More Than Maths Phobia: Supporting Dyscalculic Students in Vocational Education

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Executive Summary of Fellowship:

The aim of the Fellowship has been to examine Dyscalculia, its characteristics and methods to support dyscalculics in vocational education. Students with disability have lower uptake and completion rates in vocational education (VE) than students without disability. Historically, this is in part due to the prevailing 'one size fits all' approach to learning and assessing as well as absence or low uptake of supports. Compounding this for dyscalculics is the lack of awareness and funding of the diagnosis, reflecting a broader societal approach toward numeracy challenges. Unlike literacy, where failure is met with urgency and intervention, mathematical difficulties are often dismissed as acceptable or inevitable. By researching the effectiveness of existing and potential interventions and supports for dyscalculics, the Fellow can contribute to lifting engagement and achievement for VE students with Dyscalculia, maths difficulties and maths anxiety. This not only enhances sector outcomes but also positively influences the self-belief of dyscalculic learners and their ability to realise their potential beyond education. This has positive and wide-reaching implications for society as a whole.

As well as talking with Australian-based experts, the Fellow travelled to New Zealand and England to speak with experts on Dyscalculia and maths supports and observe teaching and learning adjustments in practice. The Fellow chose to go to England and New Zealand due to their similar education systems and history of inclusive practices. There are also global experts in the field based across the three regions and interesting research being undertaken around the neuroscience of developmental Dyscalculia. The field is dynamic and continues to evolve.

Major findings from the research indicated the need for evidence-based screener tools to accurately gauge learner profiles and then utilise this information to assist in planning and assessment. The research emphasised the importance of reasonable adjustments to assist the dyscalculic to effectively engage in learning. The Fellow observed the positive influence of training and outreach in educating and supporting maths educators and the benefits of tiered supports for students struggling to process number.

It is the Fellow's finding that the approach to maths should be refined in three areas, allowing dyscalculics and those with maths challenges to have appropriate and targeted intervention – all leading to a higher probability of success in vocational education and beyond.

Three areas for development and refinement:

1. Quality screener tools with resources
2. Training and outreach
3. Reasonable adjustments & targeted supports

The report concludes with recommendations for program-based supports and greater collaboration between teachers, disability specialists and maths subject matter experts to ensure best practice is widely known and reasonable adjustments applied across VE institutions. The report also underscores the need for effective training sector-wide to raise awareness and bring about systemic change. Effective change cannot occur without a shared understanding of the challenges. The report highlights the importance of diagnostic assessment with evidence-based screener tools in conjunction with the effective utilisation of the existing Basic Key Skills Builder (BKSB) diagnostic tool, and meaningful application of assessment data to inform teaching and learning, and to provide appropriate, individualised support for learners.

03
Fellowship Background:

Context

Dyscalculia is a life-long specific learning difficulty at the extreme end of the maths difficulties continuum (British Dyslexia Association, 2019 as cited in Hornigold, 2024; Chinn, 2021, p.9) affecting 3-8% of the population (Butterworth, 2023; Hornigold, 2024). Many individuals have comorbidity with other diagnoses, and maths difficulties and maths anxiety do not automatically indicate Dyscalculia, although maths anxiety is often part of a dyscalculic's learning profile. Current research suggests Dyscalculia is caused by neurological differences, primarily in the interparietal sulcus (IPS) in the parietal lobes of the brain, which are activated when individuals calculate (Rapin, 2016). In the dyscalculic, the IPS shows reduced activity, thus affecting their numerical processing, including the ability to perform arithmetic (Butterworth et al, 2011; J. Humberstone, personal communication, February 2, 2025; Rapin, 2016). There is also evidence that other parts of the brain contribute to deficits in mathematical ability.

There has been no link found between an individual's IQ and Dyscalculia (Butterworth, 2019; J. Humberstone, personal communication, February 2, 2025). Although growing evidence suggests genetic links, environment can have a significant impact on an individual's outcomes. The term 'maths dyslexia' is a misnomer, both originate in different parts of the brain, although there is some overlap in characteristics and interventions (J. Humberstone, personal communication, February 2, 2025; K. Morsanyi, personal communication, April 28, 2025) and the prevalence rates are similar (J. Humberstone, personal communication, February 2, 2025). Researchers have worked extensively to create a definitive, evidence-based definition for Dyscalculia, as the lack of a common language can impede diagnostic assessment and intervention. In 2025, the SpLD Assessment Standards Committee (SASC) (as cited in British Dyslexia Association, 2025) developed a working definition that speaks of the core number deficit characteristic of dyscalculics but also other factors that influence a dyscalculic's ability to "engage in the world of maths" (D. Tout, personal communication, November 22, 2024).

SASC definition of a Specific Learning Difficulty in Mathematics (2025)

It should be noted that this definition is designed to support assessors in diagnosing dyscalculia.

Features: A specific learning difficulty in mathematics is a set of processing difficulties that affects the acquisition of arithmetic and other areas of mathematics.

In **dyscalculia**, the most commonly observed cognitive impairment is a pronounced and persistent difficulty with numerical magnitude processing and understanding that presents in age related difficulties with naming, ordering and comparing physical quantities and numbers, estimating and place value.

Some individuals may not present with a specific cognitive impairment in numerical magnitude processing but have an equally debilitating specific learning difficulty (SpLD in mathematics) due to other processing difficulties. Difficulties in language, executive function (verbal and visuo-spatial working memory, inhibitory control) and visual-spatial processing may also contribute.

Impact: Mathematics is a very varied discipline. Difficulties with learning mathematics may present in specific areas (for example, basic calculation) or across of the mathematics studied by the individual in relation to age, standard teaching and instruction, and level of other attainments. Across education systems and age groups, difficulties in arithmetic fluency and flexibility and mathematical problem solving are key markers of a SpLD in mathematics. Persistent difficulties in mathematics can have a significant impact on life, learning and work. This may also have a detrimental impact upon an individual's resilience to apply mathematical skills effectively.

Presentation: The presentation and developmental trajectory of a specific learning difficulty (SpLD) in mathematics depends on the interactions of multiple genetic and environmental influences. It will persist through life but may change in manifestation and severity at different stages.

A SpLD in mathematics frequently co-occurs with one or more of the following: attention deficit hyperactivity disorder (ADHD), dyslexia, developmental language disorder (DLD) and developmental coordination disorder (DCD).

Maths anxiety commonly co-occurs with a SpLD in mathematics but is not an indicator in itself.

(SASC, 2025)

Figure 1. (SpLD Assessment Standards Committee (SASC) 2025 as cited in British Dyslexia Association, 2025).

Dyscalculia limits the ability to conceptualise, which leads the dyscalculic to rely on memorisation (J. Humberstone, personal communication, February 2, 2025). This brings its own set of challenges, due to common deficits in working memory (R. Dowling & S. Robinson, personal communication, December 11, 2024; Parker, 2022). This means the individual is unable to temporarily store and manipulate number concepts in the brain and use them to solve problems immediately – the 'mental workspace' (Gathercole, 2011). Thus, rote learning, often used by maths teachers for formulae and multiplication tables, is unlikely to hold in working memory and is in fact counterintuitive to the way a dyscalculic's brain works. They will not understand the concept through rote learning and will struggle to work out the answer when their working memory invariably becomes overloaded (S. Chinn, 2021, p.20; K. Morsanyi, personal communication, April 28, 2025; D. Tout, personal communication, November 22, 2024).

The learning and living environment can compound difficulties for the dyscalculic. If the individual has experienced extended time away from school, poor maths instruction, a rushed and packed curriculum or negative parental attitudes towards mathematics, then challenges continue and lead to feelings of failure, impacting the dyscalculics sense of worth (Butterworth 2023; S. Chinn, personal communication, April 22, 2025; K. Morsanyi, personal communication, April 28, 2025; Parker 2022; SASC, 2025). Consequently, the dyscalculic is often also encumbered with anxiety around maths and develops avoidance behaviours, exacerbated by a prevailing societal mindset that 'it's okay to be bad at maths' (S. Chinn, personal communication, April 22, 2025; D. Tout, personal communication, November 22, 2024). Individuals who do not have the neurological markers for Dyscalculia but have experienced some or all the adverse environmental factors, can have 'maths gaps'. Unlike dyscalculics, individuals with delays in maths will respond to six months of intensive maths intervention and make gains in their understanding (J. Humberstone, personal communication, February 2, 2025). Like dyscalculics, students with maths delay, maths difficulties and maths anxiety will respond to interventions designed to address core number deficits (J. Humberstone personal communication, February 2, 2025) and support working memory and executive functioning (Chinn, 2021), as detailed in this report.

Educators should be aware of various signs that may indicate a student is dyscalculic; however, a formal assessment by trained professionals is essential for an official diagnosis. This ensures the student receives the appropriate supports and intervention in the long term.

Indicators of Dyscalculia include:

- Deficit in core number sense, including counting back (Butterworth, 2023; R. Jennings, personal communication, April 24, 2025), place value and symbol representation (Parker, 2022).
- Difficulty remembering rote learning, including number facts and multiplication tables (Butterworth, 2019; Chinn, 2019; Hornigold, 2024).
- Difficulty remembering sequences of numbers, such as phone numbers, locker numbers and PINs (Butterworth, 2012).
- Challenges calculating totals and change while shopping and poor budgeting skills (Butterworth, 2023).
- Difficulty making reasonable estimates (Butterworth 2012; S. Dye, personal communication, December 10, 2024; Hornigold, 2024).
- Time blindness, including calculating the time it takes to reach a destination (Butterworth 2012; Parker, 2022; K. Morsanyi, personal communication, April 28, 2025).
- Issues with visual-spatial working memory, including route planning and following directions, (R. Jennings, personal communication, April 24, 2025; K. Morsanyi, personal communication, April 28, 2025).
- Using tally marks or finger counting to work out an amount (R. Jennings, personal communication, April 24, 2025; Parker, 2022).

- Inflexible working out strategies. They use inefficient and sometimes lengthy strategies to get to the answer, or they use a preferred strategy repeatedly even if it is not the most appropriate for the problem (R. Jennings, personal communication, April 24, 2025; SASC, 2025; Parker, 2022; Hornigold, 2024).
- Lack of generalisation. They cannot see relationships or connections between maths concepts (S. Dye, B. Clendon & J. Harden, personal communication, December 10, 2024; Hornigold, 2024), for example, in number families.
- Response times are longer with poorer accuracy (Butterworth, 2023; R. Jennings, personal communication, April 24, 2025; SASC, 2025).
- Unable to quickly subitise amounts over two (Butterworth, 2023; J. Humberstone personal communication, February 2, 2025; Hornigold, 2024).
- Numbers can be named but are meaningless; there is no connection between the word numeral or amount, e.g.: five, 5, ***** (J. Humberstone personal communication, February 2, 2025).
- Difficulty with composing and decomposing numbers (Hornigold, 2024), for example, in number bonds (S. Dye, personal communication, December 10, 2024).

According to research by Parsons and Brynner (2005, as cited in Butterworth, 2019), poor numeracy means poorer educational prospects, reduced earning power, low employment, a higher likelihood of criminal offending and poorer mental and physical health. This is backed by the Organisation for Economic Co-operation and Development (OECD) whose Survey of Adult Skills (PIAAC) released in 2024 shows that '…numeracy is often strongly associated with the probability of being employed and earning higher wages' and 'a one-standard-deviation increase in adaptive problem-solving proficiency is associated with a 7% higher hourly wage...' Although Australia did not participate in this cycle, New Zealand, with a comparable educational system, has continued

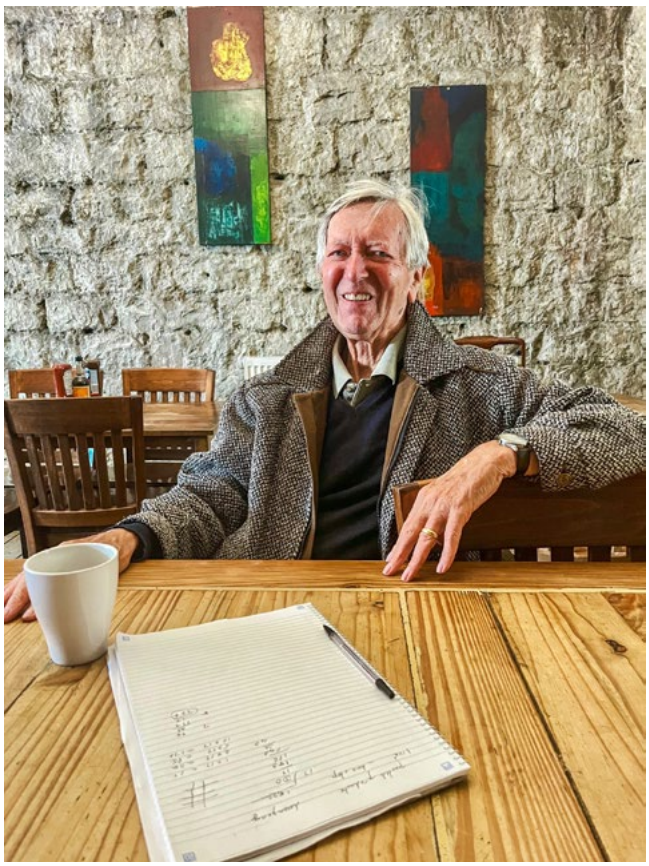

Figure 2. Dr Steve Chinn explaining composing and decomposing methods, UK.

to trend downwards in literacy and numeracy proficiency with a growing disparity between high-performing and lower performing adults. Against this backdrop, educators and learning institutions need to consider how to implement effective maths teaching and learning for all students, with attention to those facing learning barriers and significant challenges in mathematics.

Anecdotal findings recorded by the Fellow and associates support the notion that students with disability, particularly with comorbid psychological conditions, are significantly more likely to withdraw from courses in vocational education when they do not seek, find or take up offered additional supports, such as Equitable Learning Plans (ELPs) and Literacy, Language and Numeracy (LLN) tutorials. The lower pass rates are also backed by data from The National Centre for Vocational Education Research (NCVER), who in their report 'Student equity in VET 2020: participation, achievement and outcome' (2022),

found that participation rates for students with disability (171,730) were markedly lower than that of non-disabled students (3,250,770). This discrepancy was also apparent in completion rates and subsequent job opportunities, with disabled students recording a 39% completion rate and a 43% improvement in employment status (42% and 62% for non-disabled, respectively). Research from the Australian Institute of Health and Welfare (2025) as part of Australia's Disability Strategy 2021-2031, shows little movement in the participation rates for disabled students in vocational education across an eight-year period (2015-2022), with rates moving between 4.1% and 4.6%. Alarmingly, the participation rates appear to be trending downward.

The 'Parliamentary Inquiry into access to TAFE for learners with disability' (Victorian TAFE Association, 2020), discusses a willingness in the sector for improvements to access and outcomes for students with disability and stated that 'More research could be done to investigate the challenges facing teachers involved in working with learners with disability including exploring and understanding teacher practices, teacher preparation, support, and professional development in this area' (p.9) This highlights the gaps that are apparent in the VE sector in terms of inclusive education and a tendency to teach one-dimensionally.

This formal and informal data illustrates the importance of providing a welcoming and inclusive environment from the outset. This begins at a systemic level through developments in organisational policies and practice, such as utilising AI as an accessibility tool and finishes with the embedding of best educational practices at an operational level, whereby educators naturally enact adjustments in mathematical content, process and product to set all students up for success. These approaches should improve the participation and retention of students with Dyscalculia in vocational education.

Competence in core number sense is often a prerequisite in vocational education programs, although this may be inferred. This requirement can discourage students with Dyscalculia who might otherwise be excellent candidates for the course and its subsequent vocation. Research indicates that students can learn to manage Dyscalculia with the correct supports in place (Butterworth, 2019). However, studies show that the understanding of Dyscalculia is estimated to be 30 years behind that of Dyslexia (Ferrie, 2022). The Fellowship aims to expand the knowledge of vocational education practitioners and stakeholders regarding Dyscalculia, and to equip them with strategies, tools, and adjustments that can ensure students with this diagnosis can not only access learning but also thrive in vocational education.

Methodology

The objective of the Fellowship was to use applied research to investigate interventions that best support vocational students with Dyscalculia to succeed in vocational education. Once research commenced, it soon became clear that the interventions would also benefit students with maths difficulties and maths anxiety, and this insight was incorporated into the Fellowship findings. The Fellow attended development sessions on Dyscalculia facilitated by experts in England and Australia, including David Tout (Australian Council for Educational Research (ACER), Rob Jennings and Cat Eadle (Dyscalculia Network). The Fellow conducted a number of online interviews with experts, some as a precursor to in-person meetings. The Fellow attended in-person meetings with experts in Australia, New Zealand and England, including an immersive experience in the Secondary department of Fairley House, a school exclusively for students with specific learning difficulties (SpLD) in London.

The diagnosis of Dyscalculia, put simply, is a lifelong deficit in core number processing, and as such, interventions for individuals with the diagnosis change little depending on age. Thus, the Fellow was able to speak with experts who worked in different sectors and with different age groups and still gain valuable insights into best practice.

The Fellow looked to gain an understanding of the current quantitative testing procedures for Dyscalculia in Australia and abroad, including those

that are, or can, be applied in post-secondary education, and spoke with individuals who spearheaded Dyscalculia screening tools, including Dr Judi Humberstone, Rob Jennings, co-authoring with Jane Emerson on The Maths and Dyscalculia Assessment and Dr Kinga Morsanyi and fellow academic researchers currently developing the Numeralis screener tool.

Figure 3. Rob Jennings, co-founder/director of the Dyscalculia Network and co-creator of new screener tool, The Maths and Dyscalculia Assessment, UK

To explore the awareness, understanding, and interventions regarding Dyscalculia in vocational education and compare them with those in similar educational systems, the Fellow met with the Learning Support team at Ara Institute of Canterbury in New Zealand and Jessy Orlech from the RMIT Equitable Learning Services. At a local level, the Fellow also met with maths teachers in RMIT Education and Language programs to hear their perspectives.

Biography

The Fellow is a registered teacher with over two decades of experience educating students from Year 1 to adulthood, primarily in specialist education across New Zealand, England, Japan, and Australia. The majority of the Fellow's career has been working in primary and primary/secondary specialist settings teaching students with additional needs to develop their academic and pro-social skills. Students attending the schools included individuals with diagnoses such as Attention Deficit Hyperactivity Disorder (ADHD), Autism Spectrum Disorder (ASD), Oppositional Defiant Disorder (ODD), specific learning difficulties (SpLD), physical and sensory impairments, complex health needs, cognitive impairments, social, emotional and behavioural challenges, and anxiety-related conditions. Most students had comorbid diagnoses, and some were also facing additional challenges, such as family breakdowns, trauma, frequent ill health and a history of school failure or school refusal. Some students had jagged profiles, whereby they were proficient in some areas of the curriculum but had significant deficits in others. Several of these students were 'twice-exceptional' or 2e, meaning both gifted and disabled. Due to the complexity of the cohort, the Fellow applied evidence-based practices with a holistic approach centred around building relationships and trust. The Fellow enhanced her understanding by completing a Master of Education (Special Educational Needs) with Deakin University in 2015 and was awarded the Deakin University Award for The Victorian Teachers Mutual Bank Scholarship for being the highest achieving student who also gained outstanding results in teacher practice based on their Master of Education (Special Educational Needs).

In 2020, the Fellow looked to vocational education, with the goal of using her expertise to train Education Support Workers (ESWs) and pre-teachers how best to support primary and secondary students with additional needs. During the Fellow's almost five years in the sector, it has become apparent that many of the complexities she encountered in the school sector continue into adulthood. The Fellow has noted she is applying many of the same techniques to support vocational students in accessing learning and completing assessments. Following her own diagnosis of Dyscalculia and recognising the sector's lack of awareness about the condition and higher attrition rates among vocational students with complex profiles, the Fellow pursued a Fellowship to research best practices for supporting dyscalculics and students with maths difficulties and anxiety. The Fellow's goal being to enact local and systemic changes in teaching and learning approaches for dyscalculic students in vocational education.

04

Abbreviations / Acronyms / Definitions:

ACSF
Australian Core Skills Framework

ADHD
Attention Deficit Hyperactivity Disorder

ASD
Autism Spectrum Disorder

BKSB
Basic Key Skills Builder

Cognitive overload
Becoming overwhelmed when the brain's ability to process information cannot keep up with the volume of information it is receiving

Comorbid diagnoses/comorbidity
Two or more diagnoses

CoVE
College of Vocational Education (RMIT)

Differentiation
Teaching one concept with tasks adjusted to suit the needs of different learner groups

Dyscalculia
Specific Learning Difference/Disability in core number sense

Education Support Workers
Classroom support staff

ELP
Equitable Learning Plan

ELS
Equitable Learning Services

Experiential learning
Active, hands-on learning through doing

Growth mindset
Belief that abilities can be developed by persisting through challenges

GRR
Gradual Release of Responsibility

Jagged profile
Variation in a learner's abilities, showing strong skills in some areas and challenges in others

Kaimahi
(noun) worker, employee, clerk, staff

Maths families
Related mathematical facts that use the same numbers and show how operations are connected

Neurodiverse
Individuals whose cognitive functioning operates differently to what is considered 'typical'

Number bonds
Pairs or groups of numbers that combine to make a specific total

ODD

Oppositional Defiance Disorder

Pro-social skills

Behaviours and actions that benefit others, e.g.: sharing, helping, being empathetic

PTR

Pre-Training Review

Scaffolding

Teaching explicitly and fading out support as learners develop independence

SME

Subject Matter Expert

SpLD

Specific Learning Differences/Disabilities

Subitising

Recognising an amount of something without counting individually

Twice-exceptional

An individual who is both gifted and disabled

Universal Design (UDL)

Using multiple means of engagement, multiple means of representation, and multiple means of action and expression to facilitate universal access to learning

05

Fellowship Learnings and Findings:

Diagnostic testing

BKSB

The Basic Key Skills Builder (BKSB) assessment is an online diagnostic tool currently used by vocational education providers across Australia. It measures the literacy, language and numeracy skills of incoming students mapped against the Australian Core Skills Framework (ACSF). The BKSB provides information to program staff on students' strengths and needs, with recommendations for supports. Program managers can access the Pre-Training Review (PTR) and change the suitability rating following discussion with the student and analysis of their learning profile (for example, if the skill isn't required in their course, if they did not complete the test, if their score is higher than expected or balanced out by other skills). The BKSB also provides follow-up resources for staff and students, including interactive practice sessions and curriculum-based content with formative testing to address identified gaps. Prior to digitisation, the test was administered in person.

During discussions with the Fellow, experts in Dyscalculia underscored the critical need for clear, research-backed screener tools capable of accurately identifying learner profiles and informing appropriate educational interventions. Reflecting this recognised gap, several experts had already developed or were actively engaged in publishing mathematics screening tools at the time of writing. When considering the role of the BSKB in assessing VE students' literacy, language and maths skills, consideration should be made as to how it can be best utilised as a planning and teaching tool.

Strengths:

- The BKSB gives program staff an idea of individual learning profiles and overarching needs of the incoming cohort and offers a starting point on how to deliver learning content. It also provides individualised follow-up content.

Weaknesses:

- Educators have expressed concerns that the data might be flawed due to the testing environment. There is nothing preventing students with apprehensions about taking the test having someone else take it on their behalf. As a result, educators may not fully trust the results or utilise the follow-up resources, since the test may not accurately reflect the students' learning profiles.
- Students with Dyscalculia, maths difficulties and/or maths anxiety may have an adverse reaction to taking the test, influencing the results. It may not pick up the complexities of their learner profile.

Opportunity:

- Adjusting the administration of the BKSB to ensure the student is the one completing the test.
- Professional development on the BKSB for teachers, including demonstrating how to use the follow-up resources.
- Utilising Dyscalculia-specific testing as an option, either in addition to the BKSB or used by teachers in-class as a diagnostic tool. The Fellow was introduced to several evidence-based screeners in development in the UK, that test for strengths and deficits in number and other characteristics typical of an individual with maths difficulties. Once complete, the screener proposes recommendations for intervention. This data assists educators in program development and individualised approaches in maths.

Threats:

- Most students complete the BKSB at home, thus the capability to monitor the BKSB testing may be a barrier.

Barrier mitigation:

- Trial adjustments are made to BKSB administration at a local level to gauge its feasibility and scalability. A small group take the BKSB in scheduled online sessions where a teacher is present or available in a breakout room, allowing students to ask questions while working independently.
- Supplementary testing is trialled to validate students' BKSB results, administered by teachers during the initial weeks of the course. This may include an evidence-based screener tool for adult learners, such as Numeralis, and/or informal measures like work sample analysis.

Reasonable Adjustments

Under Victorian Law, disability is defined as:

- the total or partial loss of a body part or a body function (such as mobility, sight or hearing)
- disfigurement
- mental health disorders
- learning difficulties.

(Victorian Equal Opportunity and Human Rights Commission, 2025, What is disability discrimination section, para.1)

According to the Disability Standards for Education 2005 (Cth) and the Victorian Equal Opportunity Act 2010, learning institutions, including TAFEs, must put reasonable adjustments in place for students with a disability. Reasonable adjustments ensure learners with additional needs have equal access to learning on the same basis as their peers. Institutions also have a positive duty to provide a safe learning environment, by 'creating an environment where unfair treatment and problem behaviour is unlikely to happen in the first place' (Victorian Equal Opportunities and Human Rights Commission, 2025, The positive duty section, para.1). Education institutions may only refuse a reasonable accommodation if it will cause 'unjustifiable hardship' to the institution to implement, for example, a financial burden that will impact on the quality of existing services.

Best practice suggests that students with Dyscalculia, maths difficulties and/or maths anxiety benefit from accommodations and modifications to learning, and in fact, reasonable adjustments are advantageous for the entire student cohort typically made up of significantly diverse learning profiles. This is in keeping with the concept of Universal Design; what benefits one, benefits many.

Executive Functioning and Working Memory

While still the focus of ongoing research, executive functioning is widely believed to reside in the prefrontal cortex and 'manage' the brain's capacity to organise complex thoughts, feelings and actions, such as regulating emotions, planning and problem-solving and flexible thinking.

Working memory, one part of executive functioning, is the brain's ability to 'hold information in mind and work with it when performing complex tasks' (Dawson and Guare, 2018 as cited in Faith et al, 2022). Problems with working memory have obvious repercussions for individuals using maths. They may struggle to retain numbers or formulae long enough to solve multi-part problems. This can lead to cognitive overload, causing anxiety and resulting in the loss of vital information. Working memory deficits have a pervasive impact on the individual's everyday life such as remembering appointments, meeting deadlines, following directions and managing finances.

Issues with executive functioning and working memory are common in dyscalculics, and the broader neurodiverse community. It is widely believed that executive functioning and working memory can be improved over time with the correct interventions in place. Educators and VE institutions must include executive functioning and working memory supports in their reasonable adjustments.

Through her own understanding, and discourse with maths experts, the following adjustments can be made to mathematical tasks by teachers and/or VE institutions:

Content

- Teachers teach maths vocabulary (e.g., x, multiply, times, 'lots of') and demonstrate links between words, digits, and symbols. Dyscalculics need support to make the connections between concrete, pictorial and abstract representations of number.
- Learning starts at students' entry skills, building from prior knowledge and using it as a bridge between old and new concepts. Students will start to develop understanding by recognising patterns and connections.

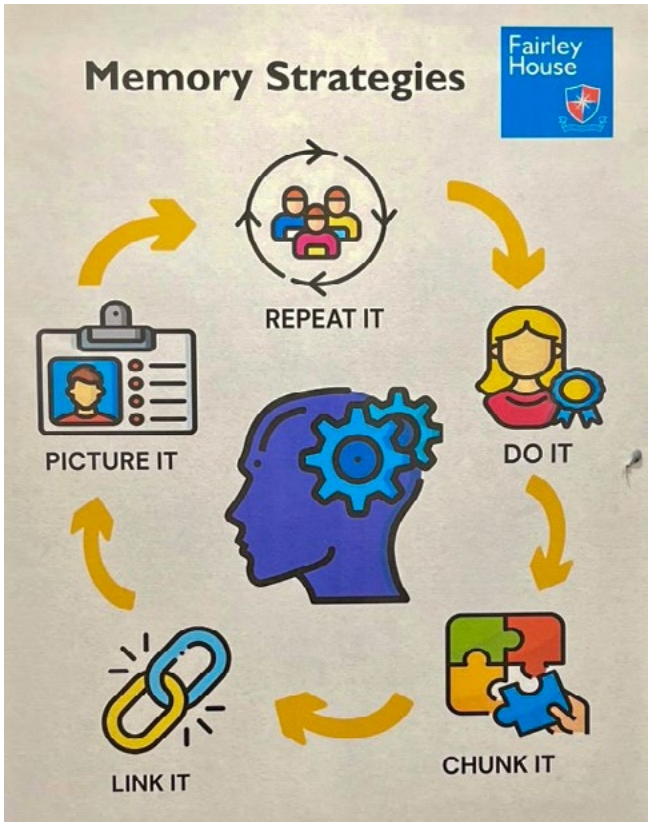

Figure 4. Posters around the school listing learning strategies, Fairley House School, UK

- Information is streamlined to reduce visual clutter. Pertinent information is highlighted and only meaningful visual cues added as hints or reinforcement. This helps students to organise and prioritise their thoughts, which aids executive functioning.

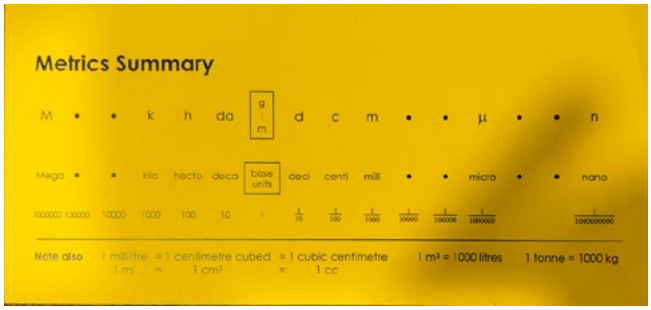

Figure 5. Visual prompt for metric measurements, created by Shane Dye, Maths Learning Advisor, Ara Institute of Canterbury, NZ.

- Teachers teach students an alternative method to solve a problem that better serves their learning preferences and gives them options or workarounds.

Figure 6. Review prompts for Maths GCSE, created by Bianca Payne, Fairley House School, UK.

- Students are asked to estimate results to evaluate the plausibility of their answers and assist in the development of critical thinking.
- Novelty, including using rhymes and mnemonics, is used to help students remember formulae. This is on the proviso that students understand how to apply the formula once recalled. These techniques help alleviate the mental load of remembering multiple formulae.
- Content is taught using an adaptation of Jerome Bruner's work, the concrete – pictorial – abstract method (Leong et al, 2015) whereby students experience a concept tangibly, then visually before moving to its abstract representation. Dyscalculics use manipulatives for as long as necessary.
- Manipulatives have visual cues, such as colour coding or size/shape variation to illustrate relationships and meaning and increase understanding.

Figure 7. Rebecca Dowling and Samantha Robinson explaining the Maths system, Numicon, at Seabrook McKenzie Centre, NZ (photo courtesy of Hester Warren).

Process

- Teachers start sessions outlining the purpose and plan of the learning. Students work with more focus and investment when they understand the benefits of the knowledge and see a clear way forward.
- Sessions have a structure that includes time to think, plan, check and reflect on working out, with the opportunity to repeat and practise concepts. Dyscalculics require more repetitions to understand and retain mathematical principles, and it gives them the opportunity to improve critical thinking skills.
- Explicit teaching is embedded into each session, using the Gradual Release of Responsibility (GRR) model first developed by Pearson & Gallagher in 1983 (Salehomoum et al). Mathematical theory is initially modelled by the teacher ('I do'), with guided ('we do'), then independent practice ('you do'). Dyscalculics receive the scaffolding they need and have multiple exposures to concepts.
- Students are actively encouraged to take notes and draw pictures/diagrams, including to support worded problems. This assists with understanding abstract notions and supports working memory challenges.
- Regular and prompt specific feedback is given throughout the maths session, addressing mistakes to ensure dyscalculics do not continue using incorrect strategies.

Product

- Multiple-choice testing is removed as it does not accurately reflect the skills of students with dyscalculia, who often rely on guesswork.
- Competition and formalised testing compounds maths anxiety, and subsequently cognitive overload. Time is crucial for dyscalculics and individuals with maths difficulties, who may reach the correct answer but require longer to do so. Therefore, extended time for completion is allocated.
- Students have options during written practice tasks, as a form of differentiation and

confidence building. Equations will be given a colour depending on their complexity (basic to extension). Success improves growth mindset in dyscalculics.

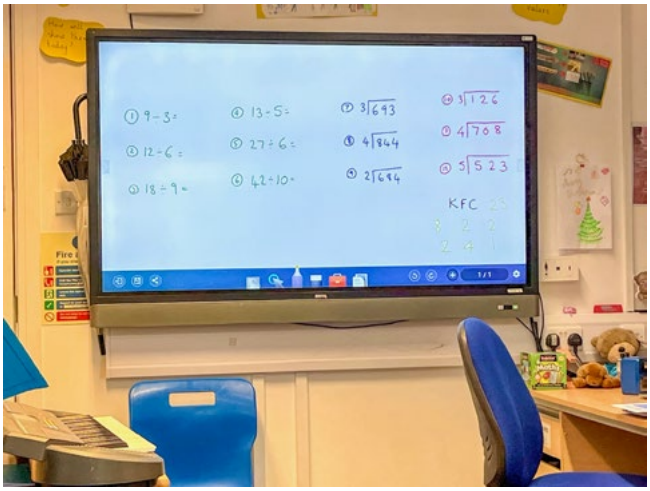

Figure 8. Differentiated maths equations at Fairey School House, UK (Dawn Kerley).

- Exit slips are used as informal assessments at the end of each session to aid student reflection and help both students and teachers determine if additional support is needed. If a pattern emerges, teachers can identify whether the entire student cohort needs to revisit a concept.
- Following a session, the content is available for students online, including worked examples, to support review and cover absences. Repetition is key to understanding and retaining learning concepts.

Environment

- The learning environment is conducive to mathematics. There is easy access to tangibles and technologies to support student learning. Visuals that act as prompts can help with cognitive overload caused by working memory issues.
- Teachers contextualise learning tasks and include relevant 'storytelling' as much as possible. This helps with engagement and novelty; both of which aid concept understanding and retention.
- Tangibles, manipulatives and equipment are integral to learning. Dyscalculics, and other neurodiverse individuals, have difficulty understanding and holding on to abstract concepts, and concrete items allows them to learn experientially.

Figure 9. Students at Fairley House School, UK completing a hands-on activity exploring shape concepts (Andrew Kennedy).

- Validated AI tools to help with calculations are allowed. This comes with the caveat that students are taught to think critically, so they can interpret the data and problem solve when there are issues with output. Students must also be given guidance on using accessibility tools for everyday maths tasks, including how to utilise their mobile phones for executive functioning assistance.
- Discussion and small-group problem solving is embedded in each session to ensure students are exposed to different methods of working out and have the opportunity to reinforce and practise concepts. Collaboration should come with clear scaffolds and parameters.

- Teachers use guiding questions to support learning progression and encourage deep thinking. Effective questioning also allows for tiered support, i.e.: the complexity of the question relates to the skills of the student. Teaching questioning techniques aids students in obtaining more information during collaborative activities and when seeking assistance from teachers.

Strengths:

- Reasonable adjustments benefit dyscalculics, students with maths difficulties and maths anxiety, as well as other neurodiverse individuals in the student cohort. This is in keeping with the principles of Universal Design for Learning (UDL): all students benefit when barriers to learning are addressed.
- Many of the listed reasonable adjustments can be implemented with minimal change to existing learning and teaching structures and without major additional cost to the VE institution.

Weaknesses:

- Teachers may need to attend training to feel comfortable implementing changes to practice.
- Additional funds and research will be required to implement some of the adjustments, e.g.: suitable AI supports and maths equipment.

Opportunities:

- Additional training on reasonable adjustments is made available to teachers via an online learning portal or in-person during regular professional development organised by the VE institution.
- Differentiation and Universal Design are embedded in teaching and learning practices to benefit all learners.
- Teachers given the tools to teach maths effectively, including tangibles, manipulatives and equipment and maths-friendly classroom spaces (e.g.: access to whiteboards, maths tools and software provided).

Threats:

- Available funds for training and resourcing may be limited.
- Space and funds may not be available to convert spaces and provide concrete and technological supports.

Barrier mitigation:

- Prioritise funding and resources for the most urgent needs first and implement a staged approach to resourcing over time to reduce pressure and ensure sustainability.
- Liaise with contacts and colleagues to share and pool resources, including leveraging existing technology.
- Incorporate free and low-cost options where possible, including reputable applications.
- Begin with small enhancements to learning spaces, such as portable document cameras, mini whiteboards, and table groupings. Where possible, allocate maths units to classrooms that are more conducive to effective maths teaching and learning.

Supports

Training & Outreach

The Fellow had the opportunity to learn more about maths-specific support and outreach through visits to Ara Institute of Canterbury (commonly referred to as Ara, NZ) and Fairley House School (UK). Ara's academic support team works through a tiered system, developed due to increased demand for service resources.

The Cornerstone Model (2017) '…enables more effective use of available resources to help achieve organisational performance goals. This is accomplished by directing more specialist 1-to-1 support towards the learners with the highest needs while improving support access for all learners through self-help resources and targeted teaching, group workshops and drop-in sessions' (S. Dye, personal communication, December 10, 2024). Following this model, Ara's Maths advisors

provide strategically targeted support across campuses to enhance both student learning and tutor development in mathematics within trade contexts. Their services include facilitating drop-in sessions and mathematics instruction in trade courses, enabling learners to engage with essential concepts using multiple methods and modes of learning.

This targeted approach particularly benefits complex students and supports comprehension of complicated topics. For tutors, maths advisors co-teach, mentor, and provide in-class and out-of-class assistance that strengthens tutor confidence and capacity. They also offer individual support for tutors developing their own maths skills, while undertaking the New Zealand Certificate in Adult Literacy and Numeracy Education. Through this holistic model, maths advisors promote sustained growth and capability in mathematics teaching and learning across the vocational education environment.

The Fellow observed a multi-disciplinary approach grounded in holistic support for students at Fairley House School. The curriculum is tailored through reasonable adjustments that reflect individual strengths and needs. Multi-sensory learning is actively employed, and essential life skills such as cultivating effective learning habits and self-regulation techniques are seamlessly integrated to benefit all learners. Collaboration between teaching staff and allied health specialists is a central feature of this approach. It includes joint planning and the co-delivery of lessons or specific lesson components by specialists to address areas of need. As with Ara, Fairley House teachers and specialists engage in outreach to disseminate evidence-based practices. This includes facilitating training, offering ongoing support to schools and educators and welcoming visitors onto campus to observe their methodology.

Using the idea of outreach to upskill teachers across the VE sector, subject matter experts (SMEs) in mathematics are given the opportunity to share best practice by co-training teachers who teach maths content, (e.g.: trades, foundation courses, pathway programs) with accessibility

Figure 10. On campus at Fairley House School, UK with the Director of CPD and Outreach, Hayley O'Brien.

services or work as a co-teacher in vocational classrooms when requested by the teacher. This approach widens the scope of influence and facilitates cross-program collaboration.

Figure 11. The Maths support space at Ara Institute of Canterbury, NZ. Pictured: Shane Dye, Maths Learning Advisor.

Training in numeracy methods and executive functioning supports can be used to develop teacher confidence and capacity. Cascade training, whereby one or two members of staff attend and return and teach the reminder what they have learned in the training, would have the benefit of expanding reach and being a time-saving and cost-effective method of sharing best practice. Training students directly on helpful supports can also be considered, primarily in the early weeks of course delivery.

Strengths:

- Training could be completed in-house at VE institutions ensuring consistency of approach and saving time and cost.
- Training, particularly cascade training, allows a wider scope of influence.
- Teachers are given alternative methods or adjustments that benefit dyscalculics, students with maths difficulties and maths anxiety and the wider student cohort.

Weaknesses:

- SMEs may find it difficult to facilitate training with existing commitments.
- Teachers across programs may be unable to take up training or outreach opportunities.

Opportunities:

- A pilot program set up to facilitate and organise maths and executive functioning training and offer advice on adjustments and resources to students early in enrolment whilst waiting for their accessibility appointment. This gives the teachers opportunity for targeted professional development and the students an additional ‘safety net’ during initial course delivery when neurodiverse students are most likely to struggle with adapting to a new, more independent, environment.

Threats:

- Ensuring adequate staff availability for pilot coordination and subject-matter expertise.
- Cost and time constraints may impact capacity for pilot coordination and input from SMEs.

Barrier mitigation:

- Allocate dedicated time within existing workloads for pilot coordination and SME input.
- Integrate pilot tasks into class sessions where possible, e.g.: subject matter experts administer the evidence-based screener tool to the pilot group.
- Schedule training opportunities facilitated by the pilot coordinator and SMEs during lower-demand periods, and record sessions where possible to support teachers unable to attend in person.

06

Considerations and Next Steps:

The learnings and findings from the Fellowship led to a focus on three areas for development and refinement:

BKSB and quality screener tools and resources

The administration of the BKSB is evaluated and refined by VE organisations to ensure the testing environment is controlled, thus findings are robust. Training should be available for teachers, possibly facilitated by accessibility services, on how to best utilise the data gathered by the BKSB and incorporate follow-up resources into planning and teaching.

Evidence-based screener tools are available to teachers of diagnosed or suspected dyscalculics to identify individual's areas of strength and need in mathematics and provide tailored interventions to enhance findings from the BKSB.

Future aspirations: The Fellow will meet with College of Vocational Education (CoVE) leadership at RMIT in 12+ months to review the current use of the BKSB and other diagnostic screening tools. She will also liaise with accessibility services and Language, Literacy and Numeracy (LLN) experts to explore ways to optimise these tools for both teachers and students, predominately in the administration and follow up . Additionally, the Fellow intends to explore the possibility of liaising with Dr Kinga Morsanyi and the Numeralis team to trial the screener tool with Australian Vocational Education students with diagnosed or suspected Dyscalculia. Its value as a complementary tool to the BKSB will be evaluated through feedback from both students and teachers, and any data or relevant insights into the cohort's experience will be shared with the Numeralis team.

Reasonable adjustments and targeted supports

Training is made available to VE teachers online and in-person on how to apply reasonable adjustments using a differentiated and universal approach, predominately in maths classes, however with some application to other contexts. Training also includes methods to support students to manage challenges with executive function and working memory.

Organisations complete an audit on existing maths resources and spaces and teachers are given access to tools and equipment that facilitate understanding of maths concepts, including manipulatives and tangibles, proven software and AI tools that support learning and reduce cognitive load. Classrooms are equipped for effective maths instruction, with access to teacher demonstration and student working out spaces.

Future aspirations: The Fellow will look to engage with the CoVE leadership and the Learning Experience team at RMIT to develop online training

for reasonable adjustments in maths, as well as additional information on supports for students with challenges in executive functioning and working memory. Within six months, the Fellow will collaborate with the Learning Experience team to develop online resources for students on executive functioning and maths strategies. These resources will be completed and fully embedded within Education and Language program shells within 12 months. Development of online training for teachers will be explored in collaboration with mathematics SMEs over the next 12+ months, with the aim of integrating this training into online learning resources for the cluster. Engagement with online resources will be measured through Canvas analytics and feedback from students and teachers on their usefulness.

The Fellow will liaise with maths SMEs to audit maths resources and spaces with the goal of setting up a 'maths-friendly' environment for learning. The Fellow will advocate for funding and support in meeting any shortfalls in provision. Once funding has been allocated, resource acquisition will be completed within six months of the maths audit. Success will be evaluated through teacher feedback on whether the audit effectively addressed provision gaps and strengthened students' conceptual understanding, as evidenced by assessment outcomes. The outcomes would be shared with the wider sector.

Training and outreach

A pilot project is set up whereby a coordinator with familiarity of program coursework connects with SMEs and colleagues to facilitate opportunities for training and outreach in mathematics. The coordinator provides targeted support to students during the early stages of course delivery helping to identify and assist those at risk of discontinuing their studies. The support offered will include guidance on mathematical techniques and tools, executive functioning strategies, and broader learning supports, including directing students to resources already available to them through RMIT.

Future aspirations: The Fellow will continue driving the implementation of the pilot program through ongoing discussions with cluster leadership, with the aim of launching the program within 6-12 months. The pilot will commence with a small group of student volunteers who are diagnosed with, or suspected of having, Dyscalculia, at the beginning of their first semester. Student attrition data, along with feedback from both students and teachers, will be used to evaluate the effectiveness of the pilot. Findings and outcomes from the project will be shared with the broader RMIT community and the VE sector.

The Fellow will lead sector-wide training initiatives in Dyscalculia support, collaborating with mathematics SMEs and facilitating cascade training to amplify impact across the broader education community. This will establish a sustainable, scalable model of professional learning that strengthens educator practice and improves outcomes for learners with Dyscalculia, maths difficulties and maths anxiety.

The aforementioned areas are seen as the most impactful at the local and systemic level. Tailored supports encourage dyscalculic learners to remain engaged in programs, teachers feel equipped to teach maths effectively, and the wider sector gains insight into the strengths and needs of dyscalculic learners. These insights inform policy and practice adjustments that set students up for success.

Figure 12. Maths Room, Ara Institute of Canterbury.

Figure 13. Ara Institute of Canterbury.

07
Impacts of Fellowship:

Personally

The Fellowship has had a positive impact on the Fellow in that it was an opportunity to think introspectively about her journey to diagnosis and the impact of the maths learning and teaching techniques she experienced on her personal and educational development. It has reinforced the importance of sharing inclusive practices with colleagues and empowering students to take control of their learning through adaptive techniques. The Fellow is looking to widen her impact on the sector by being proactive about disseminating what she knows and has learned to improve outcomes for fellow dyscalculics and individuals in the neurodiverse community.

Professionally

The Fellowship has given the Fellow a platform from which to advocate for best practice for dyscalculics and other neurodiverse learners in vocational education. By building networks here and abroad with experts in the field of Dyscalculia, the Fellow has been exposed to current and dynamic research, some of which is still evolving or in pre-publication phase. She has implemented the research in her own teaching and support practices and shared more broadly with colleagues. The Fellow had the opportunity to speak with counterparts locally and globally which has been invaluable in developing an action plan organisationally and within sector, based on strengths and needs identified through benchmarking.

Figure 14. Meeting the team behind Numeralis at Loughborough University, UK. Pictured from left, Dr Kinga Morsanyi, Jessica Maisley and George Thoma.

Organisationally

The Fellowship has enabled the Fellow to engage with experts across the broader RMIT community, resulting in the commencement of work on three key areas of development and refinement. This includes a comprehensive maths audit, which has already led to the purchase of additional resources to support SMEs in the Education and Language programs, and collaboration with the Learning Experience team to create online resources focused on executive functioning and maths strategies. At the time of writing, video drafts have been finalised, and the Learning Experience team is developing graphics for the first video in the series, 'Planning (Executive Functioning, Part 1)'. Additionally, the Fellow has delivered professional development sessions for the Education and Language programs and the College of Vocational Education at RMIT, receiving positive feedback. The Fellow has also initiated engagement with colleagues in student support to progress the development of BKSB and screener tool resources for teachers in 2026. These initiatives mark the beginning of a broader program of work, with further resources, pilots, and sector-wide collaboration planned for 2026 and beyond.

VE Sector:

While the Fellow has had opportunities to share findings at a sector level, the real driver for systemic change will come through sharing the results of practical initiatives such as the maths audit and the development of executive functioning resources. By recording, analysing, and widely disseminating these initiatives, vocational education institutions can identify benefits and barriers and understand how challenges were, and can be, addressed within their own contexts. This evidence-based approach will inform future pilots and resource development, supporting broader adoption across the sector in 2026 and beyond, with the ultimate goal of embedding sustainable, inclusive practices into vocational education systems.

08

Sector Engagement (Dissemination)

The Fellow has engaged and will continue to engage with industry professionals through workshops, seminars, and sector events focused on Dyscalculia, reasonable adjustments, and strategies to support maths learning and executive functioning. Key activities include:

- National Education Summit, Diverse Learners Symposium – May 2026, Brisbane: From Diagnosis to Discovery: A Teacher's Journey into Dyscalculia
- Teacher Learning Network (TLN) – March 2026 (online): Strategies to Build Positive Classroom Behaviours; October 2026 (online): Dyscalculia, its Impact and Effective Classroom Supports
- RMIT Education and Language PD – December 2025: Working with Directed Numbers (co-presented with Armen Dickranian, Maths SME)
- RMIT Learning and Teaching Showcase – November 2025: Supporting Dyscalculics in Vocational Education (also available as a recording)
- Illuminate Forum, VET Development Centre (VDC) – November 2025 (online): Solving for Inclusion: UDL in the Maths Classroom
- National Education Summit blog – February 2026: From Diagnosis to Discovery: A Teacher's Journey into Dyscalculia

The Fellow will continue to disseminate findings effectively by engaging stakeholders through multiple platforms at both local and sector levels. By improving awareness of the diagnosis and its impact on the uptake and completion rates of vocational education students, and most importantly, on their long-term life outcomes, this should lead to broader application of evidence-based strategies, tools and techniques in programs with a maths component. Furthermore, by collaborating with colleagues, leadership, and the wider sector to highlight the importance of diagnostic testing and maths screener tools, the Fellow seeks to influence how these tools are applied and utilised in effective planning and assessment. This approach aims to create real change by improving outcomes for learners and encouraging informed practices across the sector.

Figure 15. Presenting at the 2025 Learning and Teaching Showcase, RMIT.

09 Conclusion:

While awareness and understanding of Dyscalculia continue to lag behind other additional needs, dynamic research is emerging globally that equips educational institutions with diagnostic tools and evidence-based techniques for intervention. These can be applied as reasonable adjustments that not only support students with Dyscalculia but also benefit all learners requiring extra support in mathematics.

The 2023 Survey of Adult Skills (PIAAC Cycle 2), alongside research from experts such as Brian Butterworth, highlights the profound influence numeracy has on education, employment and life outcomes. Strong numeracy skills also contribute significantly to national economic strength. Despite the VE sector's growing commitment to neurodiversity, Dyscalculia remains one of the least understood and acknowledged learning differences. The research is here, and many of the tools are already available or in development. What is needed now is widespread recognition and evidence-based action to ensure dyscalculic learners thrive in vocational education and are empowered to reach their full potential.

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11 Appendices

Cornerstone Model handout

ARA Institute of Canterbury, NZ

(S. Dye, personal communication, December 10, 2024)

The Cornerstone Model

Academic Support (AS) implemented 'The Cornerstone Model' in 2017 to guide strategy and decision-making around meeting the academic, disability and library support needs of learners. Academic Support provides a range of services to a significant number of learners, over an increasing number of campuses and learning environments. The Cornerstone Model enables more effective use of available resources to help achieve organisational performance goals. This is accomplished by directing more specialist 1-to-1 support towards the learners with the highest needs while improving support access for all learners through self-help resources and targeted teaching, group workshops and drop-in sessions.

The Cornerstone Model has four levels, indexed from zero to three based on the type of learning experience, from self-guided to fully supported.

Level Zero

Self-directed support, where a student does not require kaimahi to interact with to access support. Level Zero Resources include:

- MyAra
  - StudySmart includes Guided Learning Pathways for essential skills, as well as other resources that address many of learners' support questions.
  - StudyFit is a five-minute self-assessment tool that helps learners determine their readiness and preparedness for study and provides learners with tailored support suggestions.
  - Library Resources
    - Subject Guides

Level **One**

The first level of support engagement with kaimahi. Learners are supported in locating and using Level Zero resources and facilitated access to Level Two and Three supports where needed. Generally, this support comes from the Library Service desks and through contact from triage specialists following up on learners referred for support by tutors.

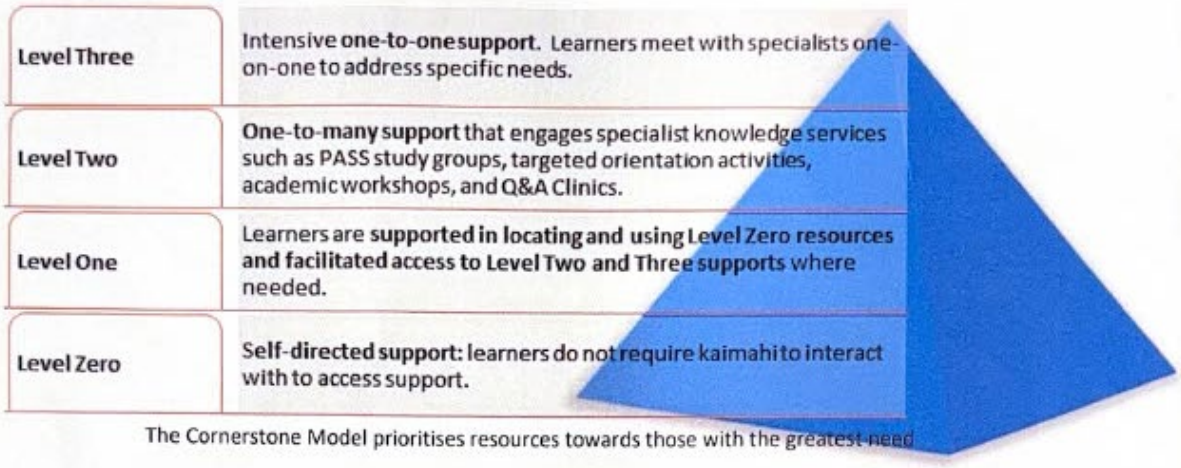
Level **Two**

One-to-many support that engages specialist knowledge services such as PASS study groups, targeted orientation activities, academic skills class teaching and workshops, Q&A Clinics and similar activities where groups of learners engage in support simultaneously.

Level **Three**

Intensive **one-to-one support**. Learners meet with specialists one-on-one to address specific needs. These include 1-to-1 appointments with Learning Advisors, Disability Advisors and Library Knowledge Advisors.

Ara is a Business Division of Te Pūkenga – New Zealand Institute of Skills and Technology



The Cornerstone Model prioritises resources towards those with the greatest need

FAQ

How do I know where to send learners who need additional support?

The online Referral Form provides a single access point to all Ākonga Success services. When following up with referred learners, frontline advisors attempt to gather a holistic understanding of their support needs and connect them with appropriate support channels. Kaimahi intending to refer learners to Academic Support can also make them aware of the Quick Question drop-in sessions, which any learner wanting Learning Services support can attend.

How can learners get support from a learning advisor?

Learners can show up at any of the Quick Question drop-in sessions run by Learning Services in the Library, where advisors can assess the need for ongoing, more intensive support. Learners with high needs, who may be at risk of failing an assessment, should be referred to Learning Services via the online Referral Form.

How come learners can't always get an appointment when they want one?

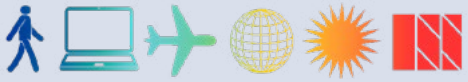
During peak periods of demand on support services, there may be delays for specialist appointments - which we aim to mitigate by putting in place Quick Question drop-in sessions and workshops that learners can access by just showing up.

How come it seems like some learners can get support and others can't?

All learners have access to Academic Support, and to other Ākonga Success supports. The Cornerstone Model does not apply to any particular learner. Rather, as a strategy, the model supports decision-making about how to best use our resources to get the best outcomes for learners.

How do I know what support a learner in my course is getting?

Tutors can view a current-year timeline of support in OnTrack Engagement Alerts dashboards.
OnTrack Learner Engagement (PDF), OnTrack Learner Engagement Video



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