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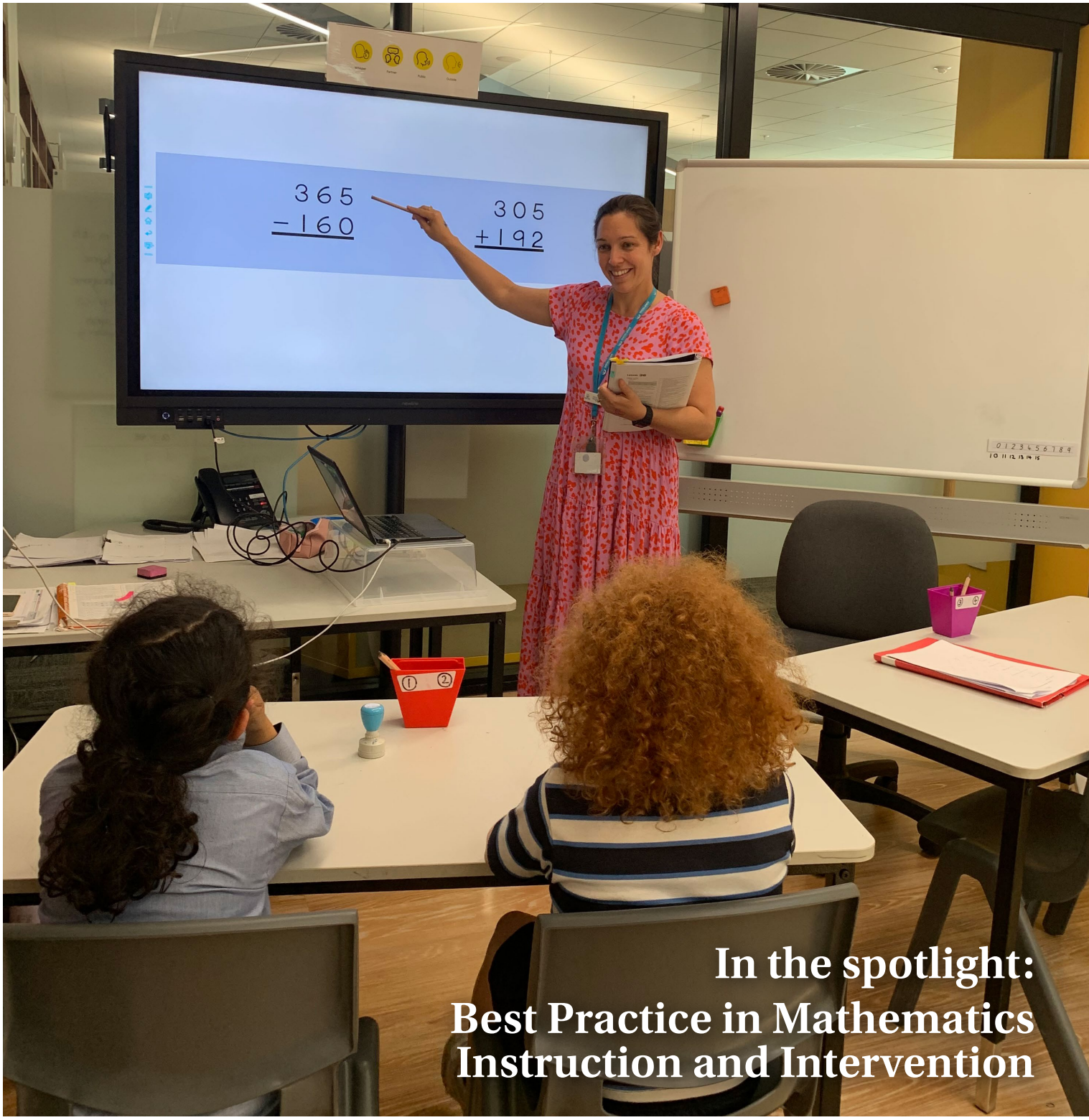
Bulletin



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Special thanks to the staff and students of Docklands Primary School, Victoria for being featured on our Bulletin cover for this issue.

From the President

Geoffrey Ongley

As the newly elected president of our organisation, I would firstly like to extend my heartfelt gratitude and thanks to our members for entrusting me with this honourable position. Although my career has been rooted in technology and business, one way or another, I have found it has always intersected with education and in taking this role, the trend continues!

Before we look forward, I would like us to briefly look back at what a resounding success our Annual General Meeting was, which was a testament to the passion and dedication that exists within LDA's council, executive and members. The event was filled with inspiring presentations from our recent award winners, as well as discussion on the financial performance of the organisation from our treasurer Iain Rothwell, and where we are headed from here from our new General Manager, Sherree Halliwell.

A special acknowledgment also goes out to our award recipients. Their remarkable contributions have considerably improved educational practices for students facing various learning difficulties. I would also like to express my deepest thanks to the staff and volunteers who were part of organising the AGM. Their tireless efforts and meticulous planning resulted in an event that was both informative and enjoyable.

In the end, it was great to have so many of our members come together both in person and online, united by a common goal: to make a meaningful difference in the lives of children and individuals with learning difficulties. Our esteemed colleague and Secretary of the organisation, Stephanie Murphy, has also put together a wonderful 'AGM Round Up' covering the event on page 6.

Now, going forward, our vision is clear. We are here to make sure that supporting students with learning difficulties is the business of every teacher. In light of this, I am interested in spending more time listening to teaching practitioners about challenges they face or have overcome, and looking at how LDA can further serve its members; in practical ways that are going to really make a difference in children's lives.

As part of this effort, I would like to aim at broadening the scope of what it means to be a member of LDA, and what it is that such a membership delivers. Be it tools, professional learning, or other things we can do to support our members in practical and meaningful ways, the goal is simple: deliver more value for LDA members.

Part of how we will get there is by listening to you, our members, and I am truly interested to learn from you, which will help us to plan and prioritise things that are going to offer the most value to you. I believe it is essential that we connect with more educators, both to understand challenges and spread awareness of what LDA can offer and achieve.

Once again, I thank you for entrusting this role to me, and I am committed to leading our organisation towards new heights of success and impact. I am confident that with your support, we will achieve our ambitious goals.

Geoffrey Ongley
President, LDA
president@ldaustralia.org

Geoffrey Ongley is the Co-founder, Director and CEO of Training 24/7, as well as the CEO of Get Reading Right. Educationally, he has completed a Bachelor of Computer Science, Master of Business Administration (Finance), and a Graduate Certificate in Professional Legal Studies.

Consultant notes

Dr Anne Bellert, Consultant Committee Convenor

Following LDA's 2023 AGM in October, we now have the following members of the Consultants' Committee: council members Elaine McLeish, Eleanor McMillan, Erin Rollason, Felicity Brown (Renewals) Anne Bellert (Convenor) and; co-opted members Jan Roberts, Diane Barton and Marg Young. Thanks to new and continuing members for your service and support. We are looking forward to a busy year ahead, working together to support the Consultant Networks and individual consultants.

By the time this piece goes to press, LDA's professional development events for the year will have concluded. I hope you were able to take advantage of some or all of the amazing professional learning opportunities offered throughout 2023. Without wanting to detract from the smaller events, which are of great value to our consultants, the RTI conference was a stand-out success, with excellent speakers roaming the topic from theory to practice in various implementations. If you were able to attend, I'm sure you learned some new ideas and approaches, and encountered information that reaffirms some of your current practices. Should there be anything in particular that you'd like us to focus on in 2024 for Consultant professional development topics, please share your ideas – just a quick email to me will be welcomed for initial suggestions.

The LDA Consultant Guidelines have had a minor revision in response to requirements for different levels of qualifications from teachers and speech therapists. The option for the latter to become LDA consultants led to the need for this 'tweak'. The wording related to new applications, from either teachers or speech pathologists, with acceptable evidence of successful qualifications now being transcripts to show: post-graduate (for teachers) or post-entry level specialist qualifications (for speech therapists) with significant evidence-based Learning Difficulties components, and evidence of at least three years' experience working in your professional field with students with Learning Difficulties. We have one new Consultant member who is a speech therapist and we are hoping to receive more applications from both teachers and speech therapists in 2024. In fact, increasing the number of Consultant Members via recruiting new people is one of our key aims for 2024, along with continuing to provide excellent support for Consultants and Network leaders.

On behalf of the Consultants Committee, I wish you all a Merry Christmas and I hope you all find time to relax and enjoy some time off – I'm sure you all deserve it!

Dr Anne Bellert
Consultants Committee Convenor.

Are you interested in becoming a Consultant Member of LDA?

Consultant Membership is a special category of LDA membership, currently open to Specialist Teachers and Speech Pathologists with training in the learning difficulties area and experience in teaching and consulting with students with learning difficulties.

In addition to standard membership benefits, Consultant Membership provides:

- Recognition of your expertise in the LD field
- Inclusion in a Consultant Network Group
- Eligibility for inclusion in the LDA Online Referral Service

For more information about becoming a Consultant Member, please contact our Consultant Convenor at *consultant.convenor@ldaustralia.org* or phone Elaine McLeish on 0406 388 325.

We would love to hear from you!

In this issue of the Bulletin...

Julie Scali, Editor, LDA Bulletin

I am pleased to share with you the Best Practice in Mathematics Instruction and Intervention edition of the LDA Bulletin. In comparison to literacy, mathematics has traditionally taken a backseat in terms of research and professional learning, however, mathematics should play an equally important role in education as getting mathematics right in the primary years has a significant knock-on effect into general society. Jayanthi, 2019, describes its importance: "Mathematics is the foundation for nation building, since the level of mathematics skills and competences go a long way to determine the level of science and technological components of any nation, which is a basic requirement for its development. Mathematics today has an enormous impact on science and society, (and) though the influence is silent and hidden, it is shaping our world in many ways."

Often a forgotten aspect of mathematics teaching and learning is the added complexity of the language of mathematics which we explore in the feature article of this edition. Karen Tzanetopoulos is a speech and language pathologist with an expertise in the language and cognitive processes of learning maths. She outlines the complexities of the mathematics language of English and points out that students with dyslexia, students from EALD backgrounds and students with specific language impairments are at a double disadvantage when it comes to mathematics due to the complexity of the mathematics language of English. Her article is on recommended approaches in the language of mathematics, outlining seven high impact adjustments to maths instruction that can improve student achievement.

Our second piece of the edition is one from the chalk face of an inner Melbourne school. Brydon O'Neill-Guy, the mathematics leader of Docklands Primary School outlines how a multi-tiered system of support model (MTSS) is utilised to ensure best practice and is embedded in all tiers of mathematics instruction across the school. O'Neill-Guy explains how tier 2 intervention occurs at Docklands Primary providing many useful recommendations for school leaders and teachers in terms of mathematics curriculum, assessments and instructional routines.

In the article, Counting really counts, Peter Westwood cites the importance of effective counting instruction as this skill is "highly predictive of a child's later development of functional numeracy and achievement in mathematics". Westwood recommends that counting skills are taught through direct instruction with clear objectives for what knowledge and skills children will learn. He outlines how this contrasts with how many early childhood educators go about teaching this crucial skill. He outlines how teachers can move from effective finger counting approaches to concepts beyond rote counting and finishes with a range of simple evidence based tips for teaching counting in primary classrooms.

Following on from this article, Brendan Lee is an experienced school leaders from NSW who outlines 'what you need to know about teaching primary mathematics' explaining evidence-based research on high impact mathematics instruction. He outlines three key principles of teaching primary mathematics including the hierarchical nature of mathematics, conceptual and procedural understandings and the link between thinking like a mathematician and maths teaching perse.

Of equal interest in a tier 2 context, is a piece on diagnostic maths assessments entitled, 'The Power of Qualitative Diagnostic Assessments in Mathematics Intervention' This piece by Karen Wedderburn draws on her experience as a mathematics interventionist and a step-by-step approach to gathering qualitative data on students to ease students into the assessment process. Her focus is also about being mindful about mathematics anxiety.

This edition's book review is on Peter Westwood's 'Teaching for numeracy across the age range' and was reviewed by Diane Pursell, an experienced teacher in WA. Westwood combines decades of scientific research about how children learn mathematics in the primary and secondary years and also explores mathematics in adulthood. Pursell cites that Westwood "provides a firm foundation to inspire teachers to reconsider how they teach mathematics within their classroom". Westwood's text also provides a range of useful, relevant print and online resources at the end of each chapter, which is beneficial for both new and experienced educators on how to plan and implement high quality numeracy lessons. It is a short, practical read for teachers and learning support specialists wanting to refine their numeracy understandings and practice.

Finally, we wrap up the issue with a reflection and celebration of the highly

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successful online *LDA Best Practice using an RTI framework* conference earlier this month. We were delighted to have a wonderful line up of speakers including the fabulous Dr Anita Archer on the magic of explicit instruction and Dr Louise-Spear Swerling on the three reading difficulty profiles. The feedback of the two-day conference was exceptional and our Education Manager, Hema Desai concludes this issue with a fantastic summary of the event.

This Bulletin is the last of the year and I hope you enjoy the wonderful contributions of all our writers. I sincerely thank each writer for their knowledge, time and wisdom sharing. Wishing you all a joyful festive season and holiday break.

Julie Scali
Editor, LDA Bulletin

Julie Scali is the Director of Literacy Impact, specialising in structured literacy and Response to Intervention. A former deputy principal in Australia, she now works with principals, school leaders and teachers Australia wide with consultancy, professional learning, and online modules to embed schoolwide evidence-based literacy approaches to ensure success for every students. She is also an author of 'High Impact Reading Instruction and Intervention in the Primary Years'.

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AGM round up

The LDA Annual General Meeting took place on October 14th at the Treacy Centre in Melbourne. This yearly event serves as a valuable opportunity to bring together the outgoing and incoming council, active LDA members, staff, and award recipients.

The year 2022-23 marked a period of consolidation and refocus for LDA, as highlighted by outgoing President Elaine McLeish. She celebrated the achievements of the 2022-23 Council, including the recruitment of crucial staff for the ongoing viability of LDA, the development of a new strategic plan, establishment of new committee structures, continued upgrades to the website, and improvements to financial and accounting systems and processes.

Dr. Sherree Halliwell, General Manager, shared her onboarding experience and emphasised, "LDA's family comprises many philanthropic, proactive, professional, and passionate people." This sentiment played a pivotal role in shaping the 2024-27 strategic plan, titled 'Amplifying our Impact,' which focuses on financial sustainability and growth.

Iain Rothwell, Treasurer, provided a financial update for 2022-23, acknowledging a decline in LDA's financial position due to the strategic decision to bring on paid staff for the organisation's ongoing sustainability. However, early indicators of growth in memberships and increased sales in upcoming professional development underscore the benefit of investing in staff to drive LDA's agenda.

At the AGM, Honorary Life Memberships were conferred upon Emeritus Professor Kevin Wheldall AM and Dr. Ros Neilson, recognising their longstanding commitment and contributions to LDA. The event also acknowledged the valuable contributions of outgoing council members Jacinta Conway and Melanie Henry.

The remainder of the afternoon was dedicated to recognising award recipients for their ongoing contributions to the learning difficulties landscape. Each recipient presented on their related work, research, and advocacy; underscoring the invaluable contribution of individuals within our LDA community. Congratulations once again to our award winners, and we extend our gratitude for their time and commitment to presenting.

AJLD Eminent Researcher Award
Emeritus Professor Kevin Wheldall AM

LDA Tertiary Student Award
Elvira Kalenjuk

LDA Tertiary Student Award Highly Commended Dr Shae Wissell

LDA Bruce Wicking Award
Julie Mavlian

LDA Mona Tobias Award Julie Phillips

LDA Rosemary Carter Award Ann Ryan

Mathematical language adjustments to increase mathematical understandings and achievement

Karen Tzanetopoulos

The English language for mathematics is phonologically, morphologically, and syntactically complex. It is also abstract and not closely aligned with the base-10 system of maths (Guerrero et al, 2020). The complexity of the English maths language makes it even more difficult for many with dyslexia and other learning difficulties to learn mathematics.

Research demonstrates that learning maths requires all components of reading in addition to maths-specific skills. For example, phonological awareness significantly predicts the acquisition of the counting number-word sequence and calculation skills and is highly predictive of long-term maths success (Michalczyk et al., 2013, Soto-Calvo et al., 2015). Rapid Automatic Naming (RAN) affects reading but also counting and arithmetic fluency skills and is highly predictive of mathematics success (Hoff et al., 2023). Children who have difficulty with RAN may say or write a number while meaning a different one, may say one number while writing a different one, say a number differently than it is written, or be slow to say the number they are trying to recall. These difficulties can cause quite a challenge and create unintentional mistakes, even when they understand the concept. Finally, learning mathematics requires orthographic skills of not only mapping sounds and spoken words with different letters and letter sequences, but also with mapping spoken numbers with written number words along with their meaning, magnitude, and relationship to other numbers (Malone et al., 2019).

Dyslexia is a language-based learning disability with deficits in the phonological component of language. These children are particularly vulnerable to having difficulty learning maths because of the complex and abstract English maths language. Specific language impairment is another learning difficulty that impacts maths. Students for whom English is not their primary language but are learning maths in an English-speaking school are also at risk. Finally, children from impoverished backgrounds and experience a reduced exposure to language and vocabulary in their early environments are also at risk.

Furthermore, math instruction today is mostly heavily language-based and taught abstractly without concrete, explicit, and systematic instruction, with an additional emphasis on teaching and assessing maths through word problems. Many children with learning difficulties are at a further disadvantage with this method of instruction. However, with structured and systematic instruction, they can learn!

Modifying and reducing the language load is one way to improve learning for those with learning difficulties. The following are just a few ways to do so. These examples are based in cognitive and neurocognitive research in how children learn maths.

1. Structured Literacy

Use structured literacy and explicit instruction for maths vocabulary and language, including saying the word, encoding, decoding, morphology, word parts, and meaning. For example, morphological endings in English math words are plentiful, such as the phonologically complex ending /th/ used in the word tenth, which is used in fraction and decimal words to indicate the total parts to make a whole, whereas tenth can also mean the place in a sequence, such as tenth in line.

Much of the vocabulary in maths contains multisyllabic words and can be difficult to say, read, spell and understand. *Addition, subtraction, multiplication, division, numerator,*

denominator, vertices, geometry, parallelogram, triangular pyramid, etc. are just a few of the many complex words in mathematics. It is important to intentionally include maths vocabulary in structured literacy interventions. Maths instructors can provide literacy interventionists with the vocabulary and terminology that students learn in maths at any time.

2. Maths Vocabulary

The English language vocabulary for maths is complex in many ways. One way that it is challenging is that many different words can be used to describe the same concept in maths and should be taught explicitly and simultaneously. For example, the concept of addition can be described with many words such as: plus, and, add, more, more than, altogether, sum, total, increased by, in all, etc. These words should be explicitly taught together and modeled when learning a new maths concept. Children will encounter these variations in word problems. The same word problem can be written with different terminology so that children can compare and understand a deeper understanding of the language.

Furthermore, there are many homonyms and homophones in maths vocabulary that have different meanings in regular language. These multiple meaning words are abstract and can confuse students. The following are some examples: Right, meaning correct, a specific direction, a specific type of angle that can face different directions. Volume, meaning how loud the music is playing or how much space a container has. Positive, meaning a happy outlook, or a type of integer that is above zero. Follows, as in follow the leader in which a child is behind another, or in numbers, 9 follows 8 but is not behind 8. Just a few more examples are base, root, count, negative, table, greater, yard to name a few. There are even words within maths language that have multiple meanings. One such example is tenth, which can be related to fractions, decimals, and the unrelated meaning of sequence or order.

Maths vocabulary is also filled with homophones. Some examples include: ate/eight, to/too/two, for/four, hole/whole, wait/weight, very/vary, lesson/lessen, grater/greater, then/than, won/one.

3. Counting the Base-10 Way

English-speaking children learn to count and do arithmetic more slowly than children speaking Chinese and some other East-Asian languages due in part to language differences (Koponen et al, 2020). These languages are less phonologically complex and more explicit and transparent in the vocabulary and phrasing of maths concepts.

…there are many homonyms and homophones in maths vocabulary that have different meanings in regular language…

The English names of numbers from 1-10 are phonologically complex, have multiple meanings, and can be difficult to spell. *Two, to*, and *too* are homophones, with the number two being the most difficult to spell. *Four, for,* and *fore*. *Eight* and *ate*. In some East-Asian languages such as Chinese, the number names to 10 have only two sounds and no homophones, making it easier to learn the number names and their sequence. The English number names after 10 are complex and abstract and not tied to the base-10 system of math. English names do not demonstrate the relationship of numbers to each other, indicate magnitude, or relate to quantity. *Eleven* is a three-syllable word unrelated to the meaning. *Twelve* is unrelated to *eleven*. The syllables in the names *thirteen* to *nineteen* are opaque and in the opposite order of the numerals. "Thir" comes first and vaguely refers to 3, "teen" refers to ten, and saying these parts in order is 31. The morphological ending "ty" for number names twenty to ninety is close in sound to "teen" and children often have difficulty discriminating the difference. The meaning of these number names must be inferred and learned over time.

In contrast, the number names for numbers past 10 in Chinese are explicit and directly tied to the base-10 system of maths. Children who speak these languages learn to count fluently and perform arithmetic much earlier and more easily (Guerrro, D., et al, 2020). It also makes place value explicit.

Instead of saying the number name, say the number in the base-10 way:

11 is "one 10 and 1"
12 is "one 10 and 2"
13 is "one 10 and 3"
20 is "two 10"s"
25 is "two 10's and 5"
99 is "nine 10's and 9"
125 is "one 100 two 10's and 5"

Counting the base-10 way immediately indicates the quantity, relationship to other numbers, and magnitude. Performing arithmetic becomes easier because students can visualise the parts of numbers more easily and utilise the orderly base-10 system of maths.

English speaking children can learn to count the "base-10" way from the earliest ages and older children can learn it later as well (Magargee, S.D., & Beauford, J.E. (2016).

The following are ways to practice counting the base-10 way.

1. Use Stern Math number blocks (sternmath.com), snap cubes, unifix cubes, or counters. Point and count to 10 first. Having created the first 10, create a second distinct set of 10 and count the base-10 way. *One 10 and 1, one 10 and 2, one 10 and 3, etc.* When the second set of 10 is complete, say "two 10's". Continue in this way, ensuring the sets of 10 are distinct.
2. Write the numerals underneath the number blocks from above. If there is one set of 10 and 2 more next to each other, write the numeral 1 under the set of 10 and the 2 under the 2 ones. Point and say, "one 10 and 2".
3. Have students line up in sets of 10, counting the base-10 way.
4. Look at numerals and point to the parts of the numeral while saying the base-10 name. 13 – "one 10" (while pointing to the 1) "and 3" (while pointing to the 3).
5. Say a number in the base-10 way and have students write the number.
6. Say the English number name, have students say it and write it in the base-10 way.
7. Using a 1-100 number chart, point to any number, say it in the base 10 way and say the English number name.
8. For older students, include larger numbers and say both the base-10 way and the English number name.
9. Write equations that reflect the base-10 way of counting:
   a. 10 + 5 = 15 saying, "10 and 5 is one 10 and 5, the name is fifteen.
   b. 20 + 8 = 28 saying, "two 10's and 8 is two 10's and 8, the name is twenty-eight.

c. 35 – 5 = 30 saying, "three 10's and 5, take away 5 is three 10's.

10. Using a 1-100 chart, point to any number and complete addition and subtraction problems with changes in the number of 10's, such as 48 – 20, or 35 + 30. Complete the problems by pointing to the change in the 10's.
11. Complete two-digit equations mentally while looking at a number chart by first changing the 10's and then the 1's. *28 + 32. 28 + 30 is 58 and 2 more is 60. 35 + 38. 35 and 30 is 65 and 8 more is 72.*

4. The = sign: *the same amount as*

Children are most often taught to say the equal sign (=) as "equals". Doing so leads students to think that it means that they are supposed to get an answer instead of understanding that the two sides of an equation are the same amount. An incorrect answer is thought of as "wrong" instead of that that the two sides of the equation are not the same amount. Children, especially those with math learning difficulties, can quickly learn to pick a number to answer an equation just to get it done. Understanding the equal sign as equivalence is critical for pre-algebra, algebra, and higher-level mathematics (Mathews and Fuchs, 2020). For many students, understanding the equal sign means *the same amount as* reduces anxiety and the impulsivity to just get an answer. It develops mathematical thinking at a higher level. The following are some ways to introduce the equal sign to mean *the same amount as*.

1. Place the same number of counters or objects on both sides of an equal sign. Count both sides and say, for example, "three is the same amount as three." Place unequal amounts on both sides of the equal sign with a line struck through it and say, for example, "three is not the same amount as five." Then ask students what they need to do to make both sides the same amount and then replace the equal sign.
2. Put the total amount of an addition problem on both sides of the equal sign: 10 = 7 + 3 and 7 + 3 = 10
3. Introduce open addend problems such as: 10 = 7 + __ and __ + 3 = 10
4. Create equations such as: 4 + 6 = 7 + __
5. Create extended equations such as: 4 + 6 = 7 + 3 = 2 + 8 = 9 + 1. Children can have fun creating their own such equations.
6. Create equations with equalities and inequalities and have children shout out whether they are *the same amount or not the same amount*.

5. The language of multiplication

The word "times" in equations is vague. 3 x 4 read as *three times four* which is not explicit. What does it mean? It is difficult to quickly answer and can be confusing for children. Instead, reading 3 x 4 as *three 4's* is explicit and easy to understand. Learning multiplication with this terminology helps students organise their thinking and learning of multiplication facts (Gotze & Baiker, 2023). Beginning with 10's, using the base-10 way of counting is multiplication. For example, the number 30 spoken as three 10's can also be written as 3 x 10 and read as three 10's. Learning multiplication facts in order using this language helps children think mathematically instead of memorising the facts. Children with learning difficulties often have difficulty memorising their facts because it is more of a language task than a mathematical task. All the facts can sound the same, and it can be very frustrating to repeatedly fail at memorising them. When children learn their facts in order using explicit language, they can build their mental number line, use strategies such as if/then reasoning (if five 5's is 25, then six 5's is 5 more), build mental organisation, and do not need to rely on language-based memorisation.

As an additional note, some curricula will teach that 3 x 4 is 3 *groups of* 4. The use of the term *groups of* adds another layer of language processing and can be more confusing than simply saying *three four's*.

6. The Language of Division

The term "divided by" in division equations is also vague and confusing. What does it mean? Many children struggle when they are introduced to division and complain that they do not understand it.

In the equation 12÷4, the language of "12 divided by 4" is opaque. Two options make the meaning clearer. The first option is to say, "How many 4's are in 12?" Doing so helps children relate division to multiplication. The second option is to say, "12 divided (or broken) into 4 groups, how many are in each group?" Understanding of division improves when multiplication and division are completed consecutively: 3 x 4 = 12, 12 ÷ 4 = 3. Both equations can be read as, "there are 3 4's in 12." The division equation does not need to be read only as, "12 divided by 4." When multiplication and division are paired, the relationship can be more easily understood and division can be learned more quickly. Doing so places less demand on the overall number of facts to be learned. Children can write their own multiplication and division equations and solutions consecutively. Repetition of this process will yield results over time.

7. The Language of Fractions

The English language of fraction numbers is challenging! It is phonologically, semantically, and morphologically complex. For instance, the term *third* is a confusing homonym, being both a very familiar ordinal number as part of a sequence of first, second, and third, as well as a number name that means it is one of three equal parts that make a whole. *Two-fifths* is difficult to say, phonologically process, and vague in its meaning.

Understanding the equal sign means the same amount as reduces anxiety and the impulsivity to just get an answer.

This challenging language does not depict what the fraction names really mean, which is a proportion of parts to the total number of parts. Confusion abounds.

East Asian languages such as Chinese and Korean use a clear way of naming fractions that focuses on the part-whole relationship. In Chinese, ¾ is named of four parts, three. In Korean, ¾ is named of four equal parts, three (Miller et al., 2005). Naming fractions in this way focuses on the relationship between the two numbers, whereas English-speaking children most typically think of fractions as two parts and focus on either the numerator or denominator to judge their magnitude (Braithwaite & Siegler, 2018). Research has shown that changing the language from, for example, three-fourths to three-out-of-four-parts, three-of-four parts, or of-four-parts, three, helps children focus on the proportion and leads to greater and

faster understanding of fractions (Paik & Mix, 2003).

When introducing fractions and decimals, begin with the descriptive language of explicitly naming the parts to the whole: instead of "one tenth", say 1 of 10 parts, or of 10 parts, 1. Instead of "three-fourths," say 3 of 4 parts, or of 4 parts, 3. Of course, students must learn the thorny English names as well because it is how we communicate about them. The descriptive terminology can come first, eventually followed by the name: 1 of 10 parts, the name is one-tenth.

1. Always focus on the denominator first, in other words, the number of parts that make the whole. When naming a fraction, first ask how many parts make the whole.
2. Practice writing fractions by always writing the denominator first. Ask, "How many equal parts make up the whole?" Then, write the dividing line and the denominator first, leaving the numerator blank. Next ask, "How many equal parts of the whole are there?" Then fill in the numerator.
3. Explicitly name the parts to the whole to make it easier when comparing fractions. Four of five parts is easier to visualise than four-fifths.
4. Practice reading fractions using the explicit language. 1/10 read as one of ten parts, or of ten parts, one. Read a wide variety of fractions using this explicit language.
5. Add magnitude comparisons when reading fractions using explicit language. For example, *one of ten parts* is close to none. *Nine of ten parts* is almost all. *Four of eight parts* is half. *Four of nine parts* is almost half. *Five of nine parts* is just over half.

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Karen Tzanetopoulos, M.S., CCC-SLP is a speech and language pathologist with an expertise in the language and cognitive processes of learning maths. She also specialises in the treatment of dyslexia. She is co-author of the book, How Children Learn Math: The Science of Math Learning in Research and Practice (Routledge, 2023). She provides in-person and online instruction to teachers, school districts, and homeschool parents of pre-school to grade 6 students on how to teach maths more effectively. Her instruction is based in current cognitive and neurocognitive research on the science of math learning, including but not limited to the language component. This evidence-based research is not readily available to teachers and parents. Karen also provides individual maths instruction and structured literacy intervention for students with dyslexia. She may be reached at karen@mathandlanguage.com.

Tier 2 Maths intervention in a Melbourne context

Brydon O'Neill-Guy

Docklands Primary School (DPS) is a Victorian Government Primary School located 2km west of the CBD. We opened our doors in 2021, with a total of 101 students from Foundation-Year 6. In our third year of operation, we now have 529 students and operate across two campuses.

Our students come from a variety of cultural and linguistic backgrounds; approximately 78% of our students speak English as an additional language or dialect. This is a real celebration of our school, bringing diversity of knowledge and experience. In serving such diversity, we do face challenges of transience which impacts on how we cumulatively build students' skills / knowledge and track the progress of our cohorts.

Our leadership structure consists of our School Improvement Team-Principal, Assistant Principal, Head of English, Head of Maths, two Instructional Coaches (behaviour and instruction) and two Learning Specialists (Maths and English). We also have an Education Support Team of Speech Pathologists, an Occupational Therapist and Counsellor.

In our first three years of operation, the focus for our school has been establishing systems and processes to support evidence based teacher practices for learning, as well as solidifying a strong Tier 1 instructional program across all curriculum areas.

A key focus of our Leadership team in 2023, has been to construct our Multi-Tiered System of Support (MTSS) framework for supporting student learning, behaviour and wellbeing. A cornerstone piece of this work has been establishing a Maths Intervention Program that mirrors our Literacy Intervention Program (established in our foundational year).

…whilst we are building teacher practice, we are also building a sustainable and consistent curriculum across our school.

Our Tier 1 instruction follows an Explicit Direct Instruction (EDI) Pedagogy. We use an abridged version of the Ochre Daily Review materials for our Daily Reviews, and have a strong focus on number fluency and retrieval. We use the PR1ME Maths program for the remaining content of our lessons.

This year, our Professional Learning focus for staff has been on implementing an effective Daily Review, and how to best support students' learning in the Guided Practice phase. This has been a collaborative effort with DPS Staff and Reid Smith (Ochre Education) and has focused on Guidance Fading, Problem Pairs, Bit-By-Bit, Live Modelling, Self-Explanation Theory and the Concrete-Pictorial-Abstract Approach, as well as Curriculum Coaching for our teachers who are responsible for planning maths. This dual approach has ensured that whilst we are building teacher practice, we are also building a sustainable and consistent curriculum across our school.

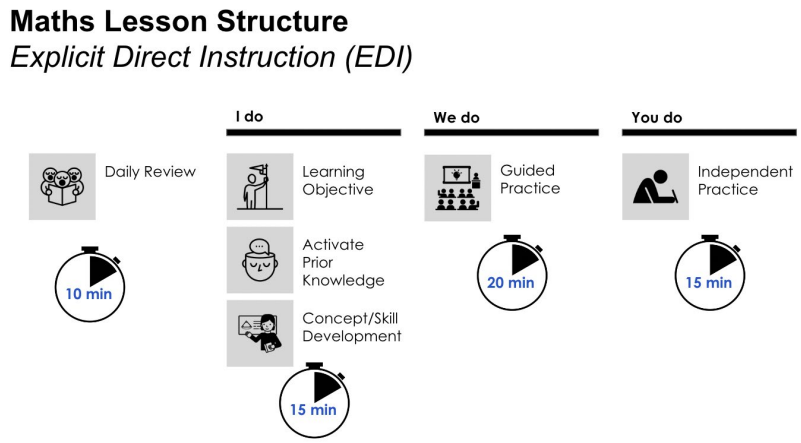

Fig 1. Tier 1 Maths Instruction at DPS

Assessment of Student Learning

At DPS, we assess students' maths learning in a number of ways:

1. **Universal Screening** – Acadience benchmark assessments are administered three times a year. This identifies students who are likely 'At Risk', require 'Strategic Support', 'Core Support' or are 'Above Core Support'
2. **Formative Assessment** – regular and strategic Checking for Understanding (CFU) throughout a lesson sequence
3. **Summative Assessment** – teacher created PR1ME Assessments, administered in Term 2 and 4. We are also currently investigating Essential Assessment for our upper years students to support teachers in aligning students' skills with the Victorian Curriculum
4. **Longitudinal Assessment** – NAPLAN and PAT Maths.

Intervention Student Selection

Data from our Tier 1 assessments (predominantly Acadience) is used to identify students requiring intervention. We also send out termly 'Expressions of Interest' to our teaching staff, where they can nominate students for an intervention place, or request their exit from the intervention program. This mechanism allows for qualitative input, and acts as a safety net to capture students who have recently arrived at DPS, or who have performed differently to expectation on assessment.

Investment in our people is investment in our students

Once students are in our intervention program, they receive more frequent Acadience Progress Monitoring Assessments (administered approximately every 4-6 weeks), along with the program's Mastery Tests and subjective judgements of student achievement following each intervention lesson. This more regular assessment allows us to tailor the focus of our 'Do Nows' and Homework.

Tier 2 Maths Instruction at DPS

When commencing our Maths Intervention program, we had a set of criteria to guide the process. We wanted to follow a program so that our interventionists could rely on the curriculum design, and could focus solely on consistency and fidelity of implementation with low variation. When selecting the program, we were looking specifically for something that was:

1. Grounded in research and evidence
2. Aligned with the recommendations in the What Works Clearinghouse Practice Guide – *Assisting Students with Mathematics: Intervention in the Elementary Grades.*
3. Consistent with our whole school pedagogy and Tier 1 instructional practices
4. Suitable to be run with education support staff for students in Foundation-Grade 6
5. Effective for 1:1, small group and class sized groups
6. Designed with built in correction procedures.

The above requirements led us to selecting a Direct Instruction program.

Students in our Tier 2 program receive 3x30 min small group (i.e. 2-4 students) intervention sessions each week, in addition to their Tier 1 classroom instruction. The exception to this is in our 5/6 cohort, where students are withdrawn for an hour of class intervention each day. This replaces their usual classroom instruction. This decision was made to support the spread of abilities seen in our 5/6 cohort.

Each Tier 2 session begins with a 'Do Now', which focuses on targeted skills to develop students' number fluency. What follows is a 20-25 min session with the Direct Instruction program. Mastery Tests are administered every 10 lessons within the program, with 'Remedies' provided if students fail particular sections.

At present, we are evaluating the effectiveness of this model in our context, and how this can be adapted to provide Tier 3 interventions in the future. Our major barriers have included:

1. **Time** – each lesson is designed for 35-70 minutes, however this is not possible within our block model of timetabling and intervention. As such, the program lessons take approximately 1.5-2 sessions to complete, hence slowing down the progress of the program
2. **Engagement** – many students entering our intervention program have a history of disengagement and challenge with maths (or learning more generally). This has required careful attention to relationship and community building, along with clear routines and expectations. This, again, has slowed down the progress of the program, but continues to be an important focus as we look to holistically support our students' needs.

Communication with Staff and Families

Students in intervention have Individual Education Plans (IEPs), updated each semester, along with letters that are sent home when a student enters/exits the intervention program. These letters detail the focus of the intervention program and the students' progress at each assessment point.

During their involvement in the program, students also receive weekly homework, and have access to Numbots and Times Tables Rockstars (applications that develop number fluency with addition/subtraction and multiplication/division respectively). This is targeted to their needs, and therefore, demonstrates their learning goals and progress to families.

Our intervention staff also complete intervention trackers following each session, which indicate to teachers how much support a student has required to be successful. They are also great at regularly communicating with classroom teachers on any concerns / student progress to ensure consistency between the tiers of instruction.

Challenges and Key Learnings

1. **Data systems are key** – as our school grows, so too does the amount of data we have! We are currently working through solutions to better manage this data in order to efficiently track our students' growth
2. **But… data isn't everything** – having the input of our teachers and intervention staff through expressions of interest and regular meetings helps us to best identify the students in most need of support
3. **Investment in our people is investment in our students** – our interventionists work with some of our most vulnerable students. This year, our ES staff attend the same weekly Professional Learning (PL) as our teachers, or more targeted PL relevant to their role. Intervention

staff are also provided with regular meeting times and opportunities for instructional coaching. Having a shared understanding of what we believe in and how we operate greatly benefits our students and culture

4. **Prioritisation** – we are currently considering how we can most effectively utilise the existing resources and skill sets within our school to equitably meet students' needs. This means analysing our students' data, re-evaluating our available interventions and establishing inclusion criteria for each of our intervention streams
5. **Considering the unique needs of students accessing intervention** – students flagged for intervention often have dual diagnoses, as well as instructional gaps in learning. We have staffed, designed and developed our intervention program with motivation, engagement and relationships front of mind. Part of this work has also been on ensuring consistency with routines and expectations across the classroom and intervention spaces.

The learning continues… our next questions:

1. What does Tier 0 (extension for students 'Above Core Instruction') and Tier 1.5 (bridging back to the classroom) look like for our students?
2. How can we better support our intervention students within Tier 1 instruction? How does this look different for our students who access Tier 2 vs. Tier 3?

If you have a good model of what this looks like in your context, I'd love to hear from you!

A massive thank-you to all of the wonderful educators I have had the experience of working with at DPS, and those across Australia who have been so generous to offer their time to share their knowledge and practice. Getting a MTSS framework off the ground requires hard work and clever thinking, as well as the courage to reflect and accept that the work is never done!

Finally, at DPS, we love to share our practice and journey, and would welcome you to join one of our monthly educator tours (Tuesdays). You can book in for this by calling our Reception.

Brydon has been working in the education sector in Victoria since 2010. She initially trained as a Speech Pathologist, and later completed her Masters of Teaching (Primary/ Educational Leadership). She is currently a Leading Teacher of Maths and Tier 2 Academic Intervention at Docklands Primary School.

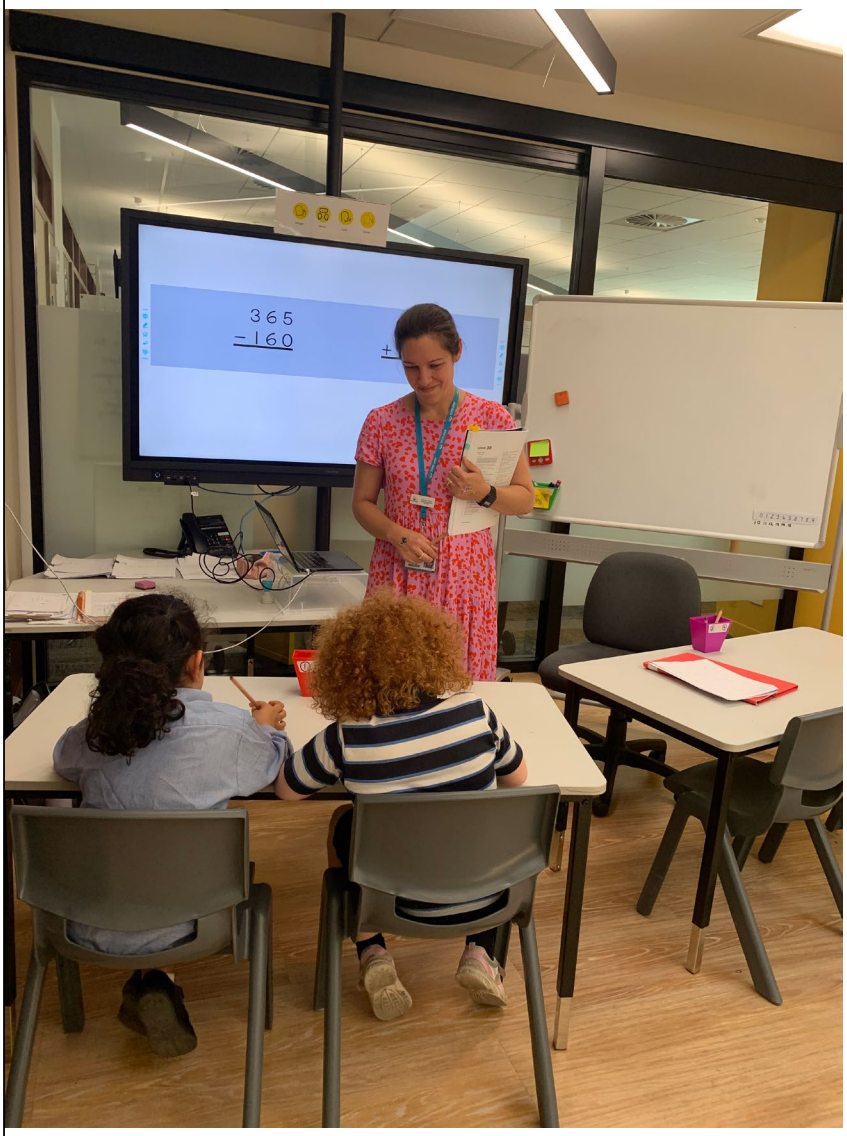

Image by Brad Nguyen, Docklands Primary

Counting really counts!

Peter Westwood

Young primary school students who use inefficient and slow methods for counting often find themselves falling behind in early mathematics development and later referred for Tier 2 and Tier 3 intervention programmes in numeracy. This could have been avoided for many of these students if, when they were in the pre-school and kindergarten years, they had been explicitly taught effective strategies for counting.

It is impossible to overstate the importance of learning to count at a very early age. The counting ability of preschoolers is known to be highly predictive of their later development of functional numeracy and their achievement in mathematics (Kesicioglu, 2021; Nguyen et al., 2016). Activities in the early years that involve counting can be enjoyable and motivating for children, providing the main pathway to understanding cardinality (Desoete & Praet, 2022; Jacobi-Vessels et al., 2016). The *cardinality principle* is that the last number-word said in the counting process indicates the 'cardinal value' (total number of items) for that set (Baroody & Lai, 2022).

It is stated in the Australian Curriculum guidelines that during the Foundation Year, children should become competent in counting by naming numbers in sequence, initially to 10 and then to 20; within that range, counting on or back from any starting point; connecting number names with numerals and quantities; and comparing, ordering and making correspondences between groups (ACARA, 2022). The important message in this article is that these counting skills and understanding of cardinality can be explicitly taught to kindergarten children by capitalising on their natural aptitude for focusing on numerosity (Carbonell-Jorney et al., 2022; Darnon & Fayol, 2022; Hannula & Lehtinen, 2005).

Unfortunately, some early years educators still shun direct teaching of basic skills, and firmly believe that young children should be free to acquire these skills and concepts incidentally through their natural engagement in play and other daily activities. This view is held despite the fact guidelines for early childhood education now recommend what is termed 'intentional teaching' as one essential component in a balanced preschool approach (DfE, 2009; Kennedy, 2014). Intentional teaching does not imply 'chalk and talk' formal instruction, instead it involves working deliberately with children on everyday activities while having clear objectives in mind for what knowledge and skills you want the children to learn from a particular activity. Learning to count is one such skill that can and should be targeted in this way.

Before entry to school

Most parents seem to know instinctively the value of being able to count, and they teach their young children to count as a common informal practice within the family setting. The creators of television programmes for young children *(Play School; Sesame Street)* also recognise the importance of counting and numeral recognition, and they include many engaging activities that present these skills through the visual medium and through songs, finger games and stories that involve counting. Picture books for young children also present many opportunities for counting (Perger & Major, 2018).

Counting on fingers

Fische et al. (2018, np) have stated, 'Finger counting is widely considered an important step in children's early mathematical development.' Similarly, Mutlu et al. (2020) suggest that the advantages of finger-counting are that it is instantly accessible and natural. In the early years, counting on fingers facilitates internalisation and retention of number names, and establishes one-to-one correspondence. Ollivier et al. (2020) support the explicit teaching of finger use with kindergarten students, to build numerical representation and enhance age-appropriate simple calculation skills. Eventually this finger-counting becomes much less necessary as children develop a memory store of common number facts that are instantly recalled (e.g., 4 + 2 = 6; 8 – 3 = 5).

The great disadvantage of clinging to finger counting in the primary school years is that it can become a habit that slows down sub processes within calculations and problem solving. Many students with learning difficulties still have to make use of fingers during math classes, slowing them down and often leaving them behind. Bay-Williams and Kling (2019, np) have asked, 'Why do students go into the upper elementary grades (and beyond) still counting on their fingers?' The answer is probably that no one has taken the time to teach a more effective strategy.

Beyond rote counting

In order to be functional, counting involves much more than simply learning the stable-order principle by reciting numbers in the correct sequence (Haylock & Cockburn, 2014). In daily life, counting is very frequently used for physically checking, sharing, or comparing groups of objects. The skill of accurate counting involves grasping the principle of using one-to-one correspondence, with each object counted only once. Gradually, when children are asked the total from joining 5 objects in one group with 4 in another group, they move beyond the simple strategy of having to count both groups. Instead of 'counting all' they now use the more effective strategy of 'counting on' from the first given number ('5 . . . 6, 7, 8, 9'). This counting on strategy can be deliberately taught through clear demonstrations from an adult and many opportunities to practice (DfE, 2009). One of the reasons why some young children begin to fall behind in mathematics in the early years of primary school is that they still rely on the slower and less-efficient 'counting all' (Hopkins et al., 2022; Westwood. 2021).

A few practical tips

- Many TV programmes for children involve them in counting and comparing small groups of counters

or blocks. Too often however, a single group containing a *mix of colours* is used (2 red, 1 yellow, 1 black = 4). This is not very helpful, because a young child can be easily distracted by colours and is much less likely to perceive and store a visual memory of the pattern of a group of 4 (MacDonald, et al., 2020). This distraction can be particularly problematic for children with ADHD, intellectual disability, or are on the autism spectrum. In the very early stages of learning to count, it is important that all counters or blocks in a group are of the same *colour*. Later, colour becomes irrelevant as the child grasps that we are simply counting the objects. Exposure to simple number patterns such as those showing on playing cards, dominoes and dice strengthens children's ability to *subitise*. Subitising refers to recognising at a glance the numerosity of a small group.

- 'Counting on' can be encouraged by demonstrating physically the action of pretending to hold the number in one group (6) in your closed hand, saying that number aloud, then counting the second group on the fingers of the other hand. '6 . . . 7, 8, 9.'
- Although the world seems now to be moving rapidly towards a cashless society, it is still useful to use coins to explicitly teach children the traditional method of physically 'counting on' when giving change for a cash purchase.
- Mobile apps have been found useful for developing the counting and quantifying skills of children aged between 3 and 5 years (Mowafi & Abumuhfouz, 2021).
- YouTube has many video clips demonstrating ways of teaching skip counting in 2s, 5s and 10s (for example: *https://www.youtube.com/watch?v=TuJk_-71KyM)*
- A brief article mainly for parents, *Numbers and counting for preschoolers: When do children learn to count and how to help them* can be found at: *https://www.bbc.co.uk/tiny-happy-people/amazing-toddlers-little-counters/z4jjwty*
- Useful ideas and resources for counting can be found online at:

  https://www.prekinders.com/teach-counting/
  https://www.verywellfamily.com/teaching-your-preschooler-how-to-count-2162482
  https://www.educatall.com/page/900/25-ideas-to-help-children-learn-to-count.html
  https://rainforestlearningcentre.ca/how-to-teach-toddlers-and-preschoolers-to-count-and-learn-their-numbers/

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Peter Westwood has been a teacher and teacher educator for many years. His research interests are in learning difficulties, inclusive education, students with disabilities, literacy and numeracy. He is widely published in these fields and his recent book 'Teaching for numeracy across the age range' is available from Springer Educational.

What you need to know about teaching primary mathematics

Brendan Lee

The science of reading movement has brought about a real shift in teachers' knowledge and practice when it comes to the teaching of reading. However, there has been a lot more confusion around what evidence-informed practice looks like in a maths classroom. What has helped me get my head around how we should be teaching maths has been understanding these three principles:

1. Understand that mathematics is highly hierarchical
2. We need both conceptual and procedural understanding
3. To think like a mathematician, we need to teach them maths

Three principles to follow for teaching primary mathematics

1. Understand that mathematics is highly hierarchical

In the primary classroom, fundamental mathematical concepts play a crucial role in shaping the mathematical journey for our young learners. From basic counting and number recognition to essential operations, these concepts serve as the building blocks for more advanced mathematical skills (Geary, 2011). Just as phonics lays the groundwork for reading and spelling, mastering these fundamental maths skills provides a solid foundation and enhances students' problem-solving abilities.

One of the first content points in the Australian Curriculum is - "Subitise small collections of objects". On the surface level, this seems fairly simple. Subitising just refers to the ability to accurately recognise a certain number of objects without counting. However, this is the perfect example of how mathematics is highly hierarchical because they actually need to understand these principles of counting first (Dehaene, 2011; Sarneka & Carey, 2008):

- The one-to-one principle: each item is only counted once
- The stable order principle: we always count in the same order
- The cardinal principle: the last number you say represents how many are in the group
- The abstraction principle: it doesn't matter what objects we are counting, we count the same way
- The order irrelevance principle: it doesn't matter what order we count the objects in, as long as we count all of the ones in the group.

...knowledge builds on knowledge in maths

We also need to be able to recognise that numbers can be represented as a numeral and a word (e.g. 4 and four). Only after understanding all of this can we properly understand what the number actually represents when we subitise. This is just one example of how knowledge builds on knowledge in maths and you will find that there is prerequisite knowledge for everything from fractions to multiplication and geometry.

"There are over 105 novel mathematics vocabulary terms that children are expected to understand and apply" by the end of Year 1 (Hughes, Powell & Stevens, 2016). So, this means that we need to be highly intentional with what we teach, how we teach and when. Curriculum designers need to think about every aspect of this sequencing from similarities and differences between concepts and how complex they are. The complexity of the concept will affect how fast you move through it e.g. division and fractions are concepts that are difficult for students to develop strong understandings of.

2. We need both conceptual and procedural understanding

A comprehensive understanding of mathematics requires a delicate balance between conceptual understanding and procedural fluency. While both conceptual and procedural understanding are vital, attempting to focus on them simultaneously can be overwhelming for students. It can lead to confusion and hinder students' overall learning experience. However, it is not about one or the other or one before the other, but rather they are bidirectional and can be intertwined (Rittle-Johnson et al, 2015).

A key way to support the conceptual understanding is through using the Concrete-Pictorial-Abstract framework. "Any idea or problem or

body of knowledge can be presented in a form simple enough so that any particular learner can understand it in a recognisable form" (Bruner, 1966).

As students progress into upper primary and high school, the extraneous load on students' working memory increases through multi-step problems. As noted in "Effective Math Interventions" (Codding, et al., 2017), "Students without basic fact fluency seem to be less able to grasp underlying math concepts, perform procedural computation tasks, solve word problems, or access higher-level math curricula (Fuchs, et al., 2006; Gersten et al., 1999; Jordan et al., 2003)."

...you will find that there is prerequisite knowledge for everything from fractions to multiplication and geometry

So, being fluent in basic maths facts opens the doors to the more complex maths that they will be exposed to (Wong & Evans, 2007). Being fluent does not mean simply memorising the facts, but knowing the concepts and procedures so well that you recall them quickly and flexibly. For example, by teaching them the following concepts, we can cut down the amount of facts that need to be memorised in half:

- inverse operations e.g. 12 ÷ 3 = 4 and 3 x 4 = 12
- commutative property e.g. 6 + 3 is the same amount as 3 + 6

3. To think like a mathematician, we need to teach them maths

If you understand the first two principles, it will help you get a grasp of this one because you will understand that without having the prerequisite knowledge to perform tasks, we can't do them. So, that means the most effective and efficient way is to teach them what they need to know first, before asking them to do a task.

While expert mathematicians might display characteristics like curiosity and relish challenging situations, a novice is not a little expert (Chi et al, 1981; Willingham, 2021). While understanding how a mathematician thinks can provide insights into their problem-solving strategies and approaches, it does not guarantee that one will automatically think better or become a better mathematician. Becoming a proficient mathematician requires practice, a deep understanding of mathematical concepts, and the ability to apply logical and analytical thinking.

Agodini and Harris (2014) compared four different maths curriculums that used different pedagogical approaches for first and second grade using 789 teachers. It found that students taught with explicit instruction made the greatest gains and the most constructivist maths program had significantly lower scores in all the participating groups.

Figure 1 details how the amount of instructional support and scaffolding fades away as students move through the stages of learning. When they are at the acquisition phase we provide a high level of modelling and guided practice through the use of multiple worked examples, examples and non-examples and think alouds.

When they display that they can complete the skill accurately without assistance, then they need a number of practice opportunities with the goal of increasing speed. At this point, feedback should be delayed; while at the acquisition phase, it should be immediate and specific. As students are building fluency, we want to delay the feedback to check they are actually understanding what they are doing.

Once they have fluency in the skill/knowledge, they are able to generalise and should be exposed to open-ended problems, interleaved practice and inquiry-based activities. However, students are only able to cognitively engage with these activities if they actually have the prerequisite knowledge and are able to call upon it fluently, without it taking up their working memory.

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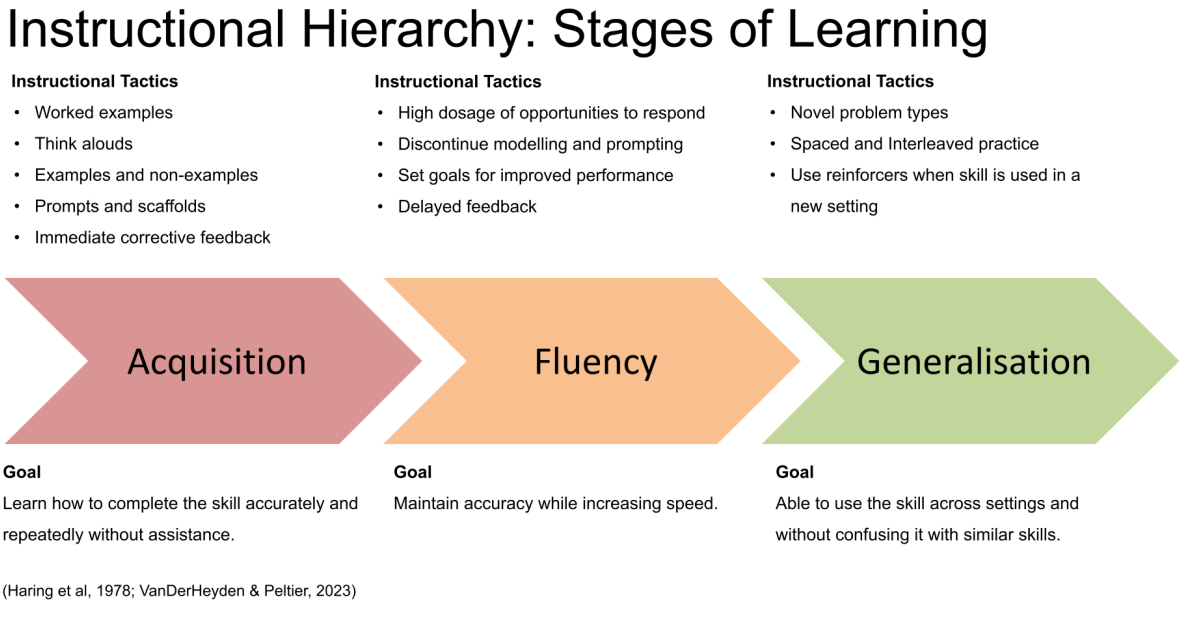

Fig 1. Instructional Hierarchy: States of Learning

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Brendan Lee is an experienced primary school leader in NSW. When he fell down the rabbit hole of educational research, he felt compelled to help bridge the gap between research and practice by supporting teachers in implementing the evidence. Currently, he does that through providing professional learning, writing on his blog (learnwithlee.net) and as the host of the Knowledge for Teachers Podcast.

The power of qualitative diagnostic assessments in mathematics intervention

Sarah Wedderburn

As a specialist maths teacher, students are referred to me by educational psychologists and schools who aren't able to meet the needs of children who struggle with maths.

I have two main objectives to achieve with these students: firstly, to improve their understanding of maths and, secondly, to help them develop a more positive self-image of their maths' ability. I would argue that the second is almost more important; because, until they believe they can do the maths, that maths can be fun and they can succeed and enjoy it; they are not in a place where they can learn.

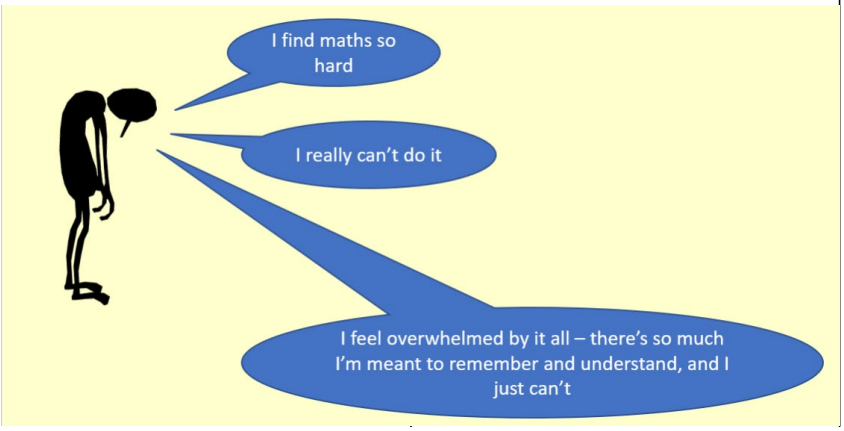
When a new student hesitatingly walks through my door their view of maths is generally one of being overwhelmed by all the information that they are meant to understand and remember, much of which makes no sense to them at all.

Having failed with maths for some time, their first session with me is vitally important.

I need to build a positive relationship with them to start them on the road to recovery and maths success, but I also need to find out what holes there are in their knowledge so I can plan their support lessons.

The maths test results that they come with provide only a superficial understanding of their knowledge. I know that they are failing – that is why they are sitting in my classroom and it doesn't really make any difference at this stage if they are failing by 6 months or 6 years! Either way, I will need to find out which mathematical concepts are secure so that I can begin to write a remediation programme that will start to build on their dependable maths blocks.

I could give them a detailed pencil and paper maths test but this would only achieve two things. Firstly, it might make them feel that this was just another occasion where they're going to be asked written questions that they can't answer so they will just fail again, and, for me, all I get is a demonstration of what they can present on paper - not what they really know. The main weakness with written tests and screeners is that we are not listening to our students' explanations. If we can't ask them 'why?' and listen to their responses, we cannot find out what they really understand and the misconceptions that are preventing them from succeeding.

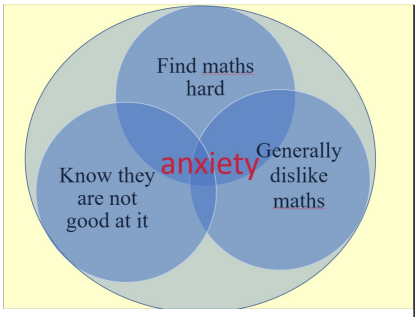


Maths Assessment

By definition, any student who comes to be assessed is having difficulty with maths.

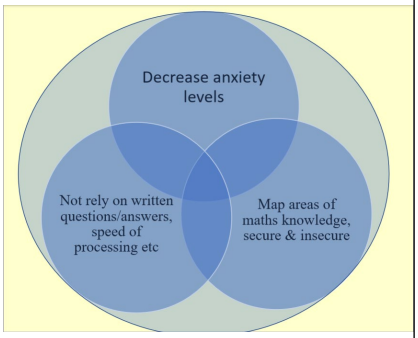
Many of my students will have comorbid difficulties such as dyslexia, dyspraxia, ADHD.

Anxiety will magnify any of these problems, cause higher level thinking skills to shut down, and when activated, prevent the student from remembering anything that they have been taught. A formal written assessment will therefore



not be an accurate measure of their maths ability and understanding.

An assessment that shows true ability and knowledge will:



Diagnostic Assessment

Rather than a written test I would much rather play snakes and ladders with my older primary students.

It's a game and I am very competitive and tell them I'm certainly not going to let them win just because they're younger than me! They forget what they can't do and relax, and I am already starting to build a way forward for them to learn.

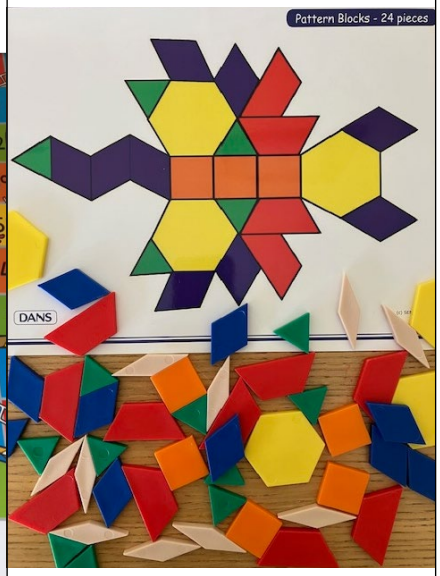
I use two 12 sided dice and a multiply and divide dice.

From this game I will learn:

- Which tables they know automatically?
- Which tables they can access?
- What strategies they use to achieve these answers?
- Their understanding of division - do they show disappointment each time they throw a divide dice?
- Whether they find it easier to multiply than divide - look out for hesitations and shoulder slumps.
- How good is their mental addition? (We ask them to add their scores mentally, not count round the board in ones)
- What strategies they use for mental addition?
- How efficient are these strategies?

All this is learnt from an eight-minute game that leaves us laughing together. I have started them on the road to maths recovery.

The majority of my students are bright and eloquent, so why are they not keeping up with their peers in maths class? The answer is often found in their underlying cognitive skills such a visual perception. So, with my younger students I might start by asking them to copy a pattern such as this:

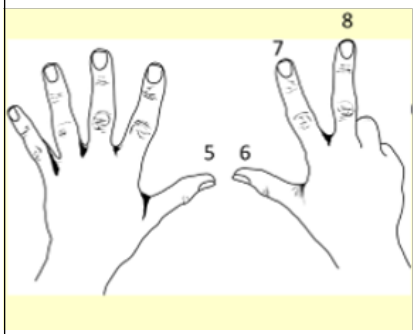


They are very happy to pick up coloured shapes and place them on the board as there is no danger of failing – if it's wrong we just turn it or move it. As they work we will chat away and I will be continually noting their language. What colour do we need here? Do you know what shape it is? How many sides has it got? How will we place it? Above? Horizontally? I am continually learning about my new student as we create the shape.

Finger Numbers

We might then move on to finger numbers. Research written up by Jo Boaler and Lang Chen[1] has shown that the quality of a 6-year-old's finger representation is a better predictor of future performance on math tests than their scores on tests of cognitive processing.

I can ask the student, 'Can you show me 8 fingers?' How do they do this? Do they start from 1 and count through to five and then on to 8 using their second hand, sometimes touching their fingers to their face while they count as they need this tactile support – even though, if you ask them, they know they have 5 fingers on each hand? Or can they say 5, 6, 7, 8.



Finger Numbers are important for future flexible numerical connections. Numbers are all about sequences and relationships and the finger numbers form the basis of a concrete representation of numerical relationships. I can also extend my questioning by asking them if they can show me 12 fingers. What is their reaction? As this will reveal the depth and flexibility of their knowledge.

1. Do they look bemused, show tension in their shoulders and say they can't do it? This shows me that they have a limited understanding of how numbers really work and lack enough understanding to be able to adapt their knowledge.
2. Do they smile and say they can't do it? At least they are not upset so showing confidence and an open mindset.
3. Do they show you 10 fingers and then 2 more? – This shows an understanding of numbers and place value and perhaps a learnt response – a good thing.
4. Do they laugh and ask to borrow two of yours, or ask if they can take off their socks and shoes and use their toes? Showing real

understanding, adaptability and confidence in their humour.

This is all essential information that I can gather from a qualitative assessment that is unavailable from a standardised written test.

Concrete Resources

Another great advantage of diagnostic assessment is that I can introduce concrete resources.

I might ask them to collect 24 of any of these manipulatives.

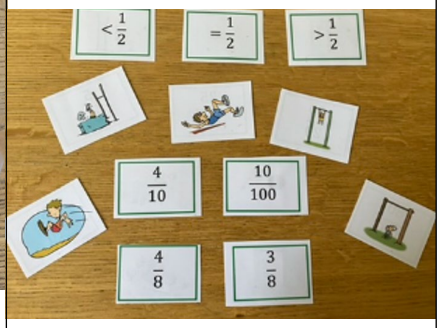
- Do they understand the question?
- Do they recognise the resources?
- How confident are they in choosing a resource?
- Do they have the necessary fine motor skills to pick up the resources?
- Do they automatically choose/create tens?
- Do they build the number with ease?

By their spoken answers and manipulation of concrete resources they will reveal their reasoning skills and by looking for signs of tension and relaxation I can add to my knowledge of their profile.

Dinoscore

There is a wide variety of ways that we can assess a student's knowledge. Many of my students really enjoy doing pages of the same sums when they know how to do them. They can succeed and show off their maths skills. However, what they find difficult is if the sums are mixed up and they have to use different operations and access different conceptual knowledge. Dinoscore is a card game that I use to assess their knowledge of ten bonds and simple maths operations together with their maths language, both their ability to read the vocabulary and to explain to me what it means. The cards look like real game cards with amusing dinosaur clipart to relax the student and make them unafraid of taking a guess or making an error. It is played like Top Trumps so we have a winner, we have fun and all the while I am listening to their explanations, noting which maths concepts are automatically retrievable for them and the questions they can work out the answers to. How do they do this? How successful are they? How persistent are they? So, throughout the activity, I am adding to my understanding of their mathematical profile.

Fractions



The concept that upsets my students the most is fractions. By the time they are referred to me they have often been taught fractions 3 or 4 times and they still don't understand.

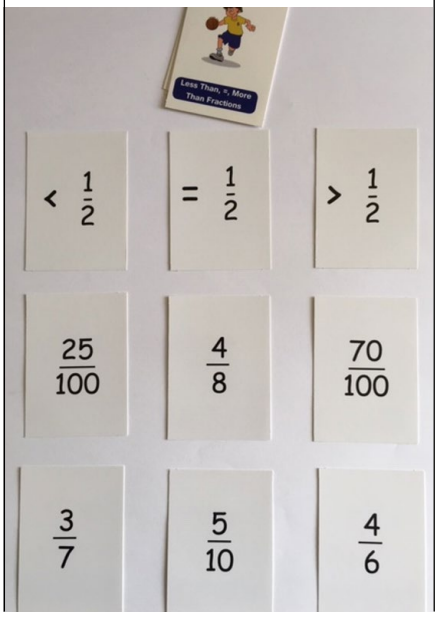
So, we assess through games as well as questioning and written sheets.

I can ask; which is larger ½ or ¼? Why? Can they write the fractions on a whiteboard?

It is this *why* that is so important and could not be asked in a screener or written test.

We then use cards to judge their understanding of how fractions work.

In this activity, Greater than, Equal to or Less than a Half, the <½, =½, > ½ cards are put up as column headings. The student turns over a card from the pack and reads the fraction aloud – can they pronounce it with ease? 25/100 - which column would it fit in, <, =, > ½?



Why? And, again, it is this ability to ask why, and listen to their explanation, that tells me whether they have a real understanding of fractions.

Can they then extend this knowledge to work with ⅜ demonstrating a flexible understanding?

Decimals

During my assessment I can ask the student, What is the value of '6' in 3.6? How do they explain this to me?

Can they explain the role of the decimal point? This is vital to an understanding of how decimal numbers work and if they cannot answer simply and concisely it will form part of my first lesson with them on decimals.

Why does the number 5 not have a decimal point? If you were to show the decimal point, where would it be written?

Can you calculate 24 + 3.7? How do they do this? If they write the numbers down on the whiteboard do they do so horizontally or as a vertical sum? If as a sum do they correctly line up the digits?

These are all questions that a student needs to be able to answer with confidence and they can be asked in a qualitative assessment where the student can answer verbally.

Language in maths tests

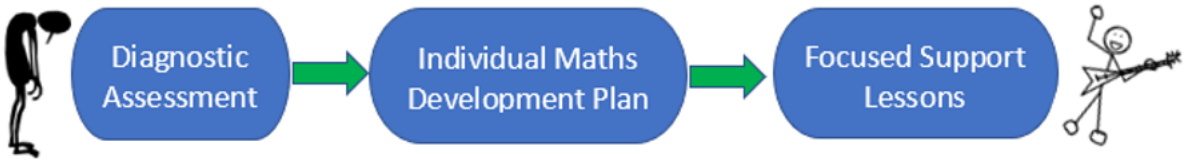
Recent research by GL Assessment Published in February 2020, has shown that a quarter of all 15-year-olds in the UK have a reading age of 12 or below and that reading ability affected GCSE maths results by a larger amount than it affected GCSE English Literature.[2]

In a written test we cannot tell whether the student failed to answer a prose question, or answered it incorrectly, because they did not have the prerequisite reading skills or they could not work the maths accurately. We need to know this. We have to ask them to read a variety of prose problems aloud to us, to retell the questions in their own words and then explain how they would answer them. Again, this information is available to me in a diagnostic test that would not be accessible from a written assignment.

Standardised or qualitative testing?

The question is not either/or. Standardised and qualitative tests should work together to form an efficient assessment protocol.

For the assessment of specific learning difficulties we need the scores from standardised tests. But if a student



has failed to answer the standardised, written questions correctly, then the verbal and resource led questions from the qualitative assessment will allow the assessor to explore and find the root of the problem.

For the writing of Individual Maths Development Plans we need diagnostic testing to allow us to dig down into the student's understanding, and also to start them on the road to maths recovery by showing them that the maths can be fun and they can succeed.

As a specialist maths teacher a complete map of a student's mathematical profile is required. For students to succeed, teachers also need to develop student enjoyment and confidence with numbers; and this must begin with their very first intervention lesson.

Diagnostic Assessment of Numeracy Skills – DANS

All the activities shown in this article are part of the DANS assessment kit. This consists of a structured set of diagnostic maths tests that build into a clear assessment map showing the mathematical concepts that are secure, the ones that are being worked towards and those lacking knowledge and understanding. The map can be used to write focused lesson plans and be shared with the student's class teacher and parents to explain why they are struggling. It can then also be used to show the student's progress.

Short video introductions to the DANS can be seen on the website: *www.unicornmaths.com*

The DANS assessment, Dans Solutions One and DANS Solutions Two are available from SEN Books, *www.senbooks.co.uk/*

1. Boaler, J. & Chen, L. (31.12.18) Why Kids Should Use Their Fingers in Math Class. The Best Writing on Mathematics 2017. https://doi.org/10.1515/9781400888559-011
2. To download a full copy of 'Read All About It: Why reading is key to GCSE success', please visit *www.gl-assessment.co.uk/whyreading*

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Cunningham, E. A. & Stanovich, K. (2001). What reading does for the mind. *American Educator*, 22(1-2), 8-15.

Ehri, L.C. (2014) Orthographic mapping in the acquisition of sight word reading, spelling memory, and vocabulary learning, *Scientific Studies of Reading*, 18:1, 5-21, DOI: 10.1080/10888438.2013.819356

Sarah Wedderburn BA. PGCE. SpLD Dip. AMBDA. MCCT founded Unicornmaths in 2003 based on the principle 'Make numbers real and make them fun'. She believes that effective maths remediation needs to be multi-sensory, encouraging students to touch and move concrete resources so that they develop full understanding and strong visual images before moving on to abstract reasoning. This interaction needs to be enjoyable and include continual overlearning and revisiting to build up a student's confidence and retention.

Sarah is the author of the Diagnostic Assessment of Numeracy Skills (DANS), a qualitative maths assessment that uses activities and games to discover what a student really knows, rather than what they can present on paper. The DANS Assessment Map enables targeted lesson planning as it clearly shows which numerical concepts are fully understood, and which need reinforcing in class and individual support lessons.

Book Review: Teaching for Numeracy Across the Age Range – An Introduction

Reviewed by **Diane Pursell**

Peter Stuart Westwood (Springer Publishers). Teaching for Numeracy Across the Age Range – An Introduction

Peter Stuart Westwood is an experienced education consultant, editor and freelance education writer who has previously taught in all areas of education – primary, secondary, special schools and universities. His bestseller, *Commonsense Methods for Children with Special Needs and Disabilities* is currently in its eighth edition of publication. His recent book, *Teaching for Numeracy Across the Age Range – An Introduction*, is a Springer Briefs in Education text, meaning it is a compact volume of current, cutting-edge research that is summarised to make it easy to read, and published relatively quickly.

Westwood prefaces this text by highlighting the importance of numeracy and its connection to both student achievement and quality of life. Not only does being numerate assist students in the STEM subjects (Science, Technology, Engineering, Mathematics), it is also viewed as essential for employees in every industry of work. The need for higher standards of numeracy is emphasised within this book through extensive research and references, across many countries.

Chapter One: Numeracy Defined

Many definitions are provided in this first chapter, considering slightly different attributes of what being numerate means for governments and schools. Westwood reaches a conclusion by providing the book's definition of numeracy as "understanding and applying knowledge and skills involved in measurement, calculation, estimation and quantitative problem-solving" (2021, p2). He emphasises that it is not just one's mathematical ability, but skills that can be applied across all learning areas. He even goes so far as to mention an emerging term, multiple numeracies, as one's numeracy needs vary across different fields of work.

… for our students to be confident and fluent in numeracy, showing a positive attitude toward numbers, we need to teach explicitly, with sequenced lessons and hands-on practical resources

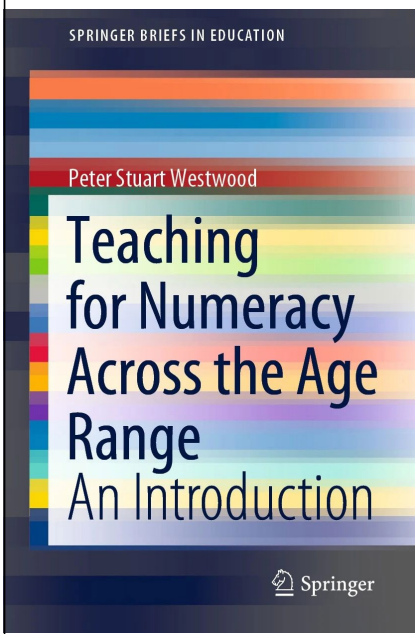
In regard to the curriculum, for our students to be confident and fluent in numeracy, showing a positive attitude toward numbers, we need to teach explicitly, with sequenced lessons and hands-on practical resources. There is an interesting contrast between the approaches in different countries, while the UK and US are carrying out this direct teaching of practised basic numeracy skills, Australia still seems to value the broader approach of investigation and discovery.

Chapter Two: Early Numeracy Development

Just as we should read and talk to our children from an early age to develop their literacy skills, Westwood encourages us to develop number sense with our toddlers so the pre-school teachers have a foundation to build on. Mathematics language should be informal and natural, so children can grow at an appropriate stage of cognitive development. It is here that Theories of Cognitive Development are revised and explained clearly – Piaget, Vygotsky and Bruner. Westwood also acknowledges at this point that our Western schools have an overloaded curriculum and that we must reduce the content, as students will have a greater chance of developing competencies and self-efficacy through frequent and successful practice of core numeracy skills.

Chapter 3: Numeracy in Preschool and Kindergarten Years

At the start of this chapter, Westwood recognises the positive influence parents can have on their children's numeracy competence, both in the language they speak (size of things, costings, comparisons, nursery rhymes, books, etc) and their own personal attitude towards maths related concepts. He encourages



teachers of the early years to make games out of maths by playing physically, mentally and orally with numbers and manipulatives. Again, there are criticisms of the Australian child-centred approach in our EYLF (Early Years Learning Framework) over teacher-led learning styles from the UK. Westwood goes on to explain the key numeracy competencies for this age group in more detail, which was both clear and concise.

Chapter 4: Numeracy Development in Primary School

Maths anxiety has been identified by more students in primary school as they exhibit a lack of confidence and mastery of basic computational processes. Westwood provides many useful teaching strategies for helping students experiencing difficulty in this area, and recognises that numeracy should be embedded across all areas of the curriculum, just as literacy is. He encourages that time poor teachers should avoid teaching a set of tricks to solve maths problems, as students must not lose their conceptual understanding for the sake of procedural fluency. At this point Westwood compares our teaching styles with the success of Asian schools where oral questioning and discussions are part of their ongoing learning process.

Westwood recognises opportunities to extend gifted students while also supporting students with learning difficulties, by providing useful examples…

Chapter 5: Secondary School Years

Similar themes are explored in this next chapter. As students begin to reason mathematically using algebra to support and construct proofs and arguments, it is encouraged that they still progress through the stages of concrete – pictorial – abstract to assist their recall of prior knowledge. Teachers of all subject areas are urged to take every opportunity to provide authentic opportunities for developing numeracy skills, such as budgeting, fundraising and sports days. While Westwood encourages a balance between computational skills and open-ended problem solving, he recognises that with some group work tasks, students can lack numeracy skills, become confused and rely on others to do the hard work, thus learning no new skills. At this point it is identified that some students have learnt to hide their maths difficulties, or been diagnosed with dyscalculia. Suggestions are provided in how to assist these learners within a multi-ability classroom or with specific tutoring assistance.

Chapter 6: Adult Numeracy

Westwood has summarised from recent research that around one third of US adults cannot handle everyday mathematics activities such as reading a bus timetable or understanding credit card conditions, while many tertiary students are considered to be "academically underprepared in mathematics" (2021, p68). Alarmingly, a 2006 survey found that about 50% of Australian adults could not attain the minimum level of mathematics needed to meet work and life demands. In response to this, the Australian government set up a strategy which aimed to have 2/3 of Australian adults competent in literacy and numeracy skills by 2022. It is recognised that adults may need numeracy courses to help them understand the specific skill set required for their job, but that becoming more fluent and confident in numeracy can also lead to personal and social gains in one's adult life.

Chapter 7: Approaches to Teaching and Assessment

This chapter revises and summarises the main concepts mentioned throughout, reiterating effective teaching practices, the need to link to prior learning and the importance of practising basic numeric skills to increase computational fluency. Westwood recognises opportunities to extend gifted students while also supporting students with learning difficulties, by providing useful examples that avoid the need for creating a low-ability group learning a 'watered-down' version of the curriculum. It is explained that early intervention can bridge understandings from concrete to abstract, while also enhancing students' attitudes and motivation to learn maths. Suggestions are given for how to carry out a range of effective assessments, while also hinting that recruiting university graduates with strong numeracy skills to mentor students might be beneficial.

Westwood's book, *Teaching for Numeracy Across the Age Range – An Introduction*, provides a firm foundation to inspire teachers to reconsider how they teach mathematics within their classroom. It is a quick and easy read to get teachers reinvigorated to pursue this subject further in ways relevant to one's own skills and that of our students. He provides a range of useful, relevant print and online resources at the end of each chapter for teachers to explore, which is beneficial for both new and experienced educators.

Diane Pursell is a teacher with 20 years of experience. Having worked in both the public and private sectors, she has taught students from Pre-Primary to Year 10, but is most experienced in the upper primary years. Diane has worked primarily in Perth, Western Australia, while also carrying out some minor teaching roles in Canberra and London.

'Best Practice Using a Response to Intervention Framework' Conference Review

Hema Desai

On October 28th and 29th, we hosted our first conference of the year. Thanks to its online format, we welcomed attendees from all corners of Australia. It was wonderful to see so many members in attendance.

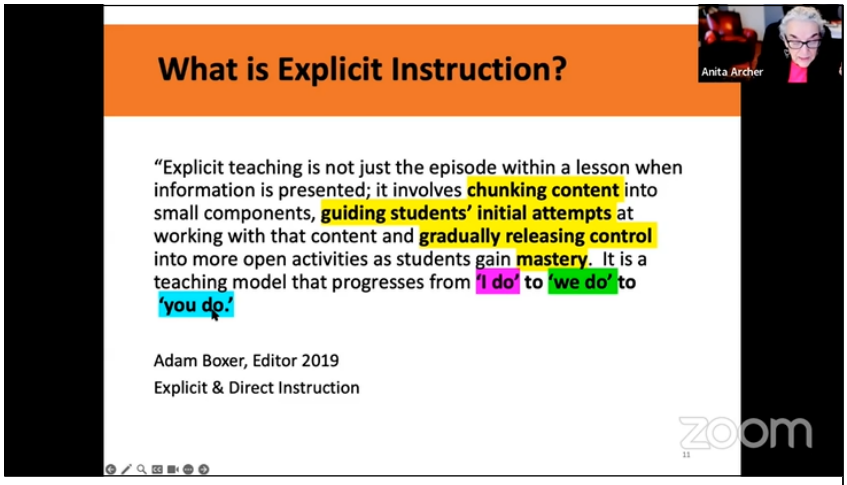
We had an exceptional line-up of inspiring speakers. Julie Scali of Literacy Impact inaugurated the event, delving into the fundamentals of Response to Intervention (RTI) and setting the stage for the weekend. Following her was Karina Stocker, who shared successful MTSS model implementations from a Melbourne school.

We were incredibly fortunate to have Dr Anita Archer as the keynote speaker. Her presentation 'The Magic is in the Instruction' inspired us all, demonstrating the importance of Explicit Instruction. Dr Archer covered definitions of explicit instruction and discussed essential elements of active participation. She provided current guidelines about Opportunities to Respond (3-5 opportunities to respond per minute). Anita shared some of her wonderful "Archerisms" such as Teach the Stuff and Cut the Fluff; Learning is not a spectator sport; and Walk around, Look around, Talk around.

Dr. Archer's presentation paved the way for Julie Sonnemann, who presented recent research on the effectiveness of small-group tutoring. She highlighted the importance of integrating small-group instruction into an RTI model and outlined the essential design features for planning small-group interventions.

On Sunday, the focus was on universal screening for literacy and numeracy and we were joined by Dr Robyn Wheldall and Dr Nicola Bell who presented on The Development and use of the Wheldall Assessments of Reading, i.e. the Wheldall Assessment of Reading Passages (WARP), the Wheldall Assessment of Reading Lists (WARL) and the Wheldall Assessment of Reading Nonwords (WARN). Dr Siobhan Merlo then presented on Numeracy and Mathematics using the RTI model. She provided examples of numeracy assessments that can be used in each of the tiers and discussed considerations for choosing assessments. Julie Scali presented on using Dibels for universal screening and provided practical examples for writing effective SMART targets.

The conference culminated with two outstanding presentations. Professor Emerita Louise Spear-Swerling explored "Identifying Common Types of Reading Difficulties within an RTI Framework." She dissected the three profiles of reading difficulties: Specific Word-Recognition Difficulties (SWRD), Specific Reading Comprehension Difficulties (SRCD), and Mixed Reading Difficulties (MRD). Her insights were supplemented with a range of case examples, covering screening assessments, assessment results, and intervention requirements. Dr. Alison Madelaine closed the



conference with her presentation on "Designing Tier 3 Interventions for Students with Learning Difficulties." She provided examples of test batteries useful for Tier 3 interventions in reading and spelling, along with instructional considerations.

Throughout the conference, we were thrilled to see participants actively engaging in live-stream chat discussions. The feedback we received from participants was overwhelmingly positive, with comments such as:

"The conference was exceptional"

"Incredibly informative. A good range of professionals presenting. Loved the live stream".

"A very worthwhile conference, that brought together a range of expert speakers. The conference has broadened my knowledge and understanding of RTI."

"The conference was fantastic and covered the content really well. A great selection of presenters whose knowledge was immense and practical suggestions very welcomed."

"Amazing calibre of presenters! Thank you - this was one of the best PD's I have attended"

The following raffle prizes were also won by worthy participants:

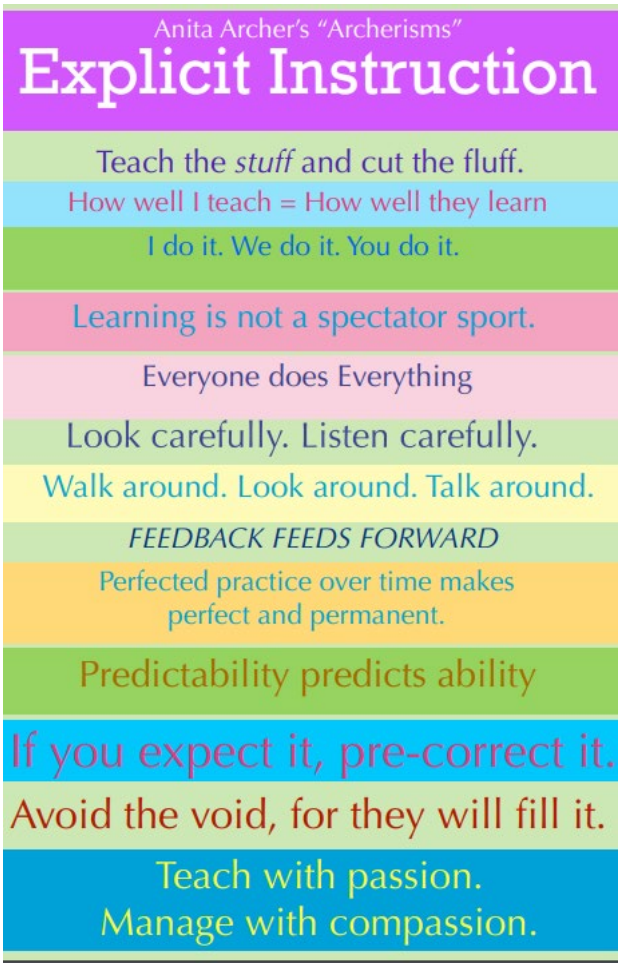
- MultiLit academic books pack including Effective Instruction in Reading and Spelling
- Essay Writing for Adolescents with Language and Learning Difficulties by Kim Knight
- PLD Comprehension Questions for 3-9-year-olds – Full set

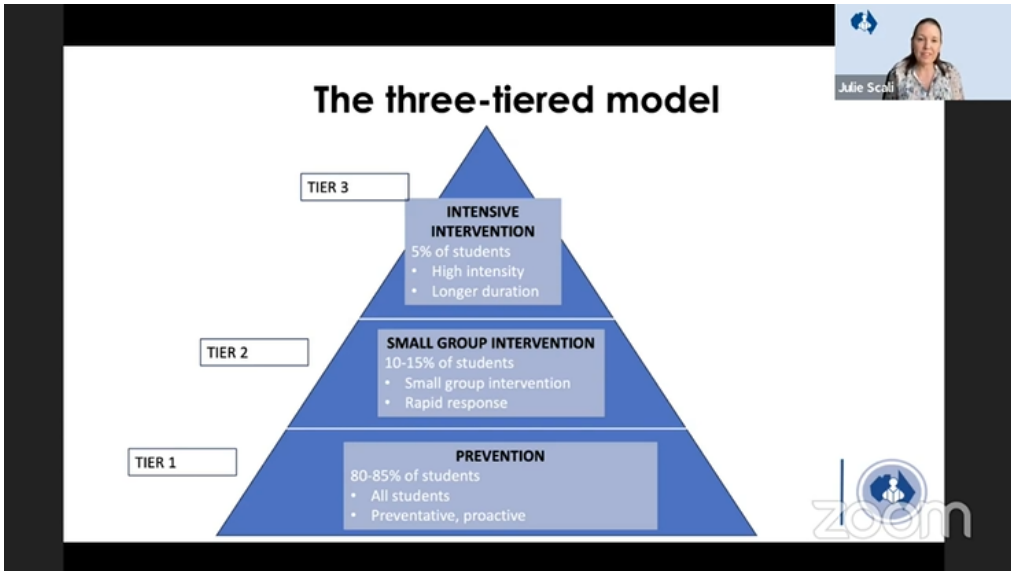
We would like to express our gratitude to our Gold Sponsors for the event:

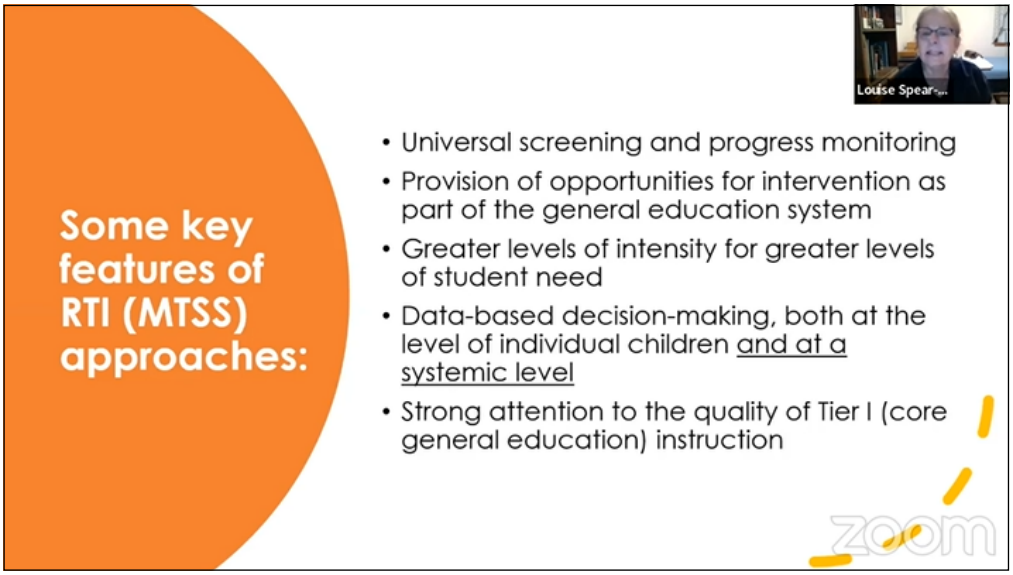
- Training 24/7
- MultiLit
- Decodable Readers Australia
- PLD

The Professional Development Committee extends its heartfelt thanks to all the speakers who have supported LDA, and to our President, Geoff Ongley, for his invaluable technical support throughout the conference.

Hema Desai is the Education Manager for Learning Difficulties Australia. She is a Speech Pathologist and has worked in the United Kingdom and Australia specialising in working with children with literacy needs.




Julie Scali
The three-tiered model
TIER 3
INTENSIVE INTERVENTION
5% of students
• High intensity
• Longer duration
TIER 2
SMALL GROUP INTERVENTION
10-15% of students
• Small group intervention
• Rapid response
TIER 1
PREVENTION
80-85% of students
• All students
• Preventative, proactive
zoom


Louise Spear...
Some key features of RTI (MTSS) approaches:
• Universal screening and progress monitoring
• Provision of opportunities for intervention as part of the general education system
• Greater levels of intensity for greater levels of student need
• Data-based decision-making, both at the level of individual children and at a systemic level
• Strong attention to the quality of Tier I (core general education) instruction
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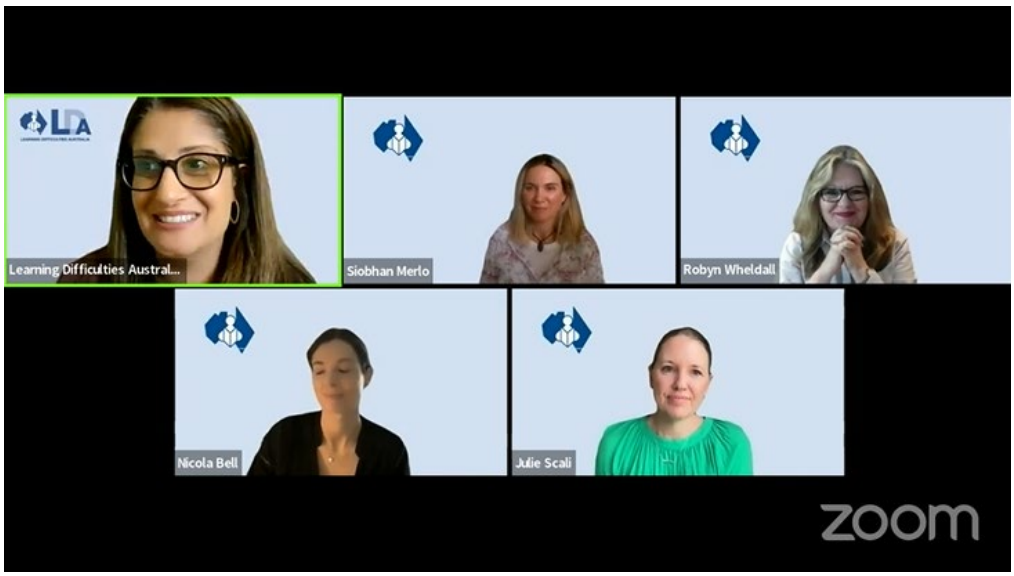
Learning Difficulties Austral...
Siobhan Merlo
Robyn Wheldall
Nicola Bell
Julie Scali
zoom

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