content, deadlines, length or style, please contact the editor. Articles in the Bulletin do not necessarily reflect the opinions nor carry the endorsement of Learning Difficulties Australia. Requests to reprint articles from the Bulletin should be addressed to the editor.

The Bulletin is designed by Andrew Faith (www.littledesignstudio.com)

Printed by The Print Team.

From the President

Lorraine Hammond

It was while writing the President's message for the last Bulletin that a completely unexpected and delightful email from Professor Maryanne Wolf, telling me she was returning to Australia, arrived in my inbox. I opened her email just before 4am so sat for a number of frustrating hours unable to share the good news as I waited for my LDA colleagues to wake up across Australia! As you would now be aware, Maryanne will speak in Sydney, Perth and Adelaide in August and details are on the LDA website.

This edition of the Bulletin is all about maths: a subject that seems to engender a phobic nightmare in some of us and presents a significant challenge for many students we teach. At the moment, I am spending a lot of time in schools coaching teachers for research projects and most recently found myself sitting at the back of my old high school maths classroom. In many respects, nothing much has changed. Whiteboards may have replaced blackboards but the concepts are the same and I am getting a refresher course!

At one school where I coach, I met Hugh, an experienced maths teacher. The first time I watched him teach he told me that he was frustrated that his students never finish their work. His lesson was on BIMDAS (the order of operations when you have to solve a problem with brackets). He started off by explaining BIMDAS and worked two examples on the board. The students sat in silence. The classroom appeared to be a picture of compliance but when I opened up my laptop to start typing I noted that there were over 10 internet connections available on students' phones. It seems they were engaged but not necessarily with maths. As Hugh gave out the first worksheet I realised, with some surprise, that there were 45 examples. The student sitting next to me completed the first three examples incorrectly but pushed on. Others raced ahead, others ground to a halt. I bravely explained to Hugh that revising the design and delivery of his lesson would result in better quality instruction and encouraged him to attend a professional learning session on Explicit Instruction I was presenting soon.

During the professional learning session Hugh heckled me mercilessly. "It's rote learning, just rote learning!" he called out, more than once during the day. I explained that 6x8 was indeed 48 and being able to recall this surface level knowledge without hesitation was essential if students were to engage in deeper learning, like BIMDAS.

Needless to say, it was with a sense of trepidation that I found myself back in Hugh's classroom last session on a Friday afternoon with his rambunctious year 10s for my second observation. Today it was Pythagoras' Theorem, but Hugh was a different teacher. He began with a learning intention that he articulated clearly and the students repeated. Instead of modelling two examples, Hugh had four but then he worked at least 10 with the students who scrawled their answers frantically on whiteboards showing their answers every few minutes. While the Year 10s eventually did some independent practice the 45 item worksheet had been replaced with five examples written on the board. Hugh had changed his practice from telling to teaching.

When I asked Hugh why he changed his practice he told me that teaching explicitly made sense. I agreed, but drew attention to how long Hugh had been teaching. In my experience, the longer teachers have been finessing their practice - whether it be great, okay or ineffective – the harder it is to change a well-established habit. "I thought I'd give it a go as it might help my students," Hugh explained.

I admire Hugh; I took him for a reluctant starter but through making small changes to his lesson design and delivery, his instruction was more effective. Of course, there will be students whose fundamental maths difficulties include learning maths facts, comprehending number problems and learning how to manipulate number, and who will require more than guided practice, but there is room for all teachers to provide more examples and giving students an opportunity to demonstrate what they do and don't know while they are learning. When teachers are able to adjust their instruction while they are teaching, they become more aware of the needs of individual learners, particularly those struggling with number concepts.

LDA's president, Dr Lorraine Hammond, is a senior lecturer at Edith Cowan University. She has a particular interest in preventing literacy based learning difficulties. Lorraine lectures in Direct Instruction and Learning Difficulties and is currently conducting research on Explicit Instruction.

Council Notes

Pamela Judge

Website Functionality

If you are a consultant, or have considered becoming one, LDA has been working on the functionality of our website to support a more efficient process for consultants to apply, renew and register professional learning. This innovation is not only designed to streamline the process for maintaining consultant membership, but also to allow our consultants to demonstrate that they have completed appropriate post graduate qualifications and regular professional learning that is relevant to their work with students with learning difficulties and learning disabilities. Consultants must complete at least 20 hours of professional development activities each year, including a minimum of four hours of face to face learning. The professional development can include presenting professional development sessions, writing articles for the *LDA Bulletin* and participating in Consultant network group meetings.

Upcoming professional learning

Professor Maryanne Wolf, internationally acclaimed reading researcher and Director of the Centre for Reading and Language and Associate Professor Child Development at Tufts University, will be visiting Australia again in August 2017. She will be presenting the following workshops:

Sydney – Monday 14 August 2017, 9.00am-12.45pm, Mantra Parramatta
From the Lab to the Classroom: New Directions in Dyslexia Research – a half day with **Professor Maryanne Wolf**, in conjunction with SPELD NSW

Perth – Saturday 19 August 2017, 9.00am – 3.00pm, Novotel Perth Langley
From the Lab to the Classroom: New Directions in Dyslexia Research with **Professor Maryanne Wolf**, followed by **What's working in WA schools to prevent and support students at risk of literacy based learning difficulties** with **Dr Lorraine Hammond**, President of LDA, Senior Lecturer and Researcher at Edith Cowan University; **Ray Boyd**, Principal West Beechboro Primary School; and **Jared Bussell** and **Jordan O'Sullivan**, Dawson Park Primary School.

Adelaide – Tuesday 22 August, 9.00am – 3.00pm, Adelaide Pavilion
From the Lab to the Classroom: New Directions in Dyslexia Research – a half day with **Professor Maryanne Wolf** supported by the SA Department for Education and Child Development and in conjunction with SPELD SA and Dyslexia SA
How to change teachers' practice to better support students at risk of literacy based learning difficulties with **Dr Lorraine Hammond**, President of LDA, Senior Lecturer and Researcher at Edith Cowan University

Inclusive Directions for Education

Brisbane 15th and 16th September 2017 Combined SPELD Qld and LSTAQ Learning Difficulties Conference. Featuring the following keynote presentations:
Developing inclusive and ethical school culture with **Professor Suzanne Carrington**
Counting all children in: differentiating in the mathematics classroom with **Professor Shelley Dole**

For more information about sessions, and to book online, please visit the LDA website.

Introducing Dr Bartek Rajkowski

In this issue of the Council notes, we introduce one of our new Council members for 2016-2017, Dr Bartek Rajkowski, B.App.Sc (SpPath), PhD, MSPA, CPSP.

Bartek is a speech language pathologist, and is the Director of Adelaide Speech Pathology Services. He has extensive experience in the research-based assessment, identification and remediation of reading and spelling difficulties in children, adolescents and adults. Bartek regularly presents training and development workshops on the latest in reading research and reading difficulties to teachers, allied professionals and parents around Australia.

Bartek's primary interest is in the relationship between speech, language, auditory processing and literacy skills. His doctoral research was an investigation of the underlying processing difficulties in children with Dyslexia and in children with Auditory Processing Disorder (APD). Bartek has developed a model of phonological representations – the brain's representations of the sounds of language – which may help to explain the range of skill deficits found in children with literacy difficulties.

Bartek is also passionate about research driven, computer based approaches to literacy and language remediation. He is determined to use his clinical experience and theoretical knowledge to develop more effective treatment methods for children with literacy difficulties, and to develop more effective teaching tools for children learning to read. He is the creator of ReadingDoctor® Software (www.readingdoctor.com.au).

Subtract the negatives

Beliefs about the way maths should be taught discriminate against pupils with special educational needs writes **Steve Chinn**

There is much about maths that makes it a great subject to study. It is logical. It is developmental. You can use what you do know to work out what you do not know.

But, there is much that makes it a bad subject for many learners, most especially those with specific learning difficulties. This is not really the fault of the maths, but the fault of the beliefs that influence the way it is taught and how many of those beliefs discriminate against learners with dyslexia, dyscalculia, speech and language difficulties and developmental coordination disorder (dyspraxia).

A current example is the UK Government's plan to test children on their ability to retrieve times table facts from long-term memory. Behind this worrying addition to our testing regime is the belief that all children can learn these facts – a belief usually based on the notion that, "It worked for me, so it will work for everyone". Of course, being able to access these facts (quickly, which is another belief) is useful, but it does not pre-determine success in maths. It will be difficult for the UK Standards and Testing Agency to create a test format that is pragmatic in terms of how it is administered and yet accommodates children with specific learning difficulties. For example, if the time allowed for each fact to be recalled is four seconds, then 25 per cent extra time will take that to five seconds, which will not improve the situation for the pupil. The pressure during the test will build for many pupils, creating anxiety which will further diminish the ability to retrieve the facts and the test will succeed only in confirming for many pupils that maths is not for them. It is likely that one of the main consequences of this "innovation" will be the need to restore motivation in pupils.

Tabling the question

In the past decade of lecturing to teachers around the UK, I have asked the question: "At age ten years, how many children do not know all the times table facts?" The most common answer, from a sample that now runs into thousands, is "70 per cent". This could be used as an argument to increase the pressure on children to master this task, or it could be interpreted as a judgment on the efficacy of using rote learning for these facts.

Now that I have mentioned speed, I can focus on that demand as a part of the discriminatory culture of maths. It is a pervasive demand in many topics within maths, in particular, mental arithmetic. Even without focusing on students with learning difficulties, there will be a normal distribution of speed for performing this skill and some pupils will not be able to match the arbitrary demands made of them.

So, let's think about the belief that mental arithmetic should be done quickly. But, also let's think what it asks of a child (or adult). To succeed in this area of maths pupils need a short-term memory capacity that is enough to remember the question, a working memory capacity to perform the steps involved and a long-term memory for the procedure and facts needed for the task. Working memory capacity is reduced by anxiety, so any fear of failure will make success even less likely. And on top of this there is a demand for speed. Yet there is a belief that mental arithmetic is an effective "warm-up" exercise. It is a warm up that starts the lesson with a high risk of failure unless these factors are adequately addressed.

Turned off maths

I am concerned, and I have another large-sample informal survey to back up my concern, that too many children are withdrawing from maths at a young age. I think that the factors I have mentioned in this article are major contributors and I think they combine with another factor – a fear of negative evaluation – to exacerbate that situation.

Early arithmetic is harsh in that answers are right or they are wrong. For example, 7 x 8 equals 56. 54, although close, won't do. It is wrong. It seems like a reasonable human behaviour to avoid continuing failure, especially in judgmental situations. In my research into maths anxiety, "Waiting to hear your score on a maths test" ranked highly for my dyslexic and for my mainstream sample. This is another example of the impact of a fear of negative evaluation. How teachers give out marks – whether orally, in writing or via stars – will have an impact on insecure learners.

Setting a risk-taking ethos for a maths class or an intervention session will enhance motivation and involvement. Dealing with the fear of negative evaluation and building self-efficacy will help maintain motivation.

Teaching by example

Another belief is that apparatus, such as Cuisenaire rods, should not be used by older children, and "older" is often interpreted as being around eight years old. Yet, when I taught physics (many years ago), not using demonstrations would have been judged as bad practice. This belief, as is the case for most beliefs, is absorbed by pupils and sets up a resistance to using apparatus, materials and visual images to aid understanding.

The lessons I learned from moving – after fifteen years of being a successful mainstream teacher - to thirty plus years of teaching, researching and writing about special needs, is that maths education would become more efficacious if it paid attention to what works with the outliers. Help the outliers and you help all learners. It's almost like inclusion!

Steve Chinn was headteacher of three specialist schools for dyslexia and co-occurring conditions. He has written and researched widely on dyscalculia and maths learning difficulties and has lectured in over thirty countries: www.stevechinn.co.uk www.mathsexplained.co.uk

Dyscalculia and Difficulties with Mathematics

Tanya Forbes

Dyscalculia is an inherited neurological condition that affects the acquisition of skills in mathematics. Difficulties in numeracy are thought to be as widespread as literacy difficulties; however, there has been much less research on dyscalculia than dyslexia (Butterworth, 2004). The incidence of dyscalculia is currently estimated to be between 6-7% of the general population (Callaway, 2013), although the figure varies because researchers use different criteria to define severe mathematical difficulties.

Generally, students with dyscalculia will lack number sense: they will be unable to grasp number concepts, will have problems learning number facts, will have trouble performing simple calculations, and will be unable to apply their mathematical knowledge to solve problems. These students tend to be resistant to good instruction and may be unable to retain and apply what they have learned.

Every student's profile will be different, but students will typically have difficulties with:

- learning to count. Students may use immature strategies to calculate such as counting by ones, often with their fingers.
- recognising number symbols
- understanding mathematical operations and performing calculations
- learning and recalling basic mathematical facts, particularly the times tables
- recognising patterns in numbers
- understanding the structure of numbers such as place value and grouping
- telling the time
- reading and interpreting graphs and charts.
- grasping abstract concepts like multi-step algorithms, fractions and algebra
- applying mathematical concepts to everyday life, such as budgeting and time management skills (Understood, 2017)

As well as basic difficulties with number sense, students may experience other limitations that impact on their success in the mathematics classroom:

Language processing problems: Accurate word reading and good comprehension are essential to understand word problems and recognise relevant information in a question. Many words have several meanings so students need a comprehensive vocabulary to understand the precise meaning of mathematical terms (Garnett, 1998).

Visuo-spatial problems: Some students may have difficulty making sense of visually presented information and visualising concepts. Visual-spatial difficulties can result in a poor sense of direction, mixing up left and right, confusion between 'less' and 'more', and trouble with measurement (Szucs, Devine, Soltesz, Nobels & Gabriel, 2013).

Memory difficulties: All aspects of memory are involved in mathematics. Short term memory allows recall of sequences and procedures. Working memory provides temporary storage of facts and figures while performing a calculation. Long term memory allows immediate recall of facts and information. If one area of memory is weak, then that will have a significant impact on maths performance. Often a slow processing speed will accompany problems with memory (Lee Swanson, et al. 2001).

Attention deficits: A high level of sustained concentration is required to learn maths concepts. Students need to maintain attention to effectively process new information, to recall maths facts and to self-monitor for careless mistakes. Attention deficits can have a significant impact on mathematical learning. Mental calculations follow an 'order of operations' and problem solving is often a multistep process. Students need to sequence each step in the right order to calculate the correct answer

Anxiety: Poor performance in maths can have a significant emotional impact. Constant failure leads to a loss of confidence, low self esteem and anxiety. When a student has a negative experience, they feel discouraged and this can lead to avoidance. High anxiety can have a direct impact on working memory leading to a further drop in performance. Some students soon believe that maths is difficult, so they give up and disengage from learning (Ashcraft, 2002).

Ways to support students with numeracy difficulties

Avoid rote learning, rapid fact recall and repetitive drills – these are empty of meaning and difficult to remember. Instead, we should teach the relationships between maths facts to develop students' understanding of basic number and operation concepts. By teaching for meaning, students are able find a solution using logic and reasoning when their memory fails them.

Pre-teach and review relevant skills and introduce new vocabulary to ensure that students have a correct understanding of the essential sub-skills required to complete the task. Build on prior knowledge by connecting new information to background knowledge to provide the student with a solid foundation to build knowledge and skills. Develop a conceptual framework to store new learning and provide strategies so information is easily retrieved and applied.

Use simple, clear and concise language during explanations – always focus on critical content and break complex skills into small manageable steps. Provide a step-by-step demonstration of problem solving - model the skill by thinking aloud as you solve the problem. Students will learn to 'self talk' through the process. Then lead students through a range of worked examples, using prompting and questioning to actively engage students in the problem solving process.

Use manipulatives (concrete materials such as blocks) and visual representations (drawings or figures) to help students to learn basic maths operations, solve story problems and master abstract concepts like fractions and algebra, as well as to explain, simplify and clarify problems. Manipulatives and diagrams function as cognitive tools to connect students to concepts: they may make difficult ideas understandable, complex problems solvable and abstract concepts tangible (Butler, Miller, Crehan, Babbit & Pierce, 2003; Cass, Cates, Smith & Jackson, 2003; Sowell, 1989; Witzel, Mercer & Miller, 2003).

Encourage students to verbalise their problem solving process – provide opportunities for students to explain concepts, describe procedures and discuss the ideas they are developing. Questioning helps students make sense of information and provides teachers with insight into learning. Frame questions to help students' gain new understanding, consolidate their learning and monitor their progress. Use feedback to check for understanding, and to provide positive reinforcement and corrective feedback. Reinforce that mistakes are an important part of the learning process – we learn from our mistakes.

Give students plenty of time. Students will need extra time to learn skills, process information and perform calculations. Allow plenty of opportunities to practise to consolidate learning and achieve mastery. Practice will increase fluency in processing, improve retention of information, facilitate recall and develop understanding. Students with learning difficulties will need more practice.

Provide scaffolding to promote success and build confidence. When students demonstrate mastery, you can gradually increase task difficulty as you decrease the level of guidance. Most importantly, teach for success so students see themselves as competent problem solvers. Then they will be more willing to attempt tasks and persevere with difficult problems.

References and Further Reading:

Ashcraft, M. (2002). Math anxiety: Personal, educational, and cognitive consequences. *Current Directions in Psychological Science*, 11(5), p181-185.

Bird, R. (2009). *Overcoming difficulties with number: Supporting dyscalculia and students who struggle with maths*. London: Sage.

Butler, F. M., Miller, S. P., Crehan, K., Babbitt, B. & Pierce, T. (2003). Fraction instruction for students with mathematics disabilities: Comparing two teaching sequences. *Learning Disabilities Research and Practice*, 18, 99–111.

Butterworth, B. (2004). Developmental dyscalculia. In J. Campbell (Ed.) *Handbook of mathematical cognition*. New York: Psychology Press.

Callaway, E. (2013). Dyscalculia: Number Games, *Nature*, 493, 150–153.

Cass, M., Cates, D., Smith, M., & Jackson, C. (2003). Effects of manipulative instruction on solving area and perimeter problems by students with learning disabilities. *Learning Disabilities Research & Practice*, 18, 112–120.

Chinn, S (2014). *The trouble with maths: A practical guide to helping learners with numeracy difficulties*. Routledge.

Garnett, K. (1998). Math learning disabilities. *Division for Learning Disabilities Journal* of CEC

Sowell, E. (1989). Effects of manipulative materials in mathematics instruction. *Journal for Research in Mathematics Instruction*, 20(5), 498 – 505.

Swanson, H. & Sachse-Lee, C. (2001). Mathematical problem solving and working memory in children with learning disabilities: Both executive and phonological processes are important. *Journal of Experimental Child Psychology*, 9(3), 294-321

Szucs D., Devine, A., Soltesz, F., Nobels, A., & Gabriel, F. (2013). Developmental dyscalculia is related to visuo-spatial memory and inhibition impairment. *Cortex*, 49 (10), 2674-2688.

Understood (2017). Understanding dyscalculia [webpage]. https://www.understood.org/en/ learning-attention-issues/child-learning-disabilities/dyscalculia/ understanding-dyscalculia

Westwood, P. (2000). *Numeracy and learning difficulties: approaches to teaching and assessment*. Canberra: ACER.

Witzel, B. S., Mercer, C. D. and Miller, M. D. (2003). Teaching algebra to students with learning difficulties: An investigation of an explicit instruction model. *Learning Disabilities Research & Practice*, 18: 121–131.

Tanya Forbes is an LDA Council member, dyslexia advocate and education campaigner. She is the creator of the documentary film Outside the Square and is the founder of the Gold Coast Dyslexia Support Group. She is committed to closing the research to practice gap in our education system and has been working closely with local schools in her area to promote evidence-based practice.

The Counting Trap

Ronit Bird

What is the problem?

Every teacher will have come across children whose only calculation strategy is to count in ones, often on their fingers, but not everyone sees this as a problem. After all, it can be argued that counting is the basis for all arithmetic, so why not leave learners to choose whatever methods they like best? Professor Eddie Gray challenges this belief by explaining how a dependence on immature counting strategies can be a trap for children, drawing them into a vicious cycle. His findings show that children who do not have a large store of number facts of which they are sure tend to fall back on habitual but laborious counting methods, a process that takes so much time and effort that the facts do not make their way into the learner's long-term memory, which means that their store of known facts remains as limited as ever. Gray's conclusion is that children need to learn how to compress the counting process and progress to more sophisticated, and more efficient, methods.

Try to imagine what it might be like to be a child with dyscalculia or dyslexia who sees every number simply as a string of 1s, one after another. What happens is that even relatively small numbers and quantities lose their individuality. A string of single units hides any identifying characteristics, such as whether the number is odd or even, or how it can be built out of smaller components. If 8 is seen only as 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1, and 9 as 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1, neither quantity can be established except by counting and either number is easily mistaken for the other.

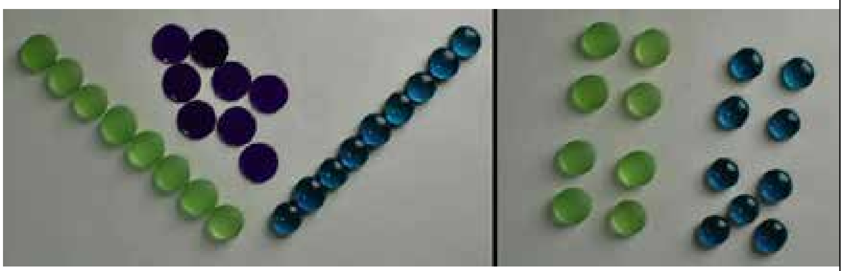


Figure 1. Numbers viewed as a string of ones lose their individuality, but when arranged as dice patterns a number can be read at a glance.

What can teachers do to help?

The single most important step is for teachers to acknowledge that a dependence on counting in ones can be damaging. This is especially true for children with dyscalculia or other learning difficulties that affect numeracy, whose constant rehearsal of immature counting methods comes at the expense of learning and adopting more efficient calculation strategies.

To avoid the counting trap, children need to learn to see numbers as being built not out of ones, but out of chunks – what I call 'components' when I work with my own pupils. Dice patterns made out of counters are ideal for component work focusing on the numbers up to 10, and

Cuisenaire rods for the numbers from 1 to 100. My choice of materials reflects my conviction that the teaching and learning must begin at the concrete stage, with hands-on practical activities reinforced by carefully targeted games. The fact that my preferred equipment is also colourful and visually striking is an important consideration (see Figures 1 and 3).

Not only does this help promote the kind of strong visualisation skills that underpin a good understanding of basic numeracy, but it also leads naturally towards a semi-abstract pictorial or diagrammatic stage that is useful for supporting reasoning strategies while serving as an important bridge between concrete and abstract work.

The dot patterns that I favour are the familiar dice patterns. For the numbers between 6 and 10, I follow a convention of doubling the dice patterns for 4 and 5 to create the even numbers 8 and 10, or combining adjacent numbers to create the odd numbers 7 and 9. Arranging discrete items into easily recognisable patterns makes the numbers up to 10 distinctive and identifiable at a glance (Figure 2).

When working with dot patterns, I insist on a great deal of active participation. It is not enough for pupils to just recognise or match the patterns; a much deeper level of understanding is achieved when learners actively engage in making specific quantities, adding to them or moving and re-arranging items, manipulating and reconfiguring the physical quantities, as a way of exploring how numbers can be built up out of, and split back into, smaller component parts. This kind of work results, in time, in children being able to develop a stronger feel for numbers and gaining a realistic sense of the quantity that each number represents. A secure understanding of components provides a good foundation for reasoning about other related number facts. A child who, for example, can see the number 9 as being made of 4 + 5 can use logic to find answers to questions such as 'what is 9 minus 5', or 'what must be added to 4 to make 19' or 'what is the total of 40 plus 50'.

A similar kind of fluency and flexibility in building and splitting small quantities is developed by working with Cuisenaire rods. Cuisenaire rods are, in my opinion, the single most useful and powerful resource for helping a learner develop numerical understanding. One of their advantages is that, whereas discrete counters become cumbersome as the quantities get bigger, Cuisenaire rods comfortably extend the range of numbers to 100 or beyond. Another significant advantage is that Cuisenaire rods can model so many different mathematical topics at many different levels, such as multiplication and division, or algebra.

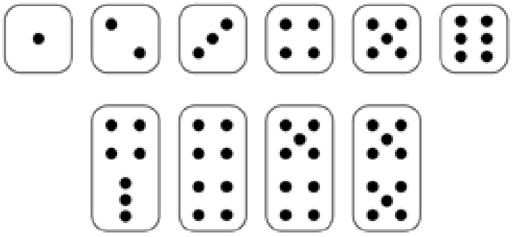


Figure 2. Dice patterns for 1-6 and dot patterns that highlight doubles or near-doubles facts for 7-10.

For the purpose of helping children grow out of their immature counting habits, Cuisenaire rods are particularly successful because they present each number up to 10 as a unit in its own right. The number 6, for example, is a dark-green rod measuring 6 cm x 1 cm x 1 cm. It is instantly recognisable as a 6 by virtue of its colour, or by the fact that it has the same dimensions as two of the light-green 3s laid end to end, or that it is larger by one than the rod for 5, or one smaller than the 7. In other words, 6 is shown as one 6, not as six 1s. Using Cuisenaire rods to model numbers and their relationships encourages children to explore many different ways of building the number and allows them to discover the fundamental relationships that connect different numbers and different numeracy topics. (See Figure 3.)

At each of the three main stages of learning – concrete, pictorial, and abstract – I strongly recommend providing practice through games that target specific and narrowly-defined teaching points, rather than worksheets. Because I use so many games with my own students (as you can see from any of my published books and ebooks) I will end this article with a simple but effective card game that treats single-digit numbers as quantities built out of components, not out of ones.

Here are the rules for *Clear the Deck*, a traditional patience game: From a pack of playing cards, take all the cards up to and including the number you wish to focus on. Shuffle them and set out, face up, one card fewer than the target number. For example, if your target is 9, shuffle the 36 cards for Ace up to 9 and turn over 8 cards face up. Clear the cards in pairs by picking up any two numbers that add up to the target number. Say the addition aloud. Fill the gaps with new cards from the pack, until all the cards have been cleared.

Ronit Bird is a specialist in dyscalculia and the author of several books and ebooks full of practical ideas for teachers and parents of children who struggle with maths. For details of Ronit Bird's publications, as well as links to her demonstration videos, see her website at: www.ronitbird.com from where you can also download many free teaching games and resources.

Reference

Gray, E., (1997). Compressing the counting process: developing a flexible interpretation of symbols. In Thompson, I. (Ed.). *Teaching and learning early number*. Open University Press.

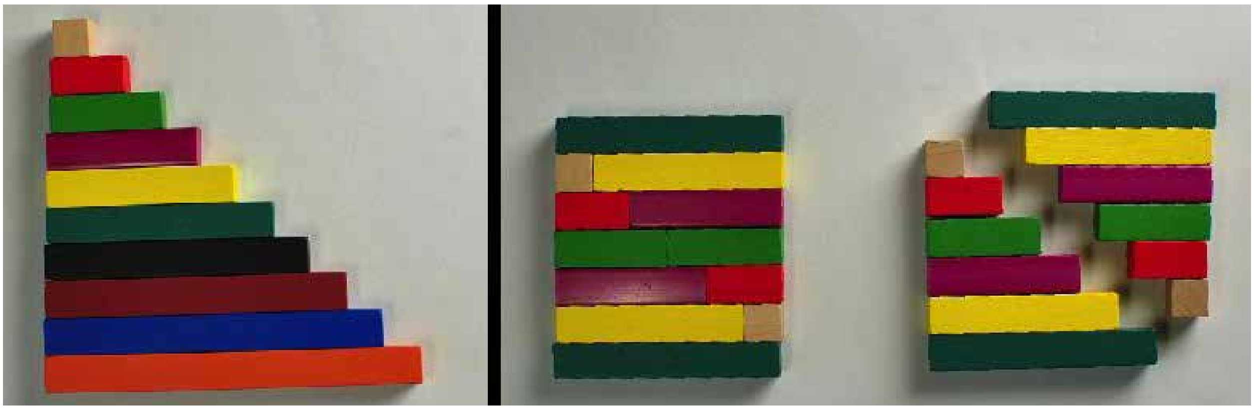


Figure 3. Cuisenaire rods arranged as a staircase show the relationships between one counting number and another. Cuisinaire rods are particularly useful for discovering how a number can be built, or split, in different ways out of smaller components.

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

Review by **Wendy Moore**

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-Köme, 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 DyscalculiaToolkit 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?

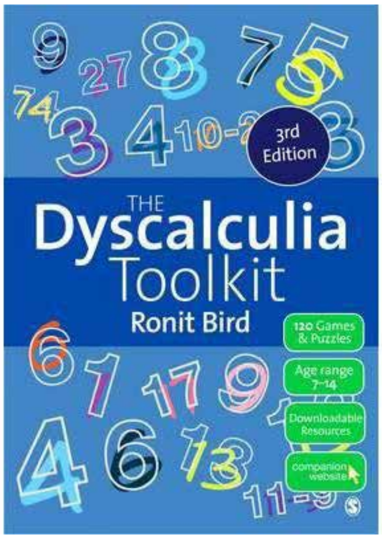
The Dyscalculia Toolkit is a collection of practical resources to support the teaching of number sense, basic fact recall and fundamental calculation strategies, designed for non-specialist teachers and tutors. The bulk of the toolkit consists of activity and game suggestions, tips and proformas for 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 the height of each object. As only the 10-unit rods are being used, you can choose objects that are up to 10 rods in length or height, i.e. up to a metre.

Far from being overly prescriptive, the detailed examples are helpful in allowing the teacher or tutor to understand precisely the strategy that has been proposed. Of course, an intuitive and knowledgeable teacher will be able to adapt and expand the strategy; a novice will be confident to begin.

Section 2: Basic calculation with numbers above 10

The focus in this section is again on the thorough learning of a few key strategies, including bridging 10 and using complementary addition as a tool for subtraction. As in the previous section, concrete materials are only faded out once students have developed the requisite mental models. Indeed, the reliance on Cuisenaire rods is so strong throughout that purchasing the toolkit without access to the rods would be rather pointless. The second major conceptual tool developed in this section is the use of empty or partially completed number lines. The ability to 'see' where numbers fit on a mental number line is not only trainable, but has been shown to transfer to improved number representation and calculation (Kucian et al., 2011). As well as activities to develop concepts, this section includes instructions and proformas for a number of games for two or more players.

The range of games that this author has described confirms her real, on the ground, classroom experience. The focus of the games is clear: repeated practice to consolidate facts, with skills and strategies emphasised. The variety of games presented is in itself a demonstration to teachers that they can create effective games themselves, putting paid to the notion that commercially published materials are required or preferable.

Section 3: Place Value

Beginning with place value mat activities and hundred chart games, Bird carefully leads teachers and their students through activities to ensure that common misconceptions and inefficiencies are debunked using smaller numbers before larger numbers are introduced. She points out that place value activities should not be delayed until after the activities in the previous sections on number and calculation are addressed, but instead introduced concurrently.

The section on place value begins with the astute observation that many children have difficulty with larger 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 Dyscalculia 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

Butterworth, B., Varma, S., & Laurillard, D. (2011). Dyscalculia: From brain to education. *Science*, 332 (6033), 1049 – 1053. http://www.jstor.org/stable/27977939

Kucian, K., Grond, U., Rotzer, S., Henzi, B., Schönmann, C., Plangger, F., Gälli, C., Martin, E., & von Aster, M. (2011). Mental number line training in children with developmental dyscalculia. *Neuroimage*, 57, 782 – 795.

Lembke, E., Hampton, D, & Beyers, S. (2012). Response to intervention in mathematics: Critical elements. *Psychology in the Schools*, 49(3), 257 – 272. doi: 10.1002/pits.21596

Monei, T., & Pedro, A. (2017). A systematic review of children presenting with dyscalculia in primary schools. *Educational Psychology in Practice*. doi: 10.1080/02667363.2017.1289076

Rubinsten, O. (2007). Interventions for students with developmental dyscalculia. *Orbit*, 37 (1), 20 – 22. Proquest Central.

Soares, N. & Patel, D. (2015). Dyscalculia. *International Journal of Child and Adolescent Health*, 8(1), 15-26. Proquest Central.

Wadlington, E. & Wadlington, P. (2008). Helping students with mathematical disabilities to succeed. *Preventing School Failure*, 53(1), 2-7.

The cost of not counting: Developmental Dyscalculia and low numeracy

Ann Williams

Awareness amongst educators of the specific learning disability *dyscalculia* is limited compared to awareness of the better understood condition *dyslexia*. Perhaps as a consequence, dyscalculia attracts far less research funding. According to Butterworth, Varma and Laurillard (2011), the National Institutes of Health (NIH) had spent $107.2 million funding dyslexia research in the United States since 2000, but had spent only $2.3 million on dyscalculia research. This is despite the prevalence of the two conditions being similar. This apparent lack of awareness and action may have consequences for both the individual and the community.

International comparative measures such as the *Programme for International Student Assessment* (PISA) and *Trends in Mathematics and Science Study* (TIMMS) show a decline in mathematics performance in Australia over a period of years. This trend is particularly notable amongst disadvantaged students, with up to 52% of disadvantaged students in Year 4 having difficulties with mathematics (Thomson, 2016; Thomson et al., 2012). While some students may not have been exposed to the necessary high quality teaching that would enable their mathematical skills to develop optimally, others seem to experience difficulties despite appropriate instruction.

In Victoria, the Department of Education and Training (DET) use the Diagnostic and Statistical Manual of Mental Disorders 5th Edition (DSM-5) to define dyscalculia thus:

> Dyscalculia is an alternative term used to refer to a pattern of difficulties characterized by problems processing numerical information, learning arithmetic facts, and performing accurate or fluent calculations. If dyscalculia is used to specify this particular pattern of mathematic difficulties, it is important also to specify any additional difficulties that are present, such as difficulties with math reasoning or word reasoning accuracy.

Dyscalculia can be contrasted with more general arithmetical difficulties as the difficulties are more likely to be persistent. According to Dowker (2004), arithmetic is multi-componential, so children can and do have difficulties with many aspects of arithmetic. Dowker also suggests that these general arithmetical difficulties may be caused by the child's environment, by maths anxiety or by inadequate instruction.

Dowker (2005) suggests that about 20% of students are likely to experience difficulty with mathematics, and Butterworth and Kovas (2013) give the estimated prevalence of dyscalculia as about 3.5-6.5% of the population. Extrapolating to Australian data, this means that there is likely to be about 117,000 students experiencing difficulties with mathematics in Victorian schools alone, with about 29,000 of these experiencing the more severe disability, dyscalculia.

One confounding factor in the diagnosis and amelioration of dyscalculia is the high co-occurrence between various specific learning disabilities (Gathercole, Woolgar, Kievit & Astlr, 2016). About 50% of students with dyslexia are also likely to have dyscalculia (Wilson & Waldie, 2010). If a child is diagnosed as having, for example, dyslexia or attention deficit hyperactivity disorder (ADHD), the difficulties the child experiences in mathematics may be assumed to be due to the dyslexia or ADHD (Butterworth & Kovas, 2013). Although intervention strategies may be implemented to remediate the students' difficulties with literacy or behaviour, it is frequently the case that interventions to remediate the dyscalculia are overlooked.

In turn, this lack of intervention can lead to poor self esteem (Williams, 2012), maths anxiety, and possible behavioural issues (Ashcraft, Krause, & Hopko, 2007; Watson & Boman, 2005). The link between learning difficulties and later delinquency has been established (Morrison & Cosden, cited in Watson & Boman, 2005), with 76% of juvenile delinquents having literacy and numeracy levels at the middle to upper primary school level.

Recommended instructional models for mathematics instruction incorporate evidence-based strategies such as Bruner's Concrete - Pictorial - Abstract (CPA) approach (Butterworth & Yeo, 2004) or the Concrete - Language - Pictorial -Symbol (CELPS) approach (Liebeck; cited in Westwood, 2000). These approaches may be beneficial for all students, including those with difficulties in mathematics.

The relative lack of awareness amongst teachers about dyscalculia and low numeracy may have a serious impact on students at a personal level and result in an economic cost to the community. This situation could be ameliorated if effective intervention strategies to help such students were used by all teachers.

References

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders*, 5th Ed. doi:10.1176/appi.books.9780890423349.7358

Ashcraft, M. H., Krause, J. A., & Hopko, D. R. (2007). Is math anxiety a mathematical learning disability? In D. B. Berch & M. M. M. Mazzocco (Eds.), *Why is math so hard for some children? The nature and origins of mathematical learning difficulties and disabilities*. Baltimore: Paul H. Brookes.

Butterworth, B., & Kovas, Y. (2013). Understanding neurocognitive developmental disorders can improve education for all. *Science*, 340(6130), 300-305. doi:10.1126/science.1231022

Butterworth, B., Varma, S., & Laurillard, D. (2011). Dyscalculia: From brain to education. *Science*, 332, 1049-1053.

Butterworth, B., & Yeo, Dorian. (2004). *Dyscalculia guidance*. London: Nelson.

Dowker, A. (2004). *What works for children with mathematical difficulties?* Department for Education and Skills : Research report RR554.

Dowker, A. (2005). Early identification and intervention for students with mathematics difficulties. *Journal of Learning Disabilities*, 38(4), 324-332.

Gathercole, E.S., Woolgar, F., Kievit, R. A., & Astlr, D., T., M. (2016). How common are WM deficits in children with difficulties in reading and mathematics? *Journal of Applied Research in Memory and Cognition*.

Thomson, S. (2016). *Australian schools continue to fall behind other countries in maths and science*. The Conversation. https://theconversation.com/australian-schools-continue-to-fall-behind-other-countries-in-maths-and-science-69341

Thomson, S., Hillman, K., Wernert, N., Schmid, M., Buckley, S., & Munene, A. (2012). *Highlights from TIMMS & PIRLS 2011* from Australia's perspective. Retrieved from https://www.acer.edu.au/files/TIMSS-PIRLS_Australian-Highlights.pdf

Watson, J., & Boman, P. (2005). Mainstreamed students with learning difficulties: Failing and underachieving in the secondary school. *Australian Journal of Learning Disabilities*, 10(2), 43-49.

Westwood, P. (2000). *Numeracy and learning difficulties: Approaches to teaching and assessment*. Camberwell, Victoria: ACER.

Williams, A. (2012). A teacher's perspective of dyscalculia: Who counts? An interdisciplinary overview. *Australian Journal of Learning Difficulties*, 2012(Oct), 1-16. doi:10.1080/19404158.2012.727840

Wilson, A., & Waldie, K. (2010). *Untangling the 'dys' from dyslexia and dyscalculia*. Paper presented at the Auckland Conference on Cognitive Neuroscience, University of Auckland.

Ann Williams taught mathematics for about 30 years, teaching in three different countries in different sectors. She held a range of leadership positions. Since retiring, she has tutored dyscalculic children and completed a Masters in Education. She has given a number of presentations in both Victoria and New South Wales to parents, teachers and Masters students.

Mathematics: The ongoing crisis

Rhonda Farkota

In December 2016 the Australian Council for Educational Research (ACER) released the Programme for International Student Assessment (PISA) report on the science, reading and mathematics skills of Australian 15-year-olds, illustrating that Australia is not only slipping backwards relative to other countries, but we are getting worse at preparing our students for the everyday challenges of adult life. The Director of Educational Monitoring and Research Dr Sue Thomson stated that evidence from the 2015 Programme now makes clear that the science, reading and mathematics achievement of Australian students is in absolute decline, and ACER Chief Executive Officer, Professor Geoff Masters stated that the decline was dramatic.

It's dispiriting to note that the math crisis that has existed in Australian schools for such a long time has continued to deteriorate. As this writer noted more than a decade ago: There are many possible reasons why Australian students are failing in mathematics, but most of them are related to curriculum and methods of teaching rather than any student lack of capacity to learn. Equally dispiriting: There is still no consensus on how the problem should be addressed.

With respect to mastering mathematics, it's essential to bear in mind one important, long-recognised fact, and that is a student of average ability requires many presentations of a new concept before learning and remembering it. Ergo, genuine mastery of both basic skills and problem-solving can only come about with constant practice.

The old adage about crawling before walking is appropriate here, for while it's all very well to encourage students to solve problems by reasoning and reflecting, it's important for them to first acquire the basic skills that provide the scaffold upon which problem-solving skills are built. Problem-solving skills almost invariably operate from a knowledge base that has been acquired through practice, but it is actually when the knowledge in a discipline is being acquired that the foundations for effective problem-solving are being laid. Fluency and automaticity, which are by-products of mastery, come about when this knowledge base can be instantly tapped into without any great mental effort, giving students the opportunity to maximise their mental powers on more complex tasks.

Since the days of Plato, the big education debate has revolved around which is better: Student-directed learning or Teacher-directed learning?

The author, in her doctoral research conducted a comprehensive review of the relevant research and literature, and reached the inescapable conclusion that some skills were better acquired through one approach, and some through the other. When it came to the employment and cultivation of higher order skills, where reasoning and reflection were required, it was clear that a student-directed approach to learning was more appropriate. But when it came to the acquisition of basic skills, the empirical evidence unequivocally showed that a teacher-directed approach was better suited.

Bearing the above in mind, the Math Mastery Series (MMS) was specifically designed for the Australian classroom. Employing its own distinctive Direct Instruction (DI) model, it strikes a balance between teacher-directed learning and student-directed learning.

Daily lessons are briskly delivered in small incremental portions, with direct explanation and daily systematic review of student work. Ideally, unobtrusive assessment should be an integral part of the learning process. It is a fact of life that few of us enjoy sitting down to examinations, so these lessons were designed to test the students, without being seen by them as formal testing. Student personal analysis of incorrect responses given during a lesson, however, provides teachers with reliable diagnostic information better than any that can be acquired from a formal test situation. This is crucial to student success because it allows for teacher feedback to specifically target individual student misunderstanding.

It is well accepted that to perform a task competently students require not only the requisite skills, but also the self-belief in their ability to implement performance. In the learning process, this is termed *self-efficacy*, and when laying the foundational skills in mathematics, or for that matter any academic discipline, it is important that student self-efficacy be accommodated. Students with low self-efficacy in a particular skill area are reluctant to engage in tasks where those skills are required, and if they do, they are more likely to quit when encountering difficulty. Daily feedback on their performance makes students aware of their progress, which strengthens their self-efficacy, and at the same time enhances their academic achievement. As students engage in the daily lessons they learn which actions produce desirable results, which in turn motivates them to persevere towards mastery.

Student self-evaluation of progress is an integral and ongoing component of the MMS. Because the tasks gradually increase in difficulty, students have clear criteria by which they can independently assess their performance and gauge their progress. As they progress they acquire more skills and become more proficient at the self-evaluation process.

A perennial problem for teachers

at the start of each school year is the diverse, and all too often, inadequate, academic standard of their new class. The traditional practice of teaching mathematics in single topics creates many problems for students. Presenting them with a heap of new information in one hit, expecting them to master it; then move onto another, often unrelated topic, master that too, and so on, is a big ask. The problem is compounded when students are not re-familiarised with the topics throughout the year.

The MMS circumvents this problem by running concurrent strands. Because the strands are run concurrently, students are soon familiar with the many connections existing between the various math disciplines, and become fluent in applying them. Once foundations to the core areas have been laid and tested, they are built on with small precise portions. None of this incremental information is left on the shelf. Students move on to questions that gradually increase in complexity, all the while relying on the skills they have acquired along the way. These questions shift from abstract numbers to real-life situations so students see the relative worth of mathematics in situations that arise in the everyday world. Students quickly learn that everything they are taught is important; everything they learn is revisited, developed further, and gradually integrated into the broad mathematical landscape. This gradual and consistent development of skills is one of the key elements of teaching to mastery.

At the outset, this article alluded to the ongoing math crisis, the ancient Student-directed learning versus Teacher-directed learning debate, and the author's doctoral research into those matters; and although the MMS and the thesis were written twenty years back, the concluding words to that thesis are every bit as relevant today:

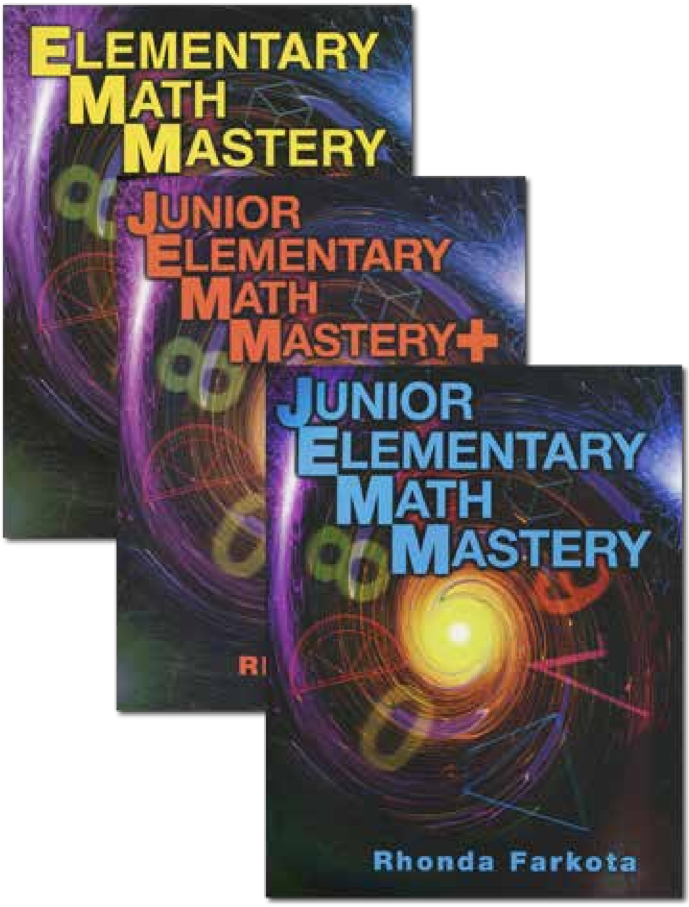
> *In conclusion it seems to this writer there is a dire urgency for the academics of the education world to put less emphasis on the ideology they feel most comfortable with and have a long hard look at the evidence. In the light of the research reviewed in this thesis it is impossible to deny the need for structured teaching in certain important circumstances just as it is impossible to deny the potential benefits to be had from student-directed learning in appropriate circumstances. If we are to provide the children of this nation with the best possible education, clearly, a balance must be achieved between teacher-directed learning and student-directed constructivist approaches — and for the children's sake it must be achieved soon. Further, it is submitted that the fitness for purpose principle …should be the guiding light when it comes to setting that balance. Unfortunately there is no one stop shop — no panacea when it comes to education — it just isn't that simple.*

References

Farkota, R. M. (2004). *The effects of a 15-minute direct instruction intervention in the regular mathematics class on students' self-efficacy and achievement.* Monash University. Faculty of Education

Masters, G. (2016). Reversing the PISA decline: national challenge requires national response, *Research Developments*, ACER. https://rd.acer.edu.au/article/reversing-the-PISA-decline

Thomson, S., De Bortoli, L., & Underwood, C. (2016). PISA 2015: A first look at Australia's results. ACER. http://research.acer.edu.au/ozpisa/21



Solving Mathematical Word Problems

Paul Swan

I would like to begin by stating that I am not an expert in learning difficulties, but I do know a little something about primary mathematics. I am constantly asked about the solving of word questions, particularly multi-part word questions. Here are the steps that I recommend to teachers, schools and systems in order to pinpoint where the main problems lie. Newman (1977) identified a basic set of five stages where errors can occur. These are reading, comprehension, transformation, processing, and encoding.

Reading

The obvious question to ask is whether the student can read the problem. It is important to invite him or her to "Read the question to me" and listen. Students often interchange words like 'and' and 'or'. This can make a significant difference to the question. Words like 'not' may be left out completely. I heard one student read 'minutes' for 'minus', which completely changed the nature of the question. Teachers can waste a lot of time intervening at the level of the mathematics, when the problem really lies with the literacy elements of the question. An excellent article by White (2009) explains this in more detail. If the student reads accurately, then "Tell me what the question is asking you to do", examines how well the student comprehends.

Comprehension

Simply reading a word does not imply comprehension. Clearly, students need to know most of the words in a text in order to have a chance of comprehending what a mathematics word question is asking a student to do. Most students

Figure 1.

could read the word 'annulus' but would not know what it meant. Simply defining what an annulus is may not help. One definition – that an annulus is "a plane figure consisting of the area between a pair of concentric circles" – has language so dense that it may not help struggling students. A diagram showing two concentric circles and a link to the idea of a washer (Figure 1.) may extend the understanding of the learner. The shaded section on the diagram is the annulus. If a question asked a student to find the area of the annulus, students can focus on the shaded part. Comprehending mathematics involves much more than just reading some text. Two further components include interpreting graphics and symbols. Symbols will complicate matters even further.

One of my sons is dyslexic so when co-authoring "Maths Terms and Tables", my co-authors and I chose to use simple words in the definitions and show diagrams and examples. The back of the book includes tables and charts that are visual. For example, everything a student might want to know about triangles is on two pages.

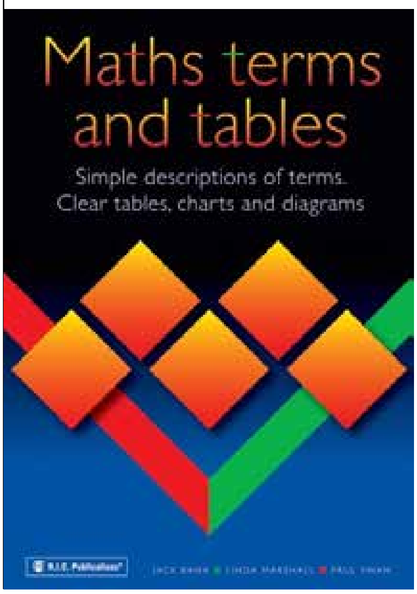
When reading mathematical text, instead of reading from the top left to the bottom right, students often have to stop reading, look at the graphic, diagram, table, or graph, and then return to reading the text. Because 60 – 70% of questions in the NAPLAN mathematics assessments include a graphic, teachers need to pay attention to how students interpret the graphics. For a discussion of the use of graphics and symbols in word questions see:

http://www.drpaulswan.com.au/mathematics-literacies

If students in a school environment are struggling to comprehend word questions in mathematics, then an examination of how comprehension is taught across the school needs to be made. Schools must consider: Should the comprehension of mathematics word questions be taught in mathematics lessons or literacy lessons (or both)? Should there be consistency in the mathematical strategies that are employed in different subject areas? For some suggestions on improving mathematical vocabulary and the understanding of mathematical language, see http://www.drpaulswan.com.au/mathematics-literacies.

A particular favourite for teaching geometric terms is the 'Frayer' model) Figure 2).

Improving mathematical vocabulary will help improve comprehension, but will not necessarily mean that students can



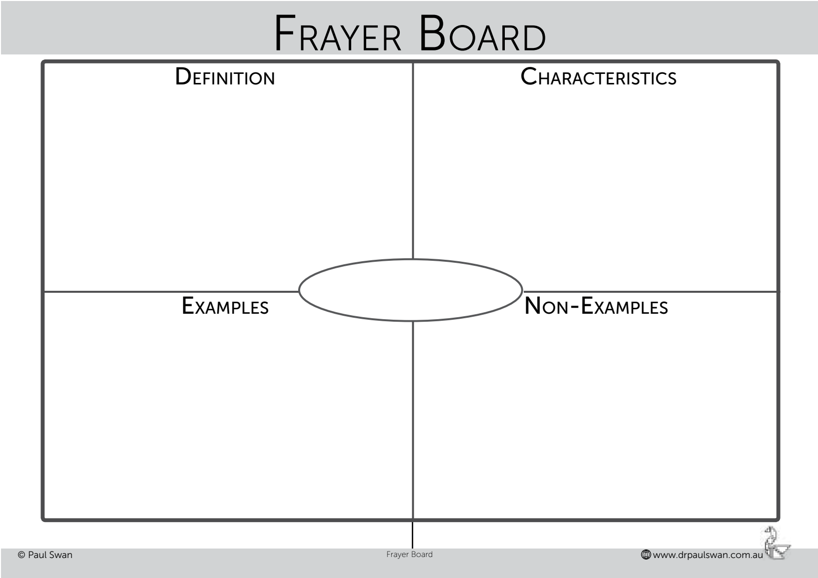


Figure 2.

transform the question into a mathematical form or number sentence. Newman described this phase as Transformation.

Transformation

Addition, subtraction, multiplication and division mathematics questions are typically written to a particular style. These styles are outlined on pages 89 and 90 of the *First Steps in Mathematics*: Number Book 2: Operations. When learning to add or subtract, students would be taught to draw and label a 'part part whole' diagram.

The process of teaching students to use a strip/bar/tape/ribbon diagram is often linked to 'Singapore' or 'Shanghai' maths (Figure 3). This approach involves explicitly teaching students to transform the word problem into a number sentence. For example, the question *I had 7 lollies and my friend gave me 2 more lollies. How many lollies do I have altogether (in total …)?* translates to 7 + 2 = ? The question *I had some lollies and my friend gave me 2 lollies and now I have 9 lollies. How many lollies did I have to start with?* translates to ? + 2 = 9

Solving these questions involves fluency with the basic number fact 7 + 2 = 9, otherwise too much cognitive space is consumed adding 7 + 2. Note, however that while the base question 7 + 2 = 9 is required to solve both of the questions above, students may struggle solving the second question because the 'missing part' is at the start of the question. A detailed discussion of this topic may be found at http://www.drpaulswan.com.au/mathematics-literacies. Now students are ready to 'do the mathematics' required to solve the problem.

Newman concluded her five step process by asking the student to *Show me what to do to get the answer* (the maths bit) and *write down your answer*. Errors can occur at any of the five steps but unfortunately, many students never make it to steps 4 and 5.

References and further reading

Newman, M. A. (1977). An analysis of sixth-grade pupils' errors on written mathematical tasks. Victorian Institute for Educational Research Bulletin, 39, 31-43. See http://numeracyskills.com.au/newman-s-error-analysis

Department of Education WA (2013). *First Steps in Mathematics*. Retrieved from http://det.wa.edu.au/stepsresources/detcms/navigation/first-steps-mathematics/

White, A. (2009). A revaluation of Newman's error analysis. https://www.mav.vic.edu.au/files/conferences/2009/08White.pdf.

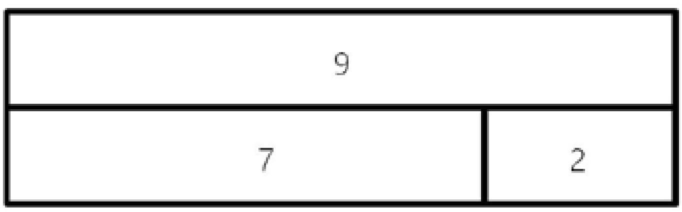


Figure 3.

Dr Paul Swan writes mathematics related books and develops maths games. He primarily works with teachers and school leaders to improve the teaching of mathematics in primary schools. His website can be found at www.drpaulswan.com.au

What's age got to do with reading?

Kevin Wheldall, **Molly de Lemos** and **Craig Wright**

Expressing reading ability in the form of a 'reading age' is a common practice within schools and in research on reading. Reading age is a term that is, perhaps, particularly attractive by virtue of its simplicity. When 'reading age' is reported alongside chronological age, this appears to serve several functions: to indicate how far behind or in front of the 'expected' level the student is reading, to allow quick comparison of the reading levels of multiple students, and to allow teachers to understand how much correction has to be made to the curriculum for students who have a delay in reading age. This article will show that, despite its apparent attractiveness, the concept of reading age is fundamentally flawed. Some of these issues have been raised before in the past (Alexander & Martin, 2004; de Lemos, 2000; McNab, 2007; Wheldall & Beaman, 2000) but given the continuing tendency for parents, teachers and others to rely on 'reading age' as a summary score, it is important to re-visit this issue.

How reading ages are constructed

First, let us look briefly at how reading ages are typically constructed. The developers of a new reading test will seek to obtain performance data on their new measure from an ideally large and representative sample of students across the age range that the test aims to cover. The sample is divided into a series of age groups, usually covering a range of about 3 months to 6 months, depending on the age range covered by the test (e.g., 7:0 years – 7:2 years, 7:3 – 7:5, and so on). The average raw score of each of these age groups is calculated, and this average score is converted to a 'reading age' based on the mid-point of the chronological age of the age norm group. For example, if the age range of the age norm group is 7:0 to 7:2, and the mean raw score of the age norm group is 48, then a raw score of 48 would equate to a reading age of 7:1. The same procedure is used for all the age groups in the standardisation sample. The raw scores are then plotted against age, with age (the midpoint of each age group) on the horizontal axis and the average raw score of each age group on the vertical axis. A smooth line is then drawn linking these points. The raw score corresponding to each age in terms of years and months can then be estimated from this smoothed graph. Note that the number of years of instruction the children have received is not taken into account in the construction of reading ages.

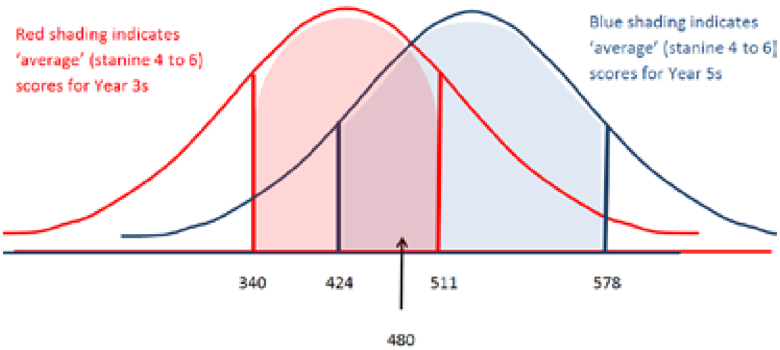


Figure 1. Both an 'average' Year 3 and an 'average' Year 5 could have obtained a score of 480 on the 2016 NAPLAN assessment for reading.

Problems with reading age – variability

So, what's wrong with reading ages obtained in this way? First, there is the problem of variability of performance for each age group. The reading age is based on the average score for the age group but some students will read better and score higher and some will read worse and score lower. For example, some children in a typical Year 4 class will score at a level more typical of Year 1 or Year 2 students while others will score at a level more typical of Year 5 and Year 6 students.

Reading age is only an average score and it gives no indication of the range of scores that is typically found in a given age group. The latest results of the National Assessment Program, Literacy and Numeracy (NAPLAN) for reading in 2016 for Year 3 and Year 5 illustrate this point (ACARA, 2016). The average scaled score for Year 3 students was 425.6, with a standard deviation of 85.6, giving a range of average scores (that is, scores within one standard deviation of the mean) from 340.0 to 511.2. For Year 5 the average scaled score was 501.0, with a standard deviation of 77.1, giving a range of average scores (that is, scores within one standard deviation of the mean) from 423.9 to 578.1. Scores of

423.9 to 511.2 therefore fell within the top half of the distribution of scores for Year 3 students, and in the bottom half of the distribution of scores for Year 5 students. From our knowledge of the normal distribution ('the bell curve'), it can be estimated that roughly 20% of the Year 3 students achieved the average score or better for Year 5 (see Figure 1). Conversely, about 20% of Year 5 students achieved the average score for Year 3 or worse. This indicates that the variability in reading performance for students within grade (year) is very large indeed. The variability in the spread of scores with age and the overlap of scores at adjacent age levels is also demonstrated by McNab (2007), who showed the expected distribution of scores at each age level as a series of overlapping bell curves based on a normal distribution.

Problems with reading age discrepancies – different meaning at different ages

A second problem with reading ages is that the significance of a discrepancy between chronological and reading age changes depending on the age of the student. Take, as an example, data from the Neale Analysis of Reading Ability 3rd Edition (NARA III; Neale, 1999), a test that until recently was widely used in Australia. A student aged 7:6 halfway through Year 2 whose reading age is 18 months below her chronological age is a very poor reader indeed. The student's score on the Accuracy part of the Neale is only at the level of ~1% of same grade peers. That is, her performance is better than only 1% of students in Year 2. In contrast, a student aged 12:6 in Year 7 whose reading age is 18 months below his chronological age is actually an average reader (his performance is as good as or better than 27% of his peers).

Problems with reading age – reading is related to years of instruction not age

The concept and method of determining reading age depends upon the assumption that age within grade is an important determinant of reading ability. It is certainly true that reading performance increases with grade level. However, older students within a given grade are not, on average, better readers than the younger students in the same grade.

Across the primary school years, reading performance correlates with grade level at least as strongly as it correlates with chronological age, and often more strongly. Further, correlations between measures of reading performance and chronological age within grade tend to be small and insignificant.

Some years ago, we looked at the results for reading from the Basic Skills Test (BST) in New South Wales that preceded NAPLAN. The BST used to be administered to all primary school students in state schools and to many students in the Catholic and independent sector schools in Years 3 and 5 in August of each year. The literacy component tested students' understanding of a range of written texts used in the primary key learning areas. Actual chronological age of the child was not collected as part of the BST testing regime and so calculation of correlations between age and BST score was not possible. However, students taking the test were required to indicate on the test protocol whether for Year 3 they were aged under 8 years (and very few were), aged over 8 up to 9 years, or aged over 9 years. Similarly, Year 5 students had to indicate whether they were aged under 10 years (again very few were), aged over 10 up to 11 years, or aged over 11 years. Given that the BST was administered to almost all students in Year 3 and Year 5 in the state, the numbers in these samples are very large and the large numbers allow reliable statistical conclusions to be drawn.

If literacy performance is correlated with age within grade then we would expect to observe appreciably higher BST mean scores in the older age group than in the lower age group within each grade. This was not the case for any literacy measure for Year 3 or Year 5 in any of the three years studied (1998 to 2000). For example, consider the means for Year 5 students for reading in 2000. The mean score for the 42,254 10-year-olds was 56.6 whereas the mean for the 17,314 11-year-olds was 55.8. The analysis was carried out over three successive years, and the pattern was replicated each year.

By way of further illustration, BST performance data were collected in the context of a study relating the Wheldall Assessment of Reading Passages (WARP; Wheldall & Madelaine, 2013) with the BST (Madelaine & Wheldall, 2002). Chronological age data were available for a sample comprising 65 Year 3 students and 58 Year 5 students. This sample of students was shown to be highly representative of the state population as a whole in terms of BST performance; the average scores for the school on BST literacy were shown to be very similar to State averages at both Year 3 and Year 5 levels consistently over several years. For Year 3 students the BST literacy measure was shown to correlate with chronological age at a very low 0.16, and for Year 5 students it correlated at 0.15. The correlations between the WARP and chronological age for these two samples were 0.07 for Year 3 and 0.26 for Year 5. In general, very little of the variation in scores within each grade (less than 7%) was related to the age of the students.

In sum, there is little or no relationship between age and reading performance within grade. Correlations with age across grades are the result of increasing years of instruction, not maturation. While learning to talk is largely a developmental process that is a function of chronological age, reading is not. Reading performance is largely a function of the amount and quality of instruction received. Given that this is the case, it probably makes more sense to relate reading performance to years of instruction received rather than to chronological age when comparing children regarding their reading ability.

Examples of how reading age is (mis)used

Two students in a Year 4 classroom, Steve (age 9) and Mark (age 10) are both tested as having the same reading age of 9:6. We would commonly claim that Steve is six months ahead in reading while Mark is six months behind, and that the two students are a year apart in terms of reading performance. Yet they are both in the same class, they have both experienced the same amount (four to five years) of reading instruction, and they are both reading at the same absolute level as measured by the raw score of the reading test (given that reading age is simply a reflection of raw score). Why would we expect them to be performing differently just because they differ in chronological age?

Here is another example. Jenny in Year 4 is 9:0 but has a reading age of 8:6. Sarah is aged 10.0 but has a reading age of only 8:0. Being 'only six months behind', Jenny would still typically be regarded as being within the average range of performance for her age. She is unlikely to be seen as a cause for particular concern. But Sarah is perceived as two years behind what we would expect for her age and would therefore typically be considered to be (by definition) a low-progress reader and a very real cause for concern. Yet they are both in the same year at school, have experienced the same amount of reading instruction over the past five years, and are only a few points different in terms of level of absolute performance as indicated by raw score on the reading test.

Link between age-based reading ages and grade-based stanine scores

The extent to which relatively large differences in reading age can still be within the 'average' range of scores according to the expected normal distribution of scores can be illustrated by looking at the range of reading ages that fall within stanines 4, 5 and 6 on the 9-point stanine scale. These stanines correspond to standardised scores ranging from 89 to 110, in which 54 per cent of scores would normally be expected to fall. The norms for the NARA III (Neale, 1999) provide reading ages, based on age norm groups, and percentile ranks and stanine scores, based on norms for 'years of schooling'. From the norm tables for this test the reading ages corresponding to each stanine level for each year of schooling can be identified.

Table 1 below provides a summary of the range of reading ages on the Reading Comprehension measure of the NARA III that fall within Stanine Levels 4 to 6, which marks the average range of scores expected at each year of schooling. In the first year of schooling, the differences in reading age that fall within the average expected for this level are less than one year (10 months), but by the fifth year of schooling the differences in reading age that fall within the average expected for this level are just over four years (four years and three months). As the variability of scores on measures of reading comprehension increases with age, a range of up to four years in reading age in one grade level can be expected as normal at older age levels.

False negatives in screening for early reading difficulties

Finally, reading age can be responsible for the identification of false negatives in screening for early reading difficulties; that is, identifying children as average readers when they are actually poor, low progress readers. Take the NARA III (Neale, 1999) as an example. A Year 2 student of seven years of age who is in their third year of school and who has a reading age of 7:0 on the Accuracy part of the test can actually be a poor reader. The student's reading accuracy is better than just 18% of Year 2 students. Yet in using reading ages the examiner/teacher might assume that the student is exactly where they would be expected to be given their age. The obvious problem with this is that the child fails to receive the intervention that is crucial for overcoming written language deficits.

A general comment on age norms versus grade norms

Reading tests tend to be constructed by assessing all students at one point in the school year. Norms are then generated for different age groups by pooling the data for all students in a given age range (e.g., 7:0-7:3, 7:4-7:7 and so on).

This practice causes two problems for test users. First, students in the same age range may actually be in different grades (and we have shown above that reading ability is related to years of instruction rather than to age within grade). This issue potentially makes interpreting age-based norms very problematic. Second, even though age norms may be provided in, say, three month intervals, in fact the normative data is typically only collected at a single time within the school year. For example, the manual for the NARA III (Neale, 1999) states, "The standardisation took place from September to November 1997 during the final term of the Australian school year". The time at which the normative data were collected can have a big effect on interpretation because reading ability changes so much over the course of a school year, particularly in younger grades. A test for which data are collected in Term 4 is likely to under-estimate the skills of a student tested in Term 1 of that year. This problem has led Vincent (1997) to argue (rightly) that"

> "Regardless of whether norms are cross-sectional or longitudinal, they will only accurately reflect children's attainment at the time of year at which they were obtained. This seemingly obvious point is too often overlooked by test users." (p. 42)

Note that these latter concerns apply to all normative scores obtained from tests, not just reading ages. Standardised scores, z-scores, percentile ranks and stanines all suffer from the same criticisms regardless of whether they are normed on the basis of age or on the basis of grade level.

The solution? Create tests that are standardised at separate time intervals over the school year. We suggest that the gold standard for tests should be data collected in each of the four Australian school terms. A less acceptable alternative would be data collected in the two Australian semesters; preferably at the mid-point of each semester to minimise false positives and false negatives at the beginning and end of each semester period respectively. (Some test developers have begun to take this problem on board. The Test of Word Reading Efficiency (TOWRE; Torgesen, Wagner & Rashotte, 2012) and the Wechsler Individual Achievement Test (WIAT-III; Psychological Corporation, 2016) both provide grade-based norms for two time points in the academic year.)

Given the increasing difficulty and expense incurred by test publishers in providing norms for reading and other performance tests, perhaps we should not hold our breath. In the meantime, we suggest that test users think critically about the quality of normative data available for any given test before purchasing or using the test. We also urge test users to interrogate the scores obtained from any test by considering how representative the normative data are for the student in question (e.g., by considering the time of year at which the data were collected, the number of students in the sample and whether number of years of instruction has been accounted for) before drawing conclusions and making high-stakes decisions. For researchers and clinicians seeking to measure progress across time,

	Year of Schooling				
	1	2	3	4	5
Mean age (Years and months)	6:2	7:2	8:2	9:2	10:2
Range of reading ages (Stanines 4 to 6)	6:0 – 6:09	6:3-8:3	7:3-9:5	8:0-11:9	8:5-12:7
Spread of average scores (Years and months)	0:10	2:01	2:03	3:10	4:03

Table 1. Correspondence between reading ages and stanine scores on the NARA III (Neale, 1999) for students in their first to fifth year of schooling.

we suggest using raw scores rather than standardised scores or reading ages.

References

Australian Curriculum, Assessment and Reporting Authority (ACARA; 2016). *NAPLAN Achievement in Reading, Persuasive Writing, Language Conventions and Numeracy: National Report for 2016*. Sydney: Author. Retrieved from https://www.nap.edu.au/results-and-reports/national-reports

Alexander, J. R. M., & Martin, F. (2004). The end of the reading age: grade and age effects in early schooling. *Journal of School Psychology,* 42, 403-416. doi:10.1016/j.jsp.2004.06.003

de Lemos, M. M. (2000). *Group reading test II: Australian norms supplement.* Camberwell: ACER Press.

Madelaine, A., & Wheldall, K. (2002). Further progress towards a standardised curriculum-based measure of reading: Calibrating a new passage reading test against the New South Wales Basic Skills Test. *Educational Psychology,* 22, 461-470. doi:10.1080/0144341022000003132

McNab, I. (2007). Making sense of reading ages. *LDA Bulletin of Learning Difficulties Australia*, 39 (2&3), 4-5. Retrieved from https://www.ldaustralia.org/lda-publications.html#bulletin

Neale, M. D. (1999). *Neale Analysis of Reading Ability* (3rd ed.). Melbourne: Australian Council for Educational Research.

Torgesen J. K., Wagner R. K., & Rashotte C. A. (2012). *Test of Word Reading Efficiency* (2nd ed.). Austin, TX: Pro-Ed.

Vincent, D. (1997). Assessment by classroom teachers. In R. Beech & C. Singleton (Eds.), *The psychological assessment of reading* (pp. 27-48). London: Routledge.

Psychological Corporation (2016). *Wechsler Individual Achievement Test* (WIAT; 3rd ed.). Sydney: Pearson

Wheldall, K., & Beaman, R. (2000). *An evaluation of MULTILIT: 'Making Up Lost Time In Literacy'*. Canberra: Department of Education, Training and Youth Affairs.

Wheldall, K., & Madelaine, A. (2013). *The Wheldall assessment of reading passages (WARP) manual*. Sydney: MultiLit Pty Ltd.

Emeritus Professor Kevin Wheldall AM is Chairman of MultiLit Pty Ltd and Director of the MultiLit Research Unit. You can follow him on Twitter (@KevinWheldall) where he comments on reading and education (and anything else that takes his fancy). He also has a blog, 'Notes from Harefield: Reflections by Kevin Wheldall on reading, books, education, family, and life in general': www.kevinwheldall.com. Email: kevin.wheldall@pecas.com.au

Dr Molly de Lemos is a psychologist and former educational researcher with the Australian Council of Educational Research. While at ACER she spent some time on the development and norming of educational and psychological tests. She is the author of the report, Closing the Gap between research and practice: Foundations for the acquisition of literacy, published by ACER, and is a former President of Learning Difficulties Australia. (2013/2014). Email: delemos@pacific.net.au

Dr Craig Wright is a psychologist and Clinic Director at Understanding Minds and Adjunct Research Fellow in the School of Psychology at Griffith University. He avoids social media but can occasionally be found blogging at www.understandingminds.com.au/blog where he writes about issues relating to developmental and learning disorders. Email: craig@understandingminds.com.au

Daryl Greaves – An LDA Icon

Diane Barwood

Dr Daryl Greaves, TPTC, BA, B Ed, PG Dip Ed Admin, MA, PhD, MAPS, was a recent recipient of LDA Life Membership

Daryl Greaves likes living 'in the moment' and does not like talking about himself or his past achievements. As a result, finding specifics of his career was dependent on research into the history of the Australian Remedial Education Association/Australian Resource Educators Association (AREA) and Learning Difficulties Australia (LDA), as well as his many friends.

Daryl's nonchalant demeanour belies an incredibly dry humour, especially when with his long-time friends Peter Jeffrey and Chris Davidson. He and Peter were sometimes a force to be reckoned with when the editing of AREA texts was at hand. Although I never took his Maths classes, my first meeting with Daryl was whilst as a post-graduate Special Education student at Melbourne Teachers College in 1975.

Throughout his career, Daryl has worn many hats: as a teacher, both in primary and secondary schools, holding positions at Melbourne Teachers College in Special Education and the University of Melbourne in the Master of Educational Psychology course where he displayed a dedication to the diagnosis of dyslexia and other specific learning difficulties. He is currently practising as an Educational and Developmental Psychologist. For most of this time Daryl has also been heavily involved in the workings of AREA/LDA as well as SPELD Victoria. In fact, his name appears multiple times in the history of AREA and LDA (see the LDA website for the LDA history as published in the *Australian Journal of Learning Difficulties*).

This commitment was sure to have imposed many constraints on the completion of Daryl's doctorate at the time. How he met the requirements of his PhD was amazing to many who witnessed his involvement in the Association's activities as he strove to balance his many roles. Daryl has in the past devoted innumerable hours to the maintenance and advancement of AREA/LDA. There are far too many involvements to mention all. Daryl's membership of Council and committees has obviously been a significant contribution to the organisation, as was his Presidency from 1994-1997. In fact it was he who, in 1993, suggested that a new name 'Australian Resource Educators Association' would provide a broader focus than the original name, Australian Remedial Education Association, as the term remedial had negative connotations. The 1993 AGM agreed to this proposed change. During his presidency, Daryl also oversaw the changes to the structure of AREA's leadership group, which provided the basis for the current leadership model.

Daryl spent many years on the Editorial Board of the *Australian Journal of Learning Disabilities* as well as the SPELD Victoria journal the *Australian Journal of Dyslexia & Specific Learning Difficulties*, which he co-edited with Chris Davidson from 2007 until October 2012. He also contributed a chapter to Volume 1 of the report *Mapping the Territory–Primary Students with Learning Difficulties: Literacy and Numeracy*, which provided an overview of the various approaches to the teaching of students with learning difficulties around Australia, and edited a number of publications, including collections of papers presented at AREA Conferences over the period 1997 to 2001, listed at the end of this article.

In 1992, after Anne Pringle negotiated office space within the Department of Educational Psychology and Special Education at the University of Melbourne in return for opportunities for students to undertake practicums with remedial consultants, Daryl Greaves was delegated to liaise with AREA on behalf of the university, a role he held for many years.

In June 1998 the AREA National Conference "Numeracy and Literacy: The Essential Partnership" was held at the University of Melbourne. It attracted speakers of international and local interest as well as many practitioners willing to share tried and true methodologies, procedures and materials. The emphasis across all contributions was on intervention practices intended to assist learners who may be experiencing difficulty, students who are often described as at risk. Without Daryl's assistance in acquiring the support of the University in the provision of this venue, LDA might not have been able to offer such a worthwhile event.

Since "retiring" Daryl has retained a passion for the study of learning difficulties and dyslexia, regularly attending the British Dyslexia Association Conference in the UK. Working through SPELD Victoria he also presented, together with Dr Michelle Hutchison, a series of four day teacher training courses to further teachers' knowledge of specific learning disorders including dyslexia, which covered both assessment and practical teaching strategies to help primary and secondary students experiencing learning difficulties. He is also still to be heard speaking on learning, including current technology, in various places around Melbourne.

Some of Daryl's Publications

Geiger-Jennings, J & Butcher, R. (2001) *Learning Differently: Assessing and Developing Literacy Skills with Adults and Young People*. D. Greaves (Ed.). Melbourne: Donvale Living and Learning Centre. [This publication includes an initial screening for learning difficulties to assess academic achievement, a Literacy Ability Profile to target specific difficulties and targeted teaching strategies for adults who learn differently.]

Greaves, D., Barwood, D., & Jeffery, P. (Eds) (1998) *Strategies for intervention with special needs students*. Melbourne: AREA. Selected papers from the 1997 AREA Conference.)

Greaves, D. & Jeffery, P. (Eds.) 2001. *Learning difficulties, disabilities and resource teaching*: Melbourne: AREA. [Selected papers from the 2001 Conference].

Greaves, D. & Barwood, D. (Eds.). 2001. *Creating positive futures: Strategies and methods for those who learn differently*. Melbourne: AREA. [Selected papers on issues relating to the teaching of students with learning difficulties.]

Consultants' Report

From the Consultants' Committee Convenor, **Jan Roberts**

Happy winter, everyone. Thankfully as I write, many of us are in recovery reconfiguration, otherwise known as mid-year vacation. The Consultant Committee has in the meantime been working on various projects, for the benefit of all LDA consultants. These include the website upgrade, a brochure, two surveys, the Consultant network groups and professional development.

A major project affecting consultants was the updating of the online registration and consultant application process. This was an important initiative undertaken by website manager Pye Twaddell in collaboration with our web developers, for which the Consultants Committee provided documentation and feedback. The new online application facility will make it much easier for new and renewing consultant members to upload their qualifications and evidence of ongoing professional learning.

There is a continuing need for the type of service LDA consultants offer, particularly in states other than Victoria. But even in Victoria, where most of our consultants are located, there is a decreasing number of consultants due to retirement, and a shortage of consultants in some areas. Members of LDA may apply for certification as LDA consultant members to provide private tuition to students with learning difficulties. Consultant members are eligible to join the LDA Group Insurance Plan and to register for the LDA Online Tutor Search. The Online Tutor Search (OTS) has modernised and streamlined the process of finding a suitable tutor by directing requests for private tuition from individuals with learning difficulties or their families to LDA consultants whose areas of expertise match the learning needs of the individual seeking tuition.

The criteria for acceptance as a consultant and renewal of consultant membership is quite demanding, so we are confident that our consultants offer a highly qualified and most effective service to students with learning difficulties. LDA consultant membership is only available to LDA members who are qualified teachers experienced in the area of students with learning difficulties and who have relevant post-graduate university qualifications in this area.

Consultants should be pleased that a new brochure has been developed to meet our marketing and professional integrity needs, with Ann Ryan taking the lead in drafting the brochure based on the suggestions of many different consultants. Deciding what to call ourselves has been one major difficulty. The term 'tutor' is essential for marketing purposes, particularly since our online tutor service is called the Online Tutor Search, and because parents are looking look for 'a tutor' not for 'a teaching specialist' or some other such title. But the term 'tutor' fails to signify the level of expertise of our consultants. Technical reproduction issues with photographs submitted for use was another issue. The brochure also has a section to attract new consultants so we hope it will meet LDA consultants' needs and increase LDA membership.

The Consultants Committee, with the help of Olivia Connelly, a co-opted member of this Committee, is also developing two web-based surveys, one for parents and one for consultants. Designed to inform us of their experiences in using the Online Tutor Search, we hope that the data gathered will guide us in meeting future needs and improving the service.

Most consultants meet at least once a term with their local network groups. These meetings provide professional learning in the form of discussion or a presentation by a guest speaker and provide the opportunity to meet with colleagues and to share issues and experiences. The meeting with and support of colleagues is very important in a type of work that can be isolating, especially for those who operate a single person practice, which applies to most consultants. It is very exciting that a successful 'remote' network has been established by Ann Ryan, using Skype, for consultants who are unable to attend other networks due to distance. Our current enthusiastic members are scattered widely, from Wangaratta in Victoria to far north Queensland. The importance of networks cannot be overestimated.

The professional development event in March with Kate Jacobs on psychological assessment was very successful, with 60 attendees, and was most informative in explaining the benefits and pitfalls in using the data from a WISC assessment. Having to postpone our maths PD with Judi Humberstone until 2018 was disappointing but necessary, as it would have clashed with one on a very similar topic that was already being advertised by SPELD Victoria. However we hope to offer more PD before the end of the year, probably one on high-functioning autism and possibly another with two consultants who are presenting at the combined LDA, SPELD, LSTAQ Brisbane conference in September. Many Melbourne consultants attend seminars organised by the TTR4L group (Teaching, Technology and Resources for Teachers) and some also attend courses in teaching specific programs, usually in literacy. Although professional development is relatively easy to access on the internet, with readings and podcasts, the face-to-face PD offered by LDA is always a bonus and an opportunity to meet with consultant colleagues and classroom teachers.

The role of an LDA consultant is challenging. It won't buy you a Mercedes, but it is very satisfying when progress is made by students who have often given up hope. Consultants offer hope through teaching students to be more successful in learning.

For details about the process and requirements for becoming an LDA Consultant, please refer to the website www.ldaustralia.org