Department for Education

Identifying and supporting children and young people with cognition and learning needs: a rapid evidence review

Research report

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Contents

List of tables

Executive summary

Background

According to the SEND Code of Practice (DfE, 2015), cognition and learning difficulties encompass a wide range of needs, including general and specific learning difficulties. These difficulties affect various areas of learning including literacy, numeracy, and the acquisition of subject-specific knowledge and skills and may be linked to underlying challenges in areas such as memory, reasoning, and processing speed.

This rapid evidence assessment (REA) reviews how mainstream education professionals can identify and support cognition and learning difficulties in children and young people, with a focus on both literacy and mathematics.

Approach

The evidence was collected by means of a rapid evidence assessment. A search of the literature aimed to retrieve key findings for children and young people with cognition and learning needs aged 0 to 25. The literature search focused on systematic reviews and meta-analyses evaluating effective tools and strategies for the identification and support for educational outcomes for children and young people with cognition and learning needs in mainstream classrooms, as well as reviews evaluating collaborative practices between families, schools, and healthcare providers or specialists.

Key findings

Identification

Findings highlight that while formal diagnosis should be undertaken by specialists, teachers are central to early recognition through structured observation, accessible screening tools, and close collaboration with Special Educational Needs Coordinators (SENCos), parents, and external professionals. The REA distinguishes between screening, assessment, and profiling, emphasising the use of multiple data sources, including classroom observations, family history, and standardised or informal assessments, to build a holistic picture of each learner's strengths and needs.

In literacy, identification in the primary years often focuses on phonological awareness, decoding, and early fluency, with whole-class screening tools such as phonics checks and curriculum-based measures providing useful first-tier information. Older pupils present more complex identification challenges, as coping strategies, vocabulary gaps, and motivational factors can mask underlying needs. For mathematics, fewer studies

address identification, but recent reviews highlight practical early numeracy screeners for younger pupils, while older students require assessments that capture both procedural fluency and conceptual understanding. In both subjects, there is limited evidence on effective identification in secondary settings compared to primary, reflecting a research bias towards early intervention.

Support

Support strategies for literacy, maths and general attainment should be systematic, targeted, and sustained. A main theme that emerged across effective strategies is the importance of reducing processing load. In literacy, early interventions addressing phonological awareness, decoding, and fluency are most effective, with older pupils benefiting from multicomponent approaches that integrate vocabulary, comprehension, and fluency work. Motivational and self-regulation strategies can enhance outcomes across age groups. In mathematics, effective approaches include explicit teacher-led instruction, peer-assisted learning, and technology-based interventions, with visual, verbal, and physical representations supporting problem-solving and reducing cognitive load. Long-term interventions generally produce greater gains than short-term programmes, and cognitive-based strategies appear particularly effective for older learners.

Across literacy and numeracy, success depends on matching support to the learner's specific profile, ensuring professional development for teachers, and strengthening collaboration between schools and specialists. Further high-quality research is needed on identification and intervention in secondary settings, scalability of effective programmes, and their application in diverse educational contexts.

Conclusions

There is strong evidence for structured, targeted interventions to support learners with cognition and learning difficulties, but their success relies on factors such as teacher expertise, access to suitable tools, interdisciplinary collaboration, and ongoing professional development. Approaches should be individualised, developmentally appropriate, and practical for mainstream settings. Further research is needed to determine how best to deliver these strategies across varied educational contexts and stages of learning.

Introduction

According to the SEND Code of Practice (DfE, 2015), cognition and learning difficulties encompass a wide range of needs, including general and specific learning difficulties. General learning difficulties (GLD) refer to challenges that affect multiple areas of learning and overall cognitive and academic development. These include moderate (MLD), severe (SLD), and profound and multiple learning difficulties (PMLD). In contrast, specific learning difficulties (SpLD) refer to difficulties in specific areas of learning despite average or above-average cognitive ability.

As of 2025, 28.0% of pupils receiving SEN support in England have either moderate (170,228 pupils) or specific (160,490 pupils) learning difficulties as their primary type of need (Department for Education, 2025). Moderate learning difficulties are the third most common type of need among pupils on SEN support (14.4%), after speech, language and communication needs (SLCN) (25.7%) and social, emotional and mental health (SEMH) needs (23.6%). Additionally, 12.1% of pupils with an Education, Health and Care (EHC) plan are identified with a primary need of moderate (34,755 pupils) or specific (19,064 pupils) learning difficulties. This represents a large proportion of children and young people with SEND in England requiring additional support for cognition and learning difficulties.

In England, for pupils with MLD and SpLD as their primary type of need, 92.9% and 97.4% respectively are in mainstream primary and secondary education settings. In comparison, fewer pupils with SLD (16.0%) and PMLD (19.6%) are educated in mainstream school settings.

General learning difficulties are typically associated with a more global cognitive delay across multiple areas of learning. Children and young people with general learning difficulties may struggle with basic literacy or numeracy skills as well as difficulties with conceptual understanding or maintaining concentration (e.g., Kelly & Norwich, 2013).

1. MLD explains significant difficulties in learning and understanding new concepts in comparison with their peers, affecting various areas of cognition, including literacy, numeracy, and general cognitive skills, such as memory and processing.
2. SLD explains significant and complex learning needs affecting various areas, including communication, understanding, and the ability to learn new skills. Substantial support is required in school and other settings to help achieve their potential.
3. PMLD is used to describe severe and complex learning difficulties as well as a physical disability or sensory impairment.

On the other hand, SpLDs refer to difficulties in more specific areas of learning. Some common SpLDs include dyslexia (reading difficulties), dyscalculia (maths difficulties), and

dyspraxia (motor coordination difficulties). Although dyspraxia is considered a SpLD, given its links with motor coordination, we have chosen to address the identification and support of dyspraxia in our Sensory and/or Physical Needs Report. Dysgraphia, or difficulties in writing, has also been proposed as an SpLD. However, the benefit of dysgraphia as an additional category has been debated, and research shows that there is an extremely high rate of co-occurrence between dyslexia and writing difficulties (Döhla, Willmes, & Heim, 2018). Therefore, this current REA will not address dysgraphia as a separate category but considers writing difficulties within the wider discussion of identification and support strategies.

Dyslexia is defined as a set of processing difficulties that affect the acquisition of reading and spelling and affects between 5-10% of the population (Carroll et al., 2025). Dyslexia has significant heritability (Snowling & Melby-Lervåg, 2016) and difficulties associated with dyslexia may persist into adulthood (Maughan et al., 2009). The most common difficulty observed in dyslexia is a difficulty in phonological processing (i.e., phonological awareness, phonological processing speed or phonological memory). Dyslexia does not have a single cause; rather, it arises from a combination of genetic, cognitive, and environmental factors, including oral language development, quality of instruction, cognitive processes, and genetic influences (Carroll et al., 2016). As a result, children and young people with dyslexia can present with widely varying profiles of strengths and needs and severity of those needs. Working memory (maintaining and manipulating information in active attention), processing speed (ability to perform cognitive tasks quickly, accurately, and fluently) and orthographic skills (ability to recognise and recall the visual patterns of written language) can contribute to the impact of dyslexia. Historically, dyslexia had been identified based on a significant gap, or discrepancy, between a child's general underlying ability (usually measured through IQ tests) and their reading achievement. However, there is no consistent evidence that children and young people with SpLD have underlying abilities below the average range (Norbury et al., 2017; Stanovich & Siegel, 1994; Tanaka et al., 2011). In other words, literacy difficulties associated with SpLD are generally not caused by low intelligence, and dyslexia can occur across a range of intellectual abilities.

Dyscalculia is defined as a persistent difficulty learning and applying mathematical facts and procedures despite otherwise typical range of general cognitive abilities and educational experiences (Landerl et al., 2004; Schwenk et al., 2017). These difficulties include quantity estimation, reduced estimation size, inaccurate mapping of different number representations, little understanding of the place-value system (e.g., 3, 13, 30, 33), problems understanding procedures and concepts, and decomposing problems into simpler ones (Cragg et al., 2017; Hawes et al., 2019). Similar to dyslexia, studies with twins indicate that there may be genetic factors accounting for dyscalculia (Kovas et al., 2007; Shalev & Von Aster, 2008). Dyscalculia is estimated to affect approximately 3–7 % of the population, with UK estimates often cited at around 6 % (British Dyslexia

Association, n.d.). Dyscalculia often co-occurs with other SpLDs, such as dyslexia, as well as Attention Deficit Hyperactivity Disorder (ADHD) (20-60%), but can also occur in isolation (Landerl & Moll, 2010; Morsanyi et al., 2018). Many researchers argue that the underlying challenge for children and young people with dyscalculia is a specific weakness in numerical processing, demonstrated by slow and error-prone responses to basic tasks such as saying which number or quantity is larger (Butterworth, 2010). Others argue that working memory deficits, particularly in visuo-spatial working memory, are core to the disorder (David, 2012) or highlight deficits in information processing speed (Willburger et al., 2008). It is likely that multiple underlying difficulties may be relevant. As with other SpLDs, there is evidence of significant co-occurrence with other SpLDs as well as ADHD and autism (Willcutt et al., 2013).

Current understanding recognises that SpLDs often co-occur with other difficulties like ADHD, autism or with difficulties such as motor coordination or oral language. It is also important to note that children and young people may have persistent literacy or mathematics difficulties who do not meet the diagnostic criteria for a GLD or SpLD. The following sections are therefore organised by area of need or difficulty rather than by discrete categories to include a broader range of children and young people with persistent difficulties in learning.

Aims

The goal of this rapid evidence assessment (REA) is to synthesise evidence-based strategies in the identification, support, and collaborative practices available to mainstream educators in supporting children and young people with cognition and learning difficulties. This goal is guided by the following research questions;

Identification:

- Which formal and informal methods and measurement tools are available to practitioners to identify children and young people with cognition and learning difficulties within diverse classroom settings?
    - For which ages or age ranges can these tools be used?
    - What are the performance parameters of these measurement tools (e.g., reliability/validity/specificity)?
- How can these tools be used to guide decisions regarding the provision of universal, targeted or specialist support?

Support:

- What are the most effective universal and targeted strategies, approaches, or adaptations for supporting children and young people with cognition and learning difficulties to improve educational outcomes?
    - What is the most appropriate level of delivery (universal or targeted or specialist) for each of these interventions?
    - What specific age groups are targeted by these interventions?
- What types of approaches/interventions do children and young people with cognition and learning difficulties respond best to?

Working with others:

- What components and characteristics foster effective collaboration between teachers, specialists, and parents/caregivers in the identification and support for children and young people with cognition and learning difficulties, and how can clear role boundaries and knowledge-sharing frameworks support this process?
- What examples are there of different models of collaboration between the multidisciplinary team?

Methods

To address these research questions, a Rapid Evidence Assessment (REA) was conducted following Cochrane rapid review guidance (Garritty et al., 2024). This REA followed the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) statement when selecting relevant articles.

We conducted a targeted search in October 2024 of two academic databases (i.e., Scopus: PsychINFO and EBSCO: ERIC) as well as grey literature using specific keywords related to the research questions (see Appendix A: Search terms). We identified systematic reviews and meta-analyses published in English between 2014 and 2024, focusing on children and young people aged 0-25 with identified cognition and learning needs in mainstream educational settings. Included studies evaluated identification, support, or collaborative practices that are feasible in UK classrooms, excluding medical, home-based, or highly resource-dependent interventions (e.g., beyond what is typically available in a mainstream classroom such as animals, robotics and virtual reality). Identification tools had to be usable by mainstream staff (not clinicians), and SEND status were independently verified through diagnosis, EHC plan, or standardised measures. Studies relying solely on teacher judgement or reporting only behavioural, emotional, physical, or motivational outcomes were excluded. Only studies reporting measurable educational attainment outcomes were included.

Titles and abstracts were initially screened for relevance by trained members of the team, followed by full-text review, resulting in the inclusion of 62 studies in the final review, with 8 studies on identification and assessment, and 54 studies on support and intervention (see Table 1). Given the central role of collaboration across both the identification and intervention processes, this strand is not presented as a standalone section. Instead, within the identification and support sections, we highlight where collaborative practices are necessary and effective. Additionally, as many studies identified for inclusion relate to collaborative practices in general SEND provision or across different areas of need, a breakdown of studies specific to cognition and learning is not included here, with collaborative practices across the categories of SEND addressed in the Cross-Cutting Themes Report.

Table 1. Number of identified studies informing each strand

Strands	Number of studies included
Identification and assessment	8
Support and intervention	54
Total	62

Data from each study were then extracted by trained members of the team. We extracted descriptive information regarding the characteristics of each study as well as information about identification tools and support strategies from the included paper(s) where available.

Our search efforts prioritised high-quality and relevant research, ensuring the inclusion of peer-reviewed studies and robust methodologies. All studies identified in the final sample are either systematic reviews or meta-analyses. To evaluate the quality of these studies, we used the Assessing the Methodology Quality of Systematic Reviews tool 2 (AMSTAR2) (Shea et al., 2017). Findings suggest that the evidence base is mixed according to this tool. Most studies were rated as high or moderate confidence in the results, with some rated as low due to a 'critical flaw' (detailed in our Technical Report). The typical critical flaw was that many studies did not conduct a formal risk of bias assessment using a recognised tool (e.g., ROBINS-I, Cochrane Risk of Bias).

For a full account of our methodology including search terms, inclusion, and exclusion criteria, PRISMA flow diagram, and extraction variables, and quality appraisal see the Technical Report.

Identification and assessment of need

The aim of this section is to review the studies identified in our search that focused on identification and assessment strategies suitable for use by mainstream education professionals in identifying the needs of children and young people with cognition and learning difficulties.

It is important to emphasise that subject and class teachers are not responsible for the formal identification or assessment of learners' needs. In line with the SEND Code of Practice (DfE, 2015), their role is to support the early recognition of students who may be experiencing difficulties, particularly those affecting educational progress. Therefore, the approaches identified in this REA are not intended to diagnose any conditions, but they can help mainstream educators in recognising children and young people's strengths and challenges to guide decisions about support or to highlight cases where referral for specialist assessment may be warranted. Where concerns are identified, these should be discussed with the school's Special Educational Needs Coordinator (SENCo) and the child's family to determine appropriate next steps, including referral and formal assessment where necessary. These processes are often involved in the graduated approach, outlined in the SEND Code of Practice (2015). The graduated approach is a four-stage process used by schools to identify and respond to SEND. It involves (1) assessing a child's needs, (2) planning appropriate support, (3) delivering that support, and (4) reviewing its effectiveness. The class or subject teacher remains responsible for implementing support, with guidance from the SENCo and, where appropriate, external specialists. It is primarily used for pupils receiving SEN support (those without an EHC plan) and aims to ensure that needs are met in a timely and responsive way.

Further, although many screening and assessment tools may be effective at identification and needs-based assessment, these tools should be interpreted with caution by mainstream educators without specialist qualifications. This is because many screening tools and assessments are founded on psychometric principles (e.g., reliability, validity, and standardisation) which determine how the results should be interpreted and used. Without specific training in these areas, it may be difficult to interpret how scores compare to typically developing populations or whether they represent meaningful results or what it means when scores fall within clinical ranges. In practice, this ambiguity places greater reliance on professional judgement, which can lead to variability in how results are interpreted, dependent on level of training and or experience with complex learning profiles or co-occurring difficulties. While educators play a vital role in completing these tools as informants, accurate interpretation should typically be assisted by an individual with specialist training. While the strategies detailed in this REA can be useful for intervention planning or flagging potential issues, they should not be used for labelling or identifying specific personality traits or diagnosis. Rather these tools should be used to identify critical areas of need that may impact a student's academic performance.

The terms ‘identification’, ‘screening’, ‘assessment’, and ‘profiling’ are often used inconsistently across research, policy, and practice and can have different meanings in relation to educational versus clinical practice. For example, the term ‘screening’ in an educational context typically refers to the process by which a tool or a strategy is used to flag potential needs in a population (e.g., whole-school or whole-class) to inform provision of timely support or targeted interventions in educational settings. In contrast, screening for clinical purposes is typically carried out by health or mental health professionals using standardised tools to determine whether a child meets criteria for a specific diagnosis, such as dyslexia or dyscalculia, with the goal of planning for further assessment or clinical treatment. However, some processes can overlap. For example, a handwriting speed assessment could be used for identification purposes to initially identify handwriting difficulties, or it could be used in formal assessment of needs (e.g., formal diagnostic assessment for dyslexia or dyscalculia) or to monitor progress of a handwriting intervention. For clarity throughout this document, we define each term within an educational context. Definitions of terms are provided in Table 2.

Table 2. Definitions of identification terms in the educational and clinical context

Term	Educational use	Clinical use
Needs-based identification	The process of recognising that a child may have additional educational needs (whether they do or do not have a diagnosis), often based on parental or child concern, observations, or professional judgement; however, this process can also include informal assessments. Informal assessments are flexible methods of gathering data to identify areas of need, guide interventions and monitor progress. These tools include checklists, questionnaires, or more structured assessments (e.g., handwriting speed, reading fluency).	Not a formal clinical term; overlaps with early signs that may prompt diagnostic referral but is not sufficient for diagnosis.

Term	Educational use	Clinical use
Screening	A brief tool or procedure used to flag or identify potential strengths and challenges across a population. In educational contexts, the goal is to flag potential needs early so that timely support or targeted interventions can be put in place within the school setting. Screeners are not diagnostic tools but designed to flag potential risk. However, given that screeners are typically quick to complete and usually measure only a specific area of concern, they should be interpreted with caution.	Tools used to determine whether further diagnostic assessment is warranted, often as a first step in a medical or psychological evaluation pathway. Typically, these tools should meet certain principles and should be administered by a trained specialist (UK Health Security Agency, 2015).
Assessment	Refers to a systematic structured process of data gathering from standardised tools to understand individual strengths and needs in order to plan intervention or monitor progress. For educational purposes, these can be informal or formal assessments. Formal assessments are structured, standardised tools used to evaluate a student's performance against national or normative standards. These include GCSEs and A-levels but also standardised assessments of literacy or other types of skills. Formal assessments sometimes require input from specialists to administer and/or interpret results. Formal assessment may result in a diagnosis or eligibility for additional provision such as exam access arrangements.	A systematic and structured process of data collection for diagnostic purposes. Assessment is conducted by specialists (e.g., educational psychologists) and involves standardised diagnostic tools to determine specific conditions or development profiles

Term	Educational use	Clinical use
Profiling	A holistic summary of a child's functioning, strengths, and areas of difficulty, often used to guide provision. Includes data from multiple informants and through multiple methods.	Less commonly used as a standalone concept; elements of profiling are embedded in comprehensive diagnostic assessments that explore functional impact across domains.

Cognition and learning difficulties affect areas of cognitive and academic development (e.g., working memory, literacy, maths, writing) which are also common areas to measure in the identification and assessment process. However, other areas such as motivation, behaviour, and social-emotional skills may also affect academic performance and therefore can be useful to measure. In a review of the literature, Carroll (2017) recommends that identification and assessment of cognition and learning difficulties should address a range of these different areas, as focusing on just one area is not sufficient in understanding a child's needs. Both strengths and challenges should be measured so that any strengths can be leveraged in targeted support. This should also be supported by information from multiple sources, including the child themselves, their families, and multiple forms of data collection such as observations and standardised assessments.

Specific learning difficulties such as dyslexia and dyscalculia can be formally assessed and diagnosed by specialist dyslexia and dyscalculia assessors, educational psychologists, or sometimes by clinical psychologists or paediatricians. General learning difficulties may also be more formally assessed by an educational psychologist, but these profiles are not often diagnosed in part due to the difficulty in defining these difficulties. However, given the significant rate of co-occurring difficulties, it may also be important to refer to a multi-disciplinary team, who could also assess for commonly co-occurring conditions such as ADHD or Developmental Language Disorder (DLD). Further, identification and assessment of SpLDs should rule out difficulties that may have resulted from visual or hearing difficulties. Therefore, regular vision and hearing tests can be important in both the diagnosis and in the identification of educational needs. Here, there are a number of specialists and healthcare professionals who may be involved in the identification and support processes for children and young people with cognition and learning difficulties. These professionals are listed in Table 3.

Table 3. Specialists and healthcare providers who may be involved in collaboration

Specialist	Role
Audiologist	Conducts hearing assessments. Diagnoses hearing loss and recommends hearing aids or other devices.
Ear, Nose and Throat (ENT) Specialist	Investigates medical causes of hearing issues May recommend surgery or further medical treatment.
Ophthalmologist	Diagnoses vision impairments and prescribes treatments or corrective lenses.
Optometrist	Performs vision tests and prescribes glasses. Identifies functional vision issues.
Orthoptist	Assesses and treats eye movement and coordination issues.
Paediatrician	Coordinates assessment of complex developmental or physical needs. Screens for conditions like cerebral palsy, muscular dystrophy, or global developmental delay.
Physiotherapist	Assesses movement, posture, and muscle function. Designs physical therapy programmes to support mobility and motor development.
Occupational Therapist (OT)	Assesses fine motor skills such as writing, daily living skills, and sensory processing. Recommends adaptations to support functional independence.
Neurologist	Assesses neurological causes of physical or sensory difficulties
Specialist teacher/ specialist assessor	A specialist teacher can formally assess and diagnose SpLDs and can plan and implement interventions.
Speech and Language Therapist (SaLT)	May be involved where speech or language production or comprehension affects areas of learning.
Clinical Psychologist / Educational Psychologist	Conducts cognitive and functional assessments and can provide diagnosis of GLDs, SpLDs or common co-occurring difficulties
Specialist Nurses (e.g., Community Children's Nurses, Epilepsy Nurse)	Provide health monitoring, care planning, and parent support for long-term conditions.

Navigating these multiple pathways of diagnosis and coordinating with multiple healthcare professionals or specialists can be challenging, especially for families and children and young people. While a formal dyslexia or dyscalculia assessment can be

useful to plan support and intervention strategies, it is important to highlight that a diagnosis is not always necessary to support children and young people with cognition and learning difficulties. Literacy, numeracy, and general learning difficulties can and should be identified and supported without formal diagnosis through needs-based identification or the graduated approach as outlined in the SEND Code of Practice (DfE, 2015). There are a number of approaches that educators can use to identify different areas of difficulty such as literacy (including reading, spelling, and writing) and numeracy. This report will discuss evidence according to these different areas of need. However, here we note a few general practices that educators should keep in mind when identifying, screening, and assessing for cognition and learning difficulties.

Firstly, teachers, early years practitioners, and SENCos should have a foundational understanding of cognition and learning difficulties. Given the limited instruction on these difficulties in initial teacher training programmes, it may be beneficial for educators to engage in ongoing professional development to strengthen their knowledge and skills in identifying and supporting children and young people with cognition and learning needs.

Second, obtaining a family history and background information is important in the identification, assessment, and profiling process. Given that a SpLD can be heritable and is impacted by environmental factors (e.g., access to high quality oral language or texts), it is useful, where possible, to obtain a detailed family history of SpLD diagnoses. There is a familial risk factor that contributes to dyslexia (Snowling et al., 2003; Van Bergen et al., 2014). Further, families with lower literacy levels or experiencing material poverty may offer fewer opportunities for reading and access to books at home, which may negatively impact the literacy skills of a child. Therefore, it can be useful to ask about the home literacy environment to gain an overall idea of a child's learning opportunities.

Oral language is also a strong predictor of literacy outcomes (Snowling & Melby-Lervag, 2016). If a child or young person has any identified speech, language, and communication difficulties, they may be more likely to have a SpLD (Botting et al., 2006; Snowling, Bishop, & Stothard, 2000). Children and young people who speak two languages or have English as an Additional Language (EAL) may also have unique profiles due to the exposure they have to two or more languages (and oral language can be impacted by the number of languages children speak) (Dixon et al., 2020). It is also useful to know whether the child or young person may have any co-occurring difficulties that could be impacting their academic performance, such as motor difficulties, handwriting difficulties, ADHD, or autism.

Finally, the cognition and learning profile of children and young people can change over time (e.g., in response to intervention, change in environment, cognitive development, and other relevant changes). Therefore, it is important that early identification is followed by monitoring and periodic reassessment as highlighted in the review by Carroll (2017). Most standardised assessments can typically be readministered every six months, but

weekly or monthly informal assessments may also be useful. These will be discussed in the following sections.

Executive functioning

In our Cross-Cutting Themes Report, we discuss executive functioning in more detail, including how executive functioning affects the learning and academic performance of children and young people with different types of SEND. However, it is also important to include a brief discussion of executive functioning within this cognition and learning REA, given its substantial influence on the underlying difficulties experienced by children and young people across a range of cognition and learning difficulties.

Executive functions refer to a set of cognitive skills such as attention, planning, inhibition, and memory processes including working memory. Working memory is the ability to temporarily hold and manipulate information in the mind (Baddeley, 2020) and is required for many everyday tasks. For example, when reading, one must remember each word that was just read and hold it in memory to finish the sentence or the paragraph so that meaning can be synthesised. This also involves drawing from other cognitive resources such as attention and inhibiting other distractions.

These cognitive resources, including working memory, are limited in capacity and can be overloaded (sometimes referred to as cognitive load) with the presentation of multiple sources of information (including verbal and visual information) (Just & Carpenter, 1992). For example, a busy classroom can present multiple forms of information (e.g., background noise, teachers' verbal instructions, notes on the blackboard) which can overload working memory capacity, making it challenging for children and young people to selectively attend to and maintain attention on tasks. Similarly, if too much information is presented at once, children and young people may struggle to process it all, affecting the quality of learning.

Children and young people with SpLD and other types of learning difficulties generally have challenges with working memory processing (David, 2012; Gathercole et al., 2016; Peng & Fuchs, 2016), attention, inhibition, and other cognitive processes. These additional challenges increase cognitive load, resulting in further difficulties in learning. Therefore, support and intervention techniques that reduce cognitive load and reduce the requirement of working memory tend to be effective for this population.

While executive functioning and other types of cognitive processes are typically assessed by a qualified dyslexia assessor or an educational psychologist, there may be specific indicators that a child or young person has difficulties with executive functioning. Children and young people may appear inattentive, have difficulty following multi-step instructions, planning, and organising tasks or physical materials, or struggle to manage their time.

Educators working with children can observe these behaviours and record them to inform intervention planning or contribute to the assessment process.

While there are interventions and support programmes that target and train working memory, it is important to note that there is limited evidence that training working memory is an effective strategy in improving educational outcomes (Melby-Lervåg & Hulme, 2013; Melby-Lervåg et al., 2016). Findings typically show gains on the specific tasks used during training, but these improvements rarely generalise to broader areas of learning or cognitive function. It may be more effective to reduce the cognitive load these processes impose on children during reading tasks (e.g., Sweller, 2011). For example, breaking down instructions into smaller, manageable chunks, repetition of information or instructions, or oral rehearsal. Therefore, while assessing these cognitive skills can inform a child's overall reading profile, they may not show improvement with targeted reading interventions.

Identification of literacy difficulties

Many children and young people with SEND will have difficulties with literacy skills including reading, spelling, and writing. Children and young people with dyslexia may have difficulties with speed of processing and word reading difficulties but may also struggle with wider literacy skills including reading comprehension, fluency, spelling, and writing. Children with MLD, SLD, or PMLD may also have a number of these same challenges in literacy. It is important to identify whether a child is struggling in any of these areas to initiate early intervention and support (Hall & Burns, 2018). This section first outlines the key skills involved in literacy development, to clarify which areas should be considered in identification and assessment processes for recognising difficulties and planning appropriate interventions. We then discuss different tools and techniques available to mainstream educators in identifying and assessing literacy difficulties.

The skills involved in literacy

It is widely agreed that the goal of reading is to comprehend a text; however, accurate and fluent word reading are necessary foundational skills for comprehension (Perfetti, 1985). The Simple View of Reading (SVR; Hoover & Gough, 1990) provides a valuable framework for understanding two essential components of reading comprehension: word reading (decoding) and language comprehension. Hoover and Gough (1990) defined decoding as being able to recognise words quickly and accurately, and language comprehension as the ability to understand the meaning of words and sentences when read or heard. Both decoding and language comprehension are equally important for successful reading comprehension and difficulties in either or both components may result in comprehension struggles. Therefore, when identifying literacy difficulties, it can

be a useful starting point to determine whether a child has difficulty in decoding, language comprehension, or both.

The SVR model has been widely supported in research and is effective in predicting reading comprehension and explaining variability among readers (Catts et al., 2015; Kirby & Savage, 2008; Tilstra et al., 2009). Definitions of dyslexia and developmental language disorder similarly highlight the importance of these skills in reading development and in identifying and supporting reading difficulties. Based on this, the SVR provides a strong foundation for determining which reading skills should be measured when identifying difficulties and monitoring interventions.

Research has indicated that decoding and language comprehension rely on distinct underlying processes, often conceptualised by Scarborough's reading rope (Scarborough, 2001). For example, language comprehension relies on skills such as vocabulary knowledge, verbal reasoning, and background knowledge, among others. Decoding relies on knowledge of the alphabetic principle and phonological awareness and can also be supported by sight recognition. Proficiency in either component exists along a continuum, varying widely among individual learners. Children and young people with cognition and learning difficulties may struggle with any number of these skills, which may in turn result in literacy difficulties. For example, children and young people with dyslexia often struggle with decoding, phonics, and aspects of working memory and processing speed (Carroll et al., 2024). Although dyslexia is primarily associated with difficulties in decoding, literacy skills are highly interconnected, meaning that weaknesses in one area, such as phonological processing, can also impact others, including reading comprehension. As a result, children with dyslexia may also exhibit difficulties in understanding what they read, especially as texts become more complex.

Conversely, some children, including those with Developmental Language Disorder, may decode words accurately but still struggle with reading comprehension due to challenges with language processing, working memory, or inferencing skills (e.g., Bishop & Snowling, 2004). These underlying language and reading skills are also linked to other areas of literacy including writing (e.g., Berninger & Amtmann, 2003) and spelling (Kohnen et al. 2009). These overlapping difficulties highlight the importance of assessing the full range of reading skills when identifying and supporting learners with literacy needs. Definitions for each of these different literacy skills are provided in Table 4.

Table 4. Definitions of literacy terms

Skill	Definition
Phonological awareness	The broad ability to recognise and manipulate sounds in spoken language, including words, syllables, rhymes, and phonemes.
Phonics	Understanding the relationship between sounds and the letters that represent them.
Decoding	Using knowledge of phonics to translate written words into their spoken forms.
Word identification	The ability to sound out a word.
Reading fluency	Reading with speed, accuracy, and proper expression (intonation and rhythm).
Reading accuracy	The ability to recognise and pronounce words correctly.
Vocabulary	Knowing the meaning of a wide range of words and the ability to understand them in context.
Morphological awareness	Understanding of how words are structured and how their meaning is built from smaller units called morphemes. A morpheme is the smallest unit of meaning in a language. For example, in the word “unhappiness”, there are three morphemes: “un-” (a prefix meaning not), “happy” (a root meaning pleased), and “-ness” (a suffix indicating a state or quality).
Reading comprehension	Understanding, interpreting, and drawing meaning from texts.
Oral language	The ability to understand and use spoken language, which supports reading development.
Working memory	The capacity to hold and manipulate information while reading and processing text.
Visual processing	The ability to interpret and make sense of what is seen (e.g., recognising letters and words).
Motivation/Engagement	The interest and willingness to read, which influences the development of reading skills over time.

These literacy skills are often strong early predictors of later literacy outcomes. For example, early difficulties in phonological awareness, fluency, and decoding appear to be the most consistent predictors of initial response to intervention (Al Otaiba & Fuchs, 2002; Lam & McMaster, 2014). Therefore, these different areas are often important to

measure and assess in order to guide support and targeted intervention. In addition to these language and reading skills, executive functions such as working memory, attention, and inhibition can impact reading performance. Reading motivation and attitudes are also key predictors of literacy performance (Breadmore et al., 2019). The relative strengths and challenges in each of these domains may be different for each learner; therefore, interventions should be guided by the profile of need rather than just targeting a narrow range of skills.

Assessment and identification of literacy difficulties findings

There are several types of literacy assessments in terms of their design, how they are scored, and how they are interpreted. Each type typically serves a different purpose. For example, norm-referenced tests compare a student's performance to that of a representative sample, known as the "norm group", to determine how a student ranks relative to their peers. In contrast, criterion-referenced tests assess whether a student has mastered specific concepts or can apply particular methods or approaches. National assessments in the UK are typically criterion-referenced tests that judge whether a student has met the expected level for their age. Finally, curriculum-based assessments are informal, teacher-led assessments that measure a student's progress aligned with the setting's curriculum. All these assessments, along with other types of data collection (e.g., family history or observations, etc.) can help identify areas of strength and need, inform instructional planning, and support decisions about a student's placement within a reading programme.

While our REA search resulted in few standardised tools available to mainstream educators without specialist qualifications, there are still a number of strategies they can employ to aid in the identification and monitoring of literacy difficulties. Given the broad range of skills involved, including oral language, phonological awareness, decoding, fluency, vocabulary, executive functioning, and comprehension, as well as the influence of genetic and environmental factors, it can be challenging to identify literacy difficulties across a whole class. To manage this complexity, educators may want to adopt a structured, tiered approach to identification that is purposeful, manageable, and aligned with observed classroom behaviours and learning progress. This allows for early and responsive identification of need to support timely intervention and ensures that decisions are based on evidence gathered over time rather than isolated assessments or assumptions. This strategy should be planned with the school's SENCo or other senior leaders for consistency and manageability.

High-quality teaching should always be the top priority when addressing literacy needs in the classroom. If a student continues to struggle despite receiving strong universal instruction, this may indicate the need for further investigation into their individual learning needs. A good starting point is to conduct general observations or broad

screening using tools such as curriculum-based assessments, phonics screeners, or sentence reading tests. The Year 1 phonics screener can be a useful early measure of difficulties in the foundational skills needed for reading. Additionally, national assessments can also be a useful benchmark for further investigation of academic need. Schools could also incorporate open communication channels for families to share any early concerns about their child's literacy or academic difficulties.

Next, students flagged by initial screening, observations, or parent and caregiver concerns, can be given more targeted assessments focussed on specific components (e.g., reading fluency and comprehension). If difficulties are identified, this is an appropriate stage to also gather a developmental history and explore any family history of SEND or related learning difficulties. As previously discussed, it is useful to measure a number of different literacy skills to understand specific strengths and challenges for different learners.

Static and dynamic assessment tools

Identifying and assessing early literacy skills can be challenging due to the recent acquisition of these skills and the rapid pace of reading development during the first few years of school. Word reading and decoding can be measured in various ways. Standardised word reading tests assess a child's ability to read individual words aloud. They often use lists of both real words and pseudowords (i.e., nonsense words), with pseudoword reading specifically testing decoding skills (see García & Cain, 2014). These assessments are typically static, meaning they measure a child's current ability.

However, two systematic reviews identified from our search (Dixon et al., 2023; Nelson-Strouts et al., 2020) also suggest that dynamic assessment tools, which evaluate a child's learning potential rather than only their current ability, are also supported by emerging evidence of effectiveness in identifying performance on oral reading fluency, word identification, phonological awareness tasks, and reading difficulties of younger children (e.g., aged 8 and younger). The combination of both dynamic and traditional standardised assessment tools yielded the most accurate results in predicting reading difficulties, though dynamic assessment was superior to static standardised tools in some cases (e.g., early in literacy development before age 7, where static tests lack sensitivity (e.g., floor effects), and in lower-performing, at-risk, or preliterate groups). Based on this, educators may want to consider using both types of assessments when investigating reading difficulties. However, research on dynamic assessment is still limited. There is still a lack of clear-cut points or consistent guidelines for interpreting scores in most dynamic assessments of early literacy which presents several challenges. Without standardised cut off points, it becomes difficult for educators and practitioners to determine whether a child's performance indicates a significant concern, falls within typical development, or shows advanced progress. This limits the usefulness of dynamic

assessment for consistent screening, monitoring, or intervention planning across different educational settings.

Curriculum-based measures

Curriculum-based measures are designed to be an assessment that a teacher can create using the same curricular materials being used for instruction (Deno, 2014). Teachers can use material sampled from their lessons to measure reading skills. In the classroom, curriculum-based measures are usually timed such as timed readings (which measure fluency and accuracy) or short comprehension quizzes that do not involve prompting. These strategies can help identify readers who may need extra support and monitor progress over time. These strategies can help provide a general picture of which students may be struggling.

One systematic review identified in our REA (Snyder & Ayres, 2020) found curriculum-based measures to be effective in measuring reading comprehension, fluency, and accuracy. Oral reading fluency was the most commonly used measure where children were either asked to read short texts within a given time frame or to read words or nonsense words. Letter sound fluency was also tested by measuring how quickly students can produce the sound of a given letter. Additionally, reading comprehension was measured using a maze task where students were asked to choose the correct word to complete sentences in a passage with missing words. A few commercially available measures were also investigated in this study including the DIBELS (Dynamic Indicators of Basic Early Literacy Skills), easyCBM, and the aimsWeb. While these tools were included in the analysis, the review did not evaluate or compare their relative effectiveness. As a result, it is not possible to determine which tools included in the study produced the most reliable or impactful outcomes. Selection should therefore be based on factors such as alignment with curriculum goals, ease of administration, training requirements, and how well the tool fits the specific needs of the student population.

Reading fluency and comprehension measures

Indeed, oral reading can be another good starting point in identifying difficulties in various reading skills such as reading accuracy, reading fluency, prosody (i.e., the patterns of stress and intonation) and expression. However, caution is needed when asking students to read aloud especially in classroom settings. Some whole-class reading aloud methods can be detrimental, potentially causing anxiety or embarrassment, particularly for students with literacy difficulties. One-to-one options or paired reading strategies may be a better option to reduce these detrimental effects (e.g., Ash et al., 2008). Teachers can then prioritise key areas, such as decoding and comprehension, as a starting point, particularly for early readers or those new to English.

Reading comprehension is commonly measured using standardised reading comprehension tests, which assess a reader’s current ability to understand written text

through questions that require literal, inferential, and evaluative comprehension (e.g., passages followed by multiple-choice or open-ended questions). Another method is cloze procedures, a reading comprehension activity where words are removed from a passage, and the reader is asked to fill in the blanks, testing their ability to understand context and meaning (Bormuth, 1968). Additionally, retelling and summarisation tasks can measure comprehension, asking students to summarise or retell a passage in their own words to assess how well they grasped the overall meaning and key details (Paris & Paris, 2003). Lastly, comprehension monitoring evaluates a student's ability to detect and resolve misunderstandings as they read, often by introducing deliberate inconsistencies into the text (Pressley & Gaskins, 2006).

One systematic review (Guo et al., 2023) identified two tools for assessing reading comprehension in pupils aged 5-18: the Neale Analysis of Reading Ability (NARA; Neale, 1989, 1997) and the Woodcock Reading Mastery Tests (WRMT; Woodcock, 1987). Both require pupils to read passages; in the WRMT, pupils complete a cloze test while reading, whereas in the NARA, pupils read aloud short stories and then answer comprehension questions. The WRMT is more clinically oriented and requires moderate training, while the NARA can be administered by teachers, although results should be interpreted with input from a trained assessor or SENCo.

Informal assessment strategies to identify literacy difficulties summary

- Real word reading and nonsense word reading for decoding
- Oral text reading accuracy
- Oral text reading fluency
- Running records with miscue analysis
- Listening comprehension
- Reading comprehension

Identifying writing difficulties

Writing is a complex activity that involves not only the physical motor process of handwriting or typing, but also spelling, sentence structure, syntax, grammar, content knowledge, vocabulary, punctuation, among others. The writing process also involves executive functioning such as planning, revising, and working memory. Difficulty with any of these aspects of writing, may impact on the ability to carry out the others (Berninger & Amtmann, 2003). For example, a child who struggles with spelling, may write less, and use less diverse vocabulary, more pausing and hesitation, which can affect overall quality of the written work (Sumner et al., 2013; 2014; 2016; 2020).

It is useful to take an unaided writing sample from a child to assess writing skills. Writing outcomes can be measured in terms of their product and process. Although, instruction requires emphasis on the writing process (planning and organising material, transcribing thoughts into words, and reviewing and revising), assessment of writing skills must focus primarily on the writing product (legibility, number of words written, vocabulary use, syntax, grammar, spelling etc). Identification and assessment of handwriting difficulties are discussed in more detail in the Cross-Cutting Themes Report of this series of REAs and therefore will not be repeated here.

Identification of numeracy difficulties

The skills involved in maths

Similar to literacy, there are also many skills involved in mathematics which may also be measured to understand a children or young person's profile of strengths and challenges.

Mathematics achievement is shaped by a complex interplay of factors, including individual differences in attitudes, motivation, language ability, as well as broader social and educational influences. While these general factors are important, domain-specific numerical skills such as understanding number sets and retrieving basic arithmetic facts are also important for success in mathematics. Students with learning difficulties in mathematics often show persistent difficulties in these specific areas, including difficulties with number processing, counting knowledge, and basic fact retrieval (Geary, Hoard, & Bailey, 2012). These challenges are not merely a result of limited working memory; research shows that children with MLD struggle to form and retrieve long-term memory representations of arithmetic facts, and often make more frequent and atypical errors when doing so (Andersson, 2008, 2010; Mazzocco et al., 2008). In addition to fact retrieval, children with MLD also experience delays in developing arithmetic procedures. While many eventually learn basic strategies, they typically lag behind their typically achieving peers by one or more years, especially on tasks with greater procedural complexity (Andersson, 2010). Notably, children with low achievement in maths show retrieval and procedural skills that are intermediate between those of children with MLD and their typically achieving peers and tend to become more similar to typically achieving children over time (Chong & Siegel, 2008). Furthermore, students with maths difficulties often demonstrate weaker reading skills compared to typically developing readers (Geary, 1993; Jordan et al., 2003), highlighting the interconnectedness of learning difficulties across domains. Definitions of different maths skills are provided in Table 5.

Table 5. Definitions of math terms

Skill	Definition
Number sense	An understanding of numbers, their magnitude, relationships, and how they are affected by operations. Includes the ability to estimate, subitise, and compare quantities.
Counting principles	Understanding how to count accurately, including stable order, one-to-one correspondence, cardinality, and order irrelevance.
Symbolic number knowledge	Recognising and understanding the meaning of numerals and number words (e.g., knowing that “5” represents five objects).
Arithmetic fluency	The ability to carry out basic calculations (addition, subtraction, multiplication, division) quickly and accurately.
Measurement	Understanding units of measurement, converting between units, and applying measurement in practical situations
Calculation strategies	Applying appropriate strategies (e.g., counting on, using known facts, breaking numbers apart) to solve arithmetic problems.
Place value understanding	Recognising the value of digits depending on their position in a number (e.g., understanding that the 3 in 34 represents 30).
Mathematical reasoning	The ability to explain and justify mathematical thinking, make inferences, and evaluate the validity of arguments or solutions.
Problem solving	Applying mathematical knowledge to unfamiliar situations, selecting relevant information, and using strategies to find solutions.
Spatial reasoning	Understanding shapes, positions, directions, and spatial relationships; essential for geometry and visualising mathematical concepts.
Working memory	Holding and manipulating information while performing calculations or following multi-step problem-solving tasks.
Visual processing	Interpreting visual information such as symbols, shapes, or number patterns, often involved in understanding graphs or diagrams.

Skill	Definition
Motivation/Engagement	Interest, confidence, and persistence in learning mathematics, which influence the development and application of skills over time.

Assessment and identification of numeracy difficulties findings

Our REA did not retrieve any studies that investigated the identification and assessment of maths and numeracy difficulties. However, we are aware of one systematic review published after we undertook our search which investigates early childhood (aged 0 to 8) assessment and screening tools to identify children at-risk for mathematics difficulties (Outhwaite et al., 2024).

This systematic review found six assessment tools and five screeners available to mainstream schools in the UK that show strong and reliable evidence for effectively measuring young children's mathematical abilities. These tools have been evaluated against common psychometric standards, such as reliability, validity, and accuracy, and have demonstrated good performance across multiple criteria. As a result, they are considered among the most trustworthy options for identifying children who may be struggling with, or are at risk of, developing maths learning difficulties. While other tools were also considered strong in this systematic review, they either were not available in English, or were diagnostic screening tools or assessments that would need specialist qualifications to use. Educators should still consider how practical and accessible these tools and screeners are within their specific classroom contexts. Here, we briefly describe these six assessment tools:

1. The Early Years Toolbox (Howard & Melhuish, 2017) is a tablet-based assessment suite developed in Australia for children aged 3 to 6 years. It measures a range of school readiness skills including early literacy, numeracy, and executive functioning. It is available in English and was specifically designed to be user-friendly for educators with minimal training, making it accessible for classroom use, though it is not standardised for use in the UK.

2. The Early Learning Outcomes Measure (ELOM; Snelling et al., 2019), developed in South Africa, also targets school readiness in children aged 4 to 6, measuring numeracy, literacy, and executive functioning. It is available in English and other languages and can be administered by trained educators or assessors. While it is primarily used in South Africa, it offers a useful framework for identifying early difficulties though it is not standardised for use in the UK.

3. The International Development and Early Learning Assessment – Emergent Numeracy (IDELA; Save the Children, 2019) is a widely used tool for children

aged 3 and 6 months to 6 and 6 months, measuring numeracy, literacy, motor, and socio-emotional development. It is available in English and is designed for use in low-resource settings, making it accessible to teachers and paraprofessionals following brief training.

4. The Parent Ratings of Numeracy Skills (Lin et al., 2021), is a researcher-designed questionnaire for parents, developed for children aged 3 to 6, which captures parental perceptions of their child's early numeracy ability. Parents were asked to provide ratings of their children's counting, numeral identification, and arithmetic abilities. To determine verbal counting abilities, parents were asked, "How high can your child count?" To determine parent ratings of children's numeral identification skills, parents were presented with numerals 1 through 15 and asked to circle all of the numerals that their child could identify. Parents were also asked to respond "yes" or "no" to the prompt, "My child can calculate simple sums (e.g., 1 plus 1, 1 plus 2)."

5. The Research-Based Early Mathematics Assessment – Short Form (REMA-SF; Clements et al., 2008; Weiland et al., 2012) assesses number sense, operations, geometry, and measurement in children aged 3 to 6 years. It is available in English and can be used by trained researchers or teachers with guidance, though its design leans more toward research applications.

6. Finally, the Teacher Rating Scale – Early Numeracy (TRS-EN; Vessonen et al., 2023) is a teacher-completed tool that evaluates early numeracy skills in 4- to 7-year-olds. It is quick to administer, available in English, and specifically intended for classroom use, making it a practical option for teachers to screen and monitor early numeracy development. This scale included 22 items measuring counting (13 items e.g., 'is able to count forward from 1 to 10 correctly'), numerical relational (7 items e.g., 'is able to order objects according to a given criteria like size), and basic arithmetical skills (2 items e.g., 'is able to add and subtract with numbers below 10 using objects).

The five screeners included:

1. Assessing Student Proficiency of Early Number Sense (ASPENS), developed by Clarke et al. (2011), is a brief screening tool designed to assess foundational number sense in early elementary-aged children. It evaluates concepts such as counting, number recognition, and quantity comparison to help identify students at risk for mathematics difficulties. It is teacher-administered and intended to guide early instructional support.
2. House of Numbers (HoN), created by Chatzaki et al. (2024), is a newly developed assessment tool for exploring symbolic and non-symbolic number sense. It features engaging, game-like tasks that can identify strengths and weaknesses in

numerical understanding and has been piloted with young children in early education settings. It is worth noting however, that this is still an emerging tool, and more research may be needed on its usability in school settings without specialist supervision.

3. Math Essential Skill Screener – Elementary Version (MESS-E), by Erford et al. (1998), is a teacher- or school-based screener designed to evaluate essential mathematics skills in primary-aged students. It measures number operations, computation fluency, and early algebraic reasoning. The MESS-E helps determine which students may benefit from targeted intervention.
4. Number Sense Screener (NSS) – English Version, developed by Jordan et al. (2010), is a research-validated screener for identifying number sense difficulties in early learners (typically aged 5-7). It covers symbolic and non-symbolic tasks, such as numeral identification, quantity discrimination, and basic arithmetic fluency, and is suitable for teacher use following brief training.
5. Preschool Early Numeracy Skills Screener – Brief Version (PENS-B), designed by Purpura et al. (2015), is a quick and reliable tool for preschool teachers to assess numeracy readiness. It includes tasks such as counting, number comparison, and understanding number magnitude, providing a practical approach for early identification of children needing further support.

These tools offer a good starting point for mainstream educators to consider the early maths and numeracy skills of young children. They may also be useful follow-up tools for early educational assessments such as the reception baseline assessment to guide support planning. For assessments and screeners where administration by teachers is not explicitly detailed, consultation with the specific user manuals may be helpful or contacting the developers to understand the training requirements and suitability for teacher administration.

Assessment and screening tools to identify children at-risk for mathematics difficulties summary

- The Early Years Toolbox.
- The Early Learning Outcomes Measure.
- The International Development and Early Learning Assessment – Emergent Numeracy.
- The Parent Ratings of Numeracy Skills
- The Research-Based Early Mathematics Assessment – Short Form
- The Teacher Rating Scale – Early Numeracy
- Assessing Student Proficiency of Early Number Sense (Screener)
- House of Numbers (Screener)
- Math Essential Skill Screener – Elementary Version
- Number Sense Screener
- Preschool Early Numeracy Skills Screener – Brief Version

Identification and assessment summary

The identification and assessment section of this REA reviewed evidence on how mainstream education professionals can identify and assess cognition and learning difficulties in children and young people. While formal assessment should be carried out by specialists, teachers play a key role in the early recognition of learning challenges and in referring pupils for further support. The section highlights that many available screening and assessment tools require specialist training to interpret correctly due to their psychometric complexity. However, there are accessible strategies that teachers can use to observe and monitor student progress and identify potential concerns.

Clear definitions of terms such as screening, assessment, and profiling are provided to distinguish between educational and clinical practices. Emphasis is placed on taking a holistic view of a child's strengths and difficulties, supported by multiple data sources such as observations, family history, and informal or standardised assessments. A wide range of cognitive, behavioural, and emotional skills can influence learning and should be considered in assessment.

The identification section underscores the importance of ongoing professional development for educators and collaboration with healthcare specialists (e.g., psychologists, speech and language therapists, and paediatricians) where appropriate. Although a formal assessment may help inform support, children can still be identified and supported using a needs-based approach without a formal label. Although the SEND Code of Practice (DfE, 2015) requires schools to support children and young people with needs even without a diagnosis, there are still relatively few tools available for use by mainstream educators without specialist qualifications. In her review of the literature, Ross (2020) argues that many educational professionals are not sufficiently prepared to identify and support children and young people with specific learning difficulties. She recommends that Initial Teacher Training frameworks should include training on SEND. Here, she highlights the gaps in teacher's knowledge of identification of need and effective support planning and recommends specific approaches to address these gaps. These include information and training on SEND in ITT frameworks, providing schools with access to specialist teachers and assessors who should receive funding to complete their training and qualifications.

Our REA also highlights literacy as a key area of concern for children and young people with cognition and learning difficulties and across SEND more broadly. Frameworks such as the Simple View of Reading and Scarborough's reading rope, outline the core components of literacy development, including decoding, language comprehension, vocabulary, fluency, and motivation. A tiered approach to identification may be useful, starting with whole-class screening tools like phonics screeners and curriculum-based measures.

Standardised reading assessments and dynamic assessments are discussed. While dynamic tools may offer additional insights into learning potential, they often lack clear scoring guidelines. Evidence suggests using a combination of informal assessments and structured tools where appropriate, while interpretation should involve SENCos or trained assessors where needed. Oral reading and reading comprehension tasks are best conducted one-to-one or through paired reading to minimise anxiety and potential embarrassment associated with reading aloud in front of peers.

In mathematics, although no studies were retrieved in the REA, a recent systematic review is summarised which identifies several evidence-based numeracy assessment tools and screeners available in English. These tools target early numeracy skills in young children and vary in ease of use and training requirements. Tools such as the TRS-EN and ASPENS are noted as particularly practical options for classroom teachers.

Consistent with previous reviews (e.g., Carroll et al., 2017; Van Herwegen et al., 2024), our REA found relatively little evidence on identifying cognition and learning difficulties in secondary pupils compared to primary-aged pupils. This imbalance is likely due to several factors. First, early identification and intervention are important to ensure pupils

receive the support that they need, so research has tended to focus on the primary years. Second, as children age, the developmental trajectory of literacy skills changes, and assessment can become more complex. Older pupils may develop coping strategies, such as memorising words or avoiding certain tasks, that can mask underlying difficulties making them difficult to identify. Others may be impacted by accumulated negative effects of difficulties in maths or literacy such as a smaller vocabulary, limited concept knowledge and low motivation (Biancarosa & Snow, 2004). Thus, more work is needed to understand this greater variability in skills of secondary pupils and how to identify needs that may be more complex.

In summary, while specialist support is often needed to formally diagnose learning difficulties, teachers can play a central role in early identification through structured observation, use of accessible tools, and collaboration with other professionals. Alongside these tools, maintaining open communication with teaching assistants, parents, and SEND staff ensures a more rounded understanding of each student's reading development. While these methods may not provide a formal diagnosis, they allow teachers to make informed decisions about differentiation, targeted interventions, or the need for further assessment by specialists.

Support and intervention

The aim of this section is to review the studies from our search that focused on support and intervention strategies suitable for use by mainstream education professionals. Here we focus specifically on approaches that are effective in supporting educational outcomes including literacy, writing, maths, science, and general attainment. This section is organised into two parts: universal approaches and high-quality teaching strategies that support children and young people at the first tier of the graduated approach, and then targeted approaches tailored to specific areas of need such as difficulties in literacy and mathematics.

When reporting on intervention and support strategies in this REA, we sometimes refer to effect sizes that were reported in the studies reviewed. Effect sizes range from 0 to 1 and refer to how much of a difference an approach or intervention makes, beyond just whether it works. A small effect (around 0.2) means a modest improvement, a medium effect (around 0.5) suggests moderate improvement or progress, and a large effect (0.8 or more) indicates a strong improvement on learning. Additionally, evidence can come from various study designs, each differing in the strength and type of reliability they offer. Single-case designs provide strong evidence for the consistency of effects within individuals, making them valuable for understanding how interventions work in specific cases. However, their findings may not be widely generalisable (i.e., applicable to other individuals and/or settings). In contrast, group-design studies such as randomised controlled trials offer more generalisable results across larger populations but may overlook important individual differences in how students respond to interventions. Ideally, a strong body of evidence should be based off of multiple types of study designs.

Universal support: High quality teaching and classroom support

Support for students with SEND can be provided at different levels, starting with universal strategies delivered to all students through evidence-based 'quality first' teaching approaches. Universal provision, or ‘tier 1’ consists of evidence-based pedagogical approaches and may be delivered as whole-class teaching, small groups, or even individual activities. When universal approaches aren’t enough to meet the educational needs of students, targeted support can be offered, tailored to individual needs, and implemented either in small groups or through one-to-one interventions. Finally, if this second ‘tier 2’ is still not effectively addressing the needs of students, support can be offered at the third ‘tier 3’ which consists of specialist support which may involve external professionals such as Speech and Language Therapists or coordinated multi-agency support (e.g., through an EHC plan). This so-called tiered approach to support children’s educational needs is well established in the UK educational context (e.g., see SEND Code of Practice, 2015). Similar models are also used in the US educational context

such as response to intervention models (Fuchs & Fuchs, 2006) or multi-tiered systems of support (McIntosh & Goodman, 2016), where children who do not progress with effective universal treatment are offered more individualised and targeted support. The SEND Code of Practice defines high-quality teaching:

High-quality teaching, differentiated for individual pupils, is the first step in responding to pupils who have or may have SEND. Additional intervention and support cannot compensate for a lack of good quality teaching (DfE, 2015, p. 99).

By providing high-quality teaching that is evidence-based and differentiated, schools may reduce the likelihood that students will require additional, more intensive support. A range of inclusive instructional strategies and classroom design approaches can support children and young people with cognition and learning difficulties. The approaches identified in our rapid review include instructional techniques and adjustments to the physical or social environment.

Instructional approaches

Academic difficulties among children and young people with cognition and learning needs may stem from underlying challenges with executive functions, including attention, working memory, planning, and organisation (executive function is covered in more detail within our Cross-Cutting Themes Report). Given the challenges children and young people with cognition and learning difficulties may have with executive functions, it is important to use instructional strategies that support these functions and reduce cognitive load. Instructional approaches refer to the methods, strategies, and techniques that educators use to facilitate learning and help students achieve specific learning goals. These practices include how teachers deliver content, organise learning activities, provide feedback, and adapt instruction to meet diverse student needs.

Techniques that provide structure, break tasks into manageable steps, use clear prompts/cues and explicit instruction have been found to be effective for children and young people with cognition and learning difficulties as they can help to reduce cognitive load. These strategies can be implemented at the whole-class level or during targeted intervention delivery (e.g., Carroll et al., 2017; Dennis et al., 2016; Myers et al., 2021). These techniques include explicit instruction, peer-assisted learning, scaffolding, the use of mnemonics (especially for learning key facts), task-sequencing, and metacognitive approaches.

Research indicates that whole-class high-quality phonics instruction benefits children with or at risk of literacy difficulties when it is systematic, explicit, and delivered by trained teachers (Castles et al., 2018). Previous meta-analyses (e.g., Ehri et al., 2001; National Reading Panel, 2000) show that systematic phonics improves decoding and word reading for all children, with particularly strong effects for struggling readers when

instruction includes ample practice, scaffolded feedback, and opportunities to apply skills in connected text. One systematic review included in our REA by Alqurani and Rao (2020) analysed single-subject design studies of reading interventions for children aged 6 to 15 and found that sight-word recognition could be improved through a two-part phonics instruction sequence using direct instruction approach, sight words with connected text, and direct instruction flashcards system. These studies also focused on supporting phonological awareness, phonics, and vocabulary as part of instruction.

Vocabulary can also be supported at the whole-class level through effective instructional approaches. One systematic review (Kuder, 2017) compared several different instruction methods to support vocabulary for children aged 11 to 18 and found that the most effective methods were mnemonic instruction, morphemic analysis strategies, direct instruction, and multimedia instruction. Peer-mediated approaches also showed positive effects, though their impact couldn't be isolated from the instructional methods used. Explicit vocabulary instruction can also improve comprehension of content-specific reading (e.g., reading science related materials) for secondary aged children with reading difficulties (Kaldenberg et al., 2014).

Classroom environment

In the Cross-Cutting Themes Report of our collection of REAs, we highlight several effective strategies to design inclusive classrooms which benefit children with different types of SEND needs. These techniques therefore won’t be repeated here. Instead, we focus on reducing processing demands to support challenges with executive functioning.

Similar to instructional approaches, reducing the load of sensory information and processing demands is helpful for children and young people with cognitive and learning challenges (Carroll et al., 2017). Classrooms and school environments can be highly stimulating and overwhelming for pupils with cognition and learning needs. For example, in a randomised controlled trial (RCT), Dockrell and Sheild (2006) found that speed of processing for children and young people with SEND can be negatively impacted by background babble and external noises such as sirens or lorries. Minimising background noise and even considering acoustic panelling in classrooms was found to help support learning.

Universal (tier 1) strategies to support pupils with cognition and learning needs summary

- Explicit instruction
- High-quality phonics instruction
- Peer-assisted learning
- Scaffolding
- Mnemonics
- Multimedia instruction
- Task-sequencing
- Metacognitive approaches
- Minimising unnecessary stimuli in classrooms

Targeted support

Pupils who do not make expected progress despite high-quality teaching and universal support should receive timely, evidence-informed targeted support, with their development regularly reviewed, and such interventions must adhere to principles shown to be effective.

Role of specialist teachers

Specialist teachers may be needed when a child does not make adequate progress despite high-quality, differentiated classroom teaching and targeted interventions (Tier 1 and Tier 2). They are particularly important when there is evidence of specific learning difficulties (e.g., dyslexia, dyscalculia) requiring structured, individualised teaching approaches (DfE/ DoH, 2015; Rose, 2009). Specialist teachers are educators with additional training to assess, plan, and deliver targeted support for pupils with SEND, particularly those with specific learning difficulties such as dyslexia or dyscalculia. To qualify, these specialist teachers must have qualified teacher states as well as a postgraduate Level 5 or Level 7 specialist qualification in SpLD (e.g., dyslexia), such as those accredited by the British Dyslexia Association (BDA). Some are also qualified to carry out diagnostic assessments and hold an Assessment Practising Certificate (APC). This makes them well-placed in both the assessment and support processes.

Specialist teachers are trained in foundational understanding of SpLDs and different areas of literacy or maths that may need to be targeted. Their training involves lessons on designing and delivering evidence-based interventions, including structured, cumulative, and multisensory phonics programmes, and in adapting curriculum content to make learning accessible for individual pupils. Their training also includes monitoring and evaluating pupil progress through standardised and curriculum-based assessments, as well as collaborating closely with classroom teachers, parents, and other professionals to implement and review personalised support plans. They may also be trained in psychometric assessment principles to assess and identify specific learning difficulties such as dyslexia, dyscalculia, and other cognition and learning needs using a range of assessment tools.

Specialist teachers can contribute in various ways, including identifying and assessing specific learning difficulties, planning structured intervention programmes, and working directly with individual pupils. They also can play a role in supporting classroom teachers and teaching assistants, as well as raising awareness of specific learning difficulties within schools.

Literacy support

Children and young people with different cognition and learning needs may struggle with various aspects of literacy including reading, spelling, and/or writing. Children and young people with dyslexia may particularly show challenges with areas of phonological awareness, decoding, and phonics. However, as discussed in the 'Identification and assessment of need' section of this REA, they may also show difficulties in other areas of reading, writing, and spelling.

Early reading instruction typically focuses on phonological awareness, phonics and decoding processes while older learners often focus more on fluency and comprehension processes. In general, literacy interventions provided in primary years have larger impacts compared to literacy interventions in secondary likely because they target foundational skills during a period of high neuroplasticity and rapid development, before difficulties become long-standing and compounded by wider academic demands. Thus, early intervention is important as later difficulties with reading can be prevented with proper reading interventions (Fuchs et al., 2008; Partanen & Siegel, 2014; Torgesen et al., 2001). However, it is still important to support fluency, vocabulary, and comprehension in younger learners, and some older learners will continue to benefit from some phonological awareness-based interventions.

Given that each literacy skill can impact others, the target of high-quality instruction or targeted intervention will depend on each learner's individual profile. For example, readers who struggle with reading fluency may also struggle with word recognition, vocabulary development and reading motivation (e.g., Chard et al., 2002). In turn, poor

reading fluency can impact reading comprehension because readers are often focusing on decoding and word-reading leaving little cognitive processing for comprehending the meaning of a text (e.g., Lange, 2019).

It is important to note that terms such as literacy disability, reading difficulty, struggling readers, and learning disability are often used interchangeably in research. There is ongoing debate around the use of labels like dyslexia, and participants in studies are frequently recruited without a formal diagnosis, based instead on the presence of reading or literacy difficulties. This means that study samples often include a broad group of struggling readers, such as those with low reading achievement, unidentified reading difficulties, dyslexia, and/or those identified with a learning disability. Therefore, it is not always possible to say which literacy interventions may support those with a SpLD better than those with MLD or GLD. Therefore, this section will address specific needs related to literacy (e.g., reading comprehension, handwriting difficulties) rather than by specific diagnostic area.

Decoding and phonological awareness

Decoding and phonological awareness skills need to be supported for successful reading. They are typically learned during the early years and key stage 1 and are often the focus of targeted interventions for children of this age. The most effective way of teaching these early literacy skills is through structured, systematic phonics programmes supplemented by engaging with real book reading (Melby-Lervag et al., 2012).

Accurate decoding of words is supported by early oral language skills as well as phonological awareness skills (Castles et al., 2018). However, even with high-quality phonics instruction, some children and young people with dyslexia and other literacy difficulties continue to struggle with these skills, and they are often the targets of early intervention. For more information on oral language support and targeted interventions for oral language difficulties, refer to our Speech, Language, and Communication Needs Report in this series of reviews.

Goldfeld et al. (2022) reviewed 55 small-group oral language and early reading intervention studies for children aged 4 to 9. The review identified a shortlist of six interventions with the strongest evidence of improving oral language or reading outcomes: These six interventions are as follows:

1. The Early Reading Intervention (ERI) is a commercially available kindergarten beginning reading intervention designed to supplement classroom instruction for students at risk of experiencing reading difficulties. It includes instruction in phonological awareness and writing and spelling with previously taught phonics skills.

2. The Phonological and Strategy Training (PHAST) and Phonological Awareness and Blending (PHAB*)* are related Canadian programmes developed to support children with reading disabilities. The PHAB targets early phonological awareness and blending skills in children from ages 4 to 16 focusing on the critical precursor skills for decoding. The PHAST is available for primary and secondary aged children with reading difficulties, combining phonological training with explicit decoding strategies, such as identifying syllable types and flexible word attack approaches (Lovett et al., 1994). This strategy was implemented with the RAVE-O programme (Retrieval, Automaticity, Vocabulary, Elaboration, Orthography) which is a separate but complementary programme to the PHAST and the PHAB, focusing on fluency through rapid retrieval of word forms, morphological awareness, and semantic networks. It is designed to complement phonics instruction by building speed, vocabulary richness, and deep orthographic knowledge.
3. Read Well-Aligned is an early literacy intervention tool designed to support students in developing foundational reading skills, particularly in the early primary years. Specifically, this programme targets phonemic awareness, phonics and decoding, vocabulary development, oral reading fluency, and comprehension. This programme involves scripted lessons delivered to small groups with regular assessments embedded to measure progress.
4. The phonological awareness and phonics intervention (unnamed) developed and delivered by Ryder, Tunmer, and Greaney (2008) involved 56 sequenced, semi-scripted lessons with explicit instruction in phonemic awareness and phonemically based decoding strategies. The intervention was delivered by a teacher aide to small-groups over a period of 24 weeks.
5. Story friends is an early language intervention designed to improve oral language skills in preschool children at risk for language delays. It was developed by Goldstein and colleagues (2016) and is typically delivered in small groups (usually 2–3 children) by teachers or teaching assistants in early years settings. This intervention targets vocabulary development, listening comprehension, and inferencing through storybook-based lessons with explicit instruction.
6. Lonigan and Phillips' (2016) unnamed needs-aligned intervention provided one programme that targeted phonological awareness and phonics, as well as a second programme that targeted syntax and vocabulary for children who had difficulties in either or both of these areas. Delivery consisted of short and intensive instruction to small groups.

In terms of implementation, these interventions typically included groups of 3 to 5 students and involved 4 to 5 sessions per week for a minimum of 11 weeks. The content of the different interventions focused on multiple language and reading components, but most commonly on phonological awareness and phonics. In general, these approaches

are effective because they include a range of pedagogical strategies, most commonly, modelling, and explicit instruction, but also scaffolding, metacognitive techniques, corrective feedback, self-monitoring, and interactive elements.

Another systematic review of randomised controlled trials investigated the effects of targeted decoding interventions for children aged 5 to 8 at-risk of reading difficulties (e.g., with assessed word decoding skills in or below the 40th percentile) (Nilvius et al., 2021). This review used strict criteria to include high-quality studies. The review found that explicit instruction in phonemic awareness, phonics, and sight word reading in small groups were effective, particularly for preventing later reading difficulties. Most interventions had multiple components to support generalisation (i.e., the ability to apply skills learned in one context to new contexts). Specific named interventions within the review included: (1) the Systematic Early Reading Intervention with phonological awareness, integrating writing and spelling with phonemic and alphabetic skills; (2) an unnamed intervention focusing on irregular word reading, phonological awareness, sound spelling, blending and word reading, accuracy and fluency reading decodable text, encoding practice, reteaching of challenging words; (3) explicit reading instruction phonologically based, phonemic decoding and spelling, text reading for fluency, comprehension instruction; and (4) phonological awareness, word attack, sight word, fluency, spelling, comprehension. Interventions lasted between 12 and 26 weeks and were delivered for 30-45 minutes 3-5 times per week. This delivery supports the distributed practice approach where shorter and more frequent sessions are more effective than massed practice (e.g., continuous periods of skill practice without intervals) (Cepeda et al., 2006; Hattie, 2009; Torgesen et al., 2001).

Stevens et al. (2021) reviewed several studies to evaluate how effective the Orton-Gillingham approach is for teaching reading and spelling for pupils with, or at risk of, word-level reading difficulties. This structured, multisensory approach involves dividing reading and spelling into smaller parts related to letters and sounds and gradually developing these abilities step by step. While the approach showed a small positive effect, the results were not statistically significant for key reading skills like phonics, fluency, spelling, vocabulary, or comprehension, suggesting we still need more high-quality research to be confident about its impact.

In a meta-analysis, Wanzek et al. (2018) found a positive impact of intensive (i.e., provided for 100 or more sessions) early reading interventions for children aged 5 to 9 with or at risk of reading difficulties. The reading interventions in this meta-analysis included:

1. Early Reading Intervention (ERI) programme targets students at risk of reading difficulties, supplementing classroom instruction with lessons focused on phonological awareness, phonics, and basic writing skills.

2. The Responsive Reading Instruction (RRI) programme is an early intervention programme that combines phonemic awareness, phonics, fluency, vocabulary, and comprehension strategies. This programme emphasises continuous assessment to inform instructional decisions in a dynamic and adaptive way (Simmons et al., 2008). The programme consists of five lesson components designed to be implemented within a 40-min lesson. Teachers provide direct, explicit instruction in phonics skills and text-reading strategies, as well as modelling and instructional scaffolding as students apply these skills and strategies while reading and writing connected text. Due to the continuous assessment and decision-making components involved in this intervention, most studies have included specific teacher training or researcher supervision in implementation.
3. Synthetic phonics is a method of teaching reading that emphasises explicit instruction in how graphemes (letters or letter combinations) correspond to phonemes (speech sounds), and how these phonemes can be blended (synthesised) to decode words (Johnston & Watson, 2007). It follows a systematic and incremental approach, typically beginning with simple, regular sound-letter correspondences and progressing to more complex ones, with the goal of enabling pupils to decode unfamiliar words independently through blending. When supplemented with an Orton-Gillingham approach it includes multisensory techniques (visual, auditory, and kinaesthetic).
4. Reading Mastery: Developed by Engelmann and Bruner (1988), this programme is a direct instruction method that includes scripted lessons to teach reading skills, focusing on decoding, fluency, and comprehension. It is designed for early learners and uses a highly structured approach.
5. Corrective Reading is similar to Reading Mastery, this programme focuses on improving fluency and comprehension in struggling readers through systematic, step-by-step instruction. It includes a range of exercises aimed at decoding, vocabulary, and text comprehension.
6. Sound Linkage programme is a phonics-based approach that supports students in learning letter-sound correspondences and blending sounds to form words. It integrates speech, reading, and writing exercises to reinforce skills.
7. Sound Partners is a reading intervention programme designed for young children, especially those with reading disabilities. It focuses on phonological awareness, letter-sound correspondence, and word decoding through one-on-one or small group sessions.
8. Early Steps is a programme focused on early literacy development, specifically for preschool and early primary school students. It includes activities designed to foster phonemic awareness, letter recognition, and basic writing skills.

9. Read, Write, and Type is a programme that combines reading and writing skills with the use of technology. It is designed for students with dyslexia and helps them develop phonological awareness, spelling, and typing skills through interactive lessons.
10. The Lindamood-Bell programmes are designed to improve reading and comprehension by focusing on sensory-cognitive processing. These programs use multisensory techniques to help students process language more effectively, targeting areas such as phonemic awareness, language comprehension, and fluency.

Wanzek et al. (2018) found that the positive effects of the interventions did not appear to differ by group size or hours of intervention. However, given that some previous research has found that decreasing group-size is one effective way to increase intervention intensity and improve students' response to intervention, the authors call for further research investigating differences in group-size. The meta-analysis also highlighted the lack of research on individualised interventions compared to the research on manualised interventions with prescriptive lessons and materials.

Effective early reading support strategies summary

- Systematic phonics instruction
- Oral language interventions
- Explicit instruction in phonological awareness, decoding, and sight word instruction

Interventions for older learners with word-reading difficulties

Older learners (ages 8 to 18) with dyslexia or other literacy difficulties may continue to struggle with accurate and fluent word reading skills. One meta-analysis (Boucher et al., 2024) investigated word-reading interventions across 22 studies for children aged 8 and older who had word-reading difficulties (not necessarily with a diagnosis of SpLD). Interventions were targeted multicomponent (e.g., including vocabulary, reading comprehension, decoding, fluency, phonological awareness, and spelling) reading interventions delivered in small groups during school hours. In terms of dosage, the number of intervention sessions ranged from 12 to 155 over a period of 4 to 32 weeks. Sessions lasted an average of 43 minutes, with durations ranging from 10 minutes to one hour.

Findings suggested more total hours spent on an intervention resulted in better reading outcomes, specifically pseudo-word reading (i.e., decoding) and fluency, but the number of sessions or duration of sessions may not significantly impact outcomes. However, it is important to note that interventions are generally more effective when delivered with a

distributed practice approach. Multicomponent interventions are effective for older students with persistent reading difficulties, but based on findings from this study, it was not clear which instructional components are most essential, how much time should be devoted to each, and whether the order of instruction matters. While most studies in Boucher et al.'s (2024) meta-analysis included word reading as a component, no single component was linked to significantly better outcomes. The limited ability to isolate the effects of individual components was noted as a methodological limitation.

Strategies to support older learners with word reading difficulties summary

- Targeted multicomponent (e.g., including vocabulary, reading comprehension, decoding, fluency, phonological awareness, and spelling) reading interventions delivered in small groups during school hours

Reading fluency

Lee and Yoon (2017) reviewed 34 studies investigating the impact of repeated reading. Repeated reading is an instructional strategy aimed at improving reading fluency, particularly for students with reading difficulties. In repeated reading, a student reads the same passage (typically a short text between 50-200 words) multiple times (usually three to four times) until they reach a certain level of fluency (which is measured by speed, accuracy, and appropriate inflection). Repeated reading can also be delivered as a whole class strategy with paired reading.

The review found that repeated reading was effective for children with reading difficulties aged 5 and older in improving reading fluency. Positive effects on reading fluency were further improved when a listening passage preview (listening to the text being read aloud first) was incorporated alongside repeated reading strategies, especially in primary-aged children.

Reading fluency can also be supported by technology-assisted interventions. A systematic review of case studies (e.g., Mize et al., 2023) categorised technology use in fluency interventions into four groups: presenting text only on a screen (Text), providing model reading only (Read Aloud), combining text presentation with model reading (Text + Read Aloud), and combining text, model reading, and vocabulary support (Text + Read Aloud + Vocabulary Support). All approaches showed positive effects on oral reading fluency, with the strongest outcomes observed when vocabulary support was provided by offering definitions for unknown/unfamiliar words. Findings also indicated that the effects of the intervention did not differ by age, however they did differ by mode of delivery. Here, studies that used laptops or desktop computers reported more effective results compared to studies using tablets.

Reading fluency support strategies summary

- Repeated reading
- Technology-assisted interventions

Vocabulary support

Vocabulary knowledge can be effectively taught and supported as a Tier 2 intervention for children and young people with reading difficulties. One systematic review (Louick et al., 2023) found that vocabulary interventions that also incorporated motivational techniques such as goal-setting and monitoring, self-graphing (e.g., keeping a regular recording of one's ongoing scores/progress on a personal graph, either on graph paper or on the computer), using high-interest texts, and using rewards were effective for children aged 5 and older at risk of literacy or language difficulties.

Presenting new vocabulary in its written form can enhance acquisition and retention in children and young people. A systematic review (Clark & Reuterskiöld, 2021) shows that children aged 7-11 with developmental language disorder (DLD), Down syndrome, autism, and dyslexia benefit from including written words (orthographic representations) during vocabulary learning rather than with images or oral presentation alone. Studies found that presenting the written form alongside spoken input helps these children learn new words more quickly and accurately, especially in tasks like picture naming. These findings suggest that integrating written word forms into vocabulary instruction can support better word retention, and that encouraging educators on the use of strategies that make the written word a visible part of learning could be beneficial for children with these needs.

Vocabulary support strategies summary

- Incorporating motivational techniques with vocabulary teaching
- Presenting written form along with the spoken form of vocabulary

Reading comprehension

As students move into secondary school, reading comprehension demands become more challenging. They must not only decode text but also understand more specialised language and complex text structures specific to different subjects (Catts, 2022).

Our REA highlighted several techniques that have been found to be effective in improving reading comprehension for students of various ages with reading difficulties. For example, Read-aloud strategies have been effective for children aged 6 to 15 with intellectual or developmental disabilities (Alqurani & Rao, 2020). A Read-aloud strategy is when an adult (e.g., teacher or caregiver) reads a text out loud to students in a way that actively engages them with the content. This can involve questioning strategies, thinking

out loud models (like predicting, summarising, clarifying), drawing connections, or discussing unfamiliar words.

A second is explicitly teaching text structure, which involves directly showing students how different types of texts are organised (e.g., cause and effect, compare and contrast, problem and solution, or chronological order). Students are taught to use this knowledge to understand and summarise what they read. Instruction typically includes modelling, guided practice, and the use of signal words and graphic organisers to help students identify and use these structures independently.

Explicitly teaching text structure improves expository reading comprehension in adolescents with or at risk of learning disabilities, with moderately strong evidence showing large effects (Hall-Mills & Marante, 2022).

Boon et al. (2015) reviewed 12 studies on story mapping interventions for children aged 11 and older with a learning disability or related disorder (e.g., dyslexia). Story mapping is an instructional strategy used to help students understand and remember the key elements of a narrative text. This strategy involves creation of visual representations, such as a graphic organiser, that breaks down the structure of a narrative into key components such as beginning, middle, end, plot, setting, characters, conflict, etc.

Findings indicated that the use of a story map was an effective strategy to improve students' ability to recall and comprehend the key story grammar components in short, narrative story passages. Seven studies reported positive outcomes, either when story mapping was used on its own or alongside other strategies such as modelling or guided practice aimed at improving reading comprehension. Of the remaining studies, most showed moderate to slight improvements, with one reporting no significant benefit, though the authors noted possible confounding factors. Overall, the evidence supports story mapping as a helpful tool for improving narrative comprehension.

Self-questioning strategies can also be effective for reading comprehension outcomes for children with reading difficulties. One systematic review (Daniel & Williams, 2021) reported positive effects of self-questioning strategies on reading comprehension for children aged 5 to 17 who struggled with reading. Self-questioning strategies help students monitor their understanding, think about the content, and engage with the task through generating questions about the text. This strategy can also help students pause and review the text to check their understanding or apply their background knowledge in cases where they are uncertain of the answers. Techniques such as asking 'Wh' questions (e.g., who, what, when, where, and why) or generating questions about themes or main ideas can be used. These strategies are sometimes embedded within wider reading comprehension intervention programmes.

The interventions in this systematic review were delivered either in small groups or in one-to-one sessions Intervention dosage ranged from 1 to 13.5 total hours of intervention and frequency of delivery ranged from once a day to once a week, and group sizes ranging from one-on-one sessions to groups. According to this analysis the effects may improve with two or more total hours of self-questioning strategies.

In the research literature, metacognitive and multicomponent strategies (e.g., interventions with some combination of the following: explicit instruction in phonics, fluency, text structures, and vocabulary as well as development of background knowledge) are two common instructional strategies that support adolescents' reading comprehension (e.g., Ahmed et al., 2014; Fogarty et al., 2014). These strategies were compared in a meta-analysis of interventions for struggling readers aged 12 to 18 (Sohn et al., 2023). Other strategies were also investigated including instruction that focuses exclusively on phonics, peer-mediated strategies, or computer-adapted instruction (CAI). Metacognitive strategies showed the most effective reading comprehension outcomes. The researchers also tested whether factors like text type (expository or narrative), instructional setting (mainstream versus specialist classrooms), and group size (small groups) influenced how effective the reading interventions were. None of these factors were found to be significant moderators, meaning they did not make a meaningful difference in how well the interventions worked.

In a meta-analysis, Scammacca et al. (2015) investigated any type of reading instruction, including word study, fluency, vocabulary, reading comprehension, or multiple components of reading instruction for children aged 9 and older with reading difficulties. They found that vocabulary and comprehension-based interventions tended to be more effective than fluency or other types of reading support, especially for improving comprehension skills.

Both Scammacca et al. (2015) and Sohn et al. (2023) found that relatively shorter intervention durations (i.e., up to two months) demonstrated better outcomes in reading comprehension than longer interventions for children and young people aged 9 to 21. However, this result should be interpreted with caution, as these findings may be confounded by other factors. These include differences in how students are classified as 'struggling readers' across studies, the type of intervention and its intensity, and the reliance on standardised measures to measure reading comprehension (e.g., standardised tests versus curriculum measures). Given this, it's not clear based on the studies found in this REA whether shorter versus longer reading comprehension interventions are more effective.

Effective reading comprehension support strategies summary

- Read-aloud
- Explicit teaching of text structure
- Story mapping
- Self-questioning strategies and thinking out loud
- Metacognitive and multi-component approaches for older learners (e.g., including vocabulary, reading comprehension, decoding, fluency, phonological awareness, and spelling)

Morphological awareness

Morphological awareness (MA) is the ability to recognise and manipulate morphemes, the smallest units of meaning in language, including base words, prefixes, and suffixes (Carlisle, 2000; Apel, 2014). For example, the inflectional suffix ‘ing’ may be added to base words to indicate progressive tense, as in ‘singing’. In the multimorphemic word ‘reaction’, the base morpheme ‘act’ means ‘do’, the prefix ‘re’ adds a second meaning unit, ‘again/against’ and the derivational suffix ‘ion’ adds a third, transforming the verb to an abstract noun.

Morphological awareness typically begins to develop as pre-school children become aware of inflectional rules in spoken language and is important for the development of literacy skills including word reading, reading comprehension, and spelling (e.g., Kirby et al., 2012; Pittas & Nunes, 2012; Levesque et al., 2021). A growing body of literature suggests that understanding morphemes significantly correlates with reading proficiency across both child and adult populations (see Rastle, 2018, for a review).

One systematic review (Brady & Mason, 2024) investigated morphological awareness interventions targeting reading and writing outcomes (i.e., decoding, reading comprehension, vocabulary, spelling, and writing) in students aged 5 to 18 with literacy difficulties. The morphological awareness strategies included strategies that focused on affix and root word identification, segmenting, and word-building activities. All 10 studies included identification tasks such as word sorts, decoding, or initial instruction that involved identification of word parts of morphologically complex words through oral or written strategies. Intervention duration ranged from 9 days (Wolter & Dilworth, 2014) to approximately 15 weeks and each study had a set intervention time that ranged from 25 to 45 min per session.

Four of the ten studies reviewed by Brady and Mason (2024) focused on developing word segmenting skills through morphological awareness strategies. For example, Harris et al. (2011) introduced a generative morphological analysis word mapping approach,

where students broke words into prefix, root, and suffix to derive meaning, and compared it to a non-generative strategy. Other studies (Apel et al., 2013; Apel & Diehm, 2014; Brimo, 2016) used hands-on and written tasks where students added or removed affixes using letter blocks or identified affixes in printed word lists. To support word building, eight of the studies included interactive oral or written activities. Several studies also employed tasks such as “Say it another way,” prompting students to change a base word into a different morphological form (e.g., "to dance right now" becomes "dancing"). Other studies used manipulatives or games to teach affixation, such as building words with letter blocks (Good et al., 2015), spelling games using morphological patterns (Wolter & Dilworth, 2014), or guided spelling tasks that incorporated prompts for suffix rules (Kirk & Gillon, 2009). These approaches aimed to strengthen students’ morphological awareness by explicitly teaching the structure and formation of complex words.

For primary aged children, the morphological awareness interventions led to positive outcomes in decoding, reading comprehension, spelling and vocabulary after relatively short interventions (8 to 39 sessions). For secondary aged students, morphological awareness interventions led to positive outcomes in vocabulary, spelling and writing composition. However, only one study in the review included learners aged 11 to 14 (upper primary to lower secondary), indicating that further research is needed to strengthen the evidence base for this age group.

Morphological awareness strategies to support reading and writing summary

- Teaching affix and root word identification
- Segmenting
- Word-building activities
- Morphological analysis
- Word mapping

Motivation and self-regulation strategies for literacy

As previously discussed, motivation and attitudes about reading can have an impact on literacy skills. If a child is not motivated to read or holds negative attitudes about reading, this may reduce their interest in reading and limit their exposure and engagement with texts, which in turn can hinder literacy development. Promoting self-determination and self-advocacy in learners can help address these challenges by encouraging children and young people to take an active role in their own learning. When students are supported to set goals and understand their own learning needs, they are more likely to develop positive attitudes toward reading and to persist when faced with difficulties. This, in turn, can foster greater confidence, autonomy, and sustained engagement in literacy-

related activities. Three studies in our REA investigated motivation, self-determination, and self-regulation strategies in reading interventions.

Cho et al. (2023) investigated whether incorporating motivational strategies and supports into reading interventions influenced reading outcomes for children aged 5 to 11 with dyslexia. Across 53 reading intervention studies that were reviewed, most interventions included general motivational supports (e.g., such as game-like activities, peer collaboration, rewards, and goal setting) and only a small proportion explicitly taught motivational strategies. In this context, motivational supports are interest-based elements that support autonomy whereas instructional strategies align with self-regulatory instruction and goal/attribution training approaches (McBreen & Savage, 2021). Importantly, interventions that included direct motivational strategy instruction led to larger improvements in reading outcomes, particularly in word reading, compared to those that used only general supports or none at all. This highlights the added value of explicitly addressing motivation as part of reading intervention design for younger learners.

Motivational strategy instructional interventions can be embedded within reading instruction and teach students to be more goal-directed by incorporating goal setting, asking learners to monitor progress towards their goals or performance. Growth mindset beliefs about reading are encouraged and learners are taught to engage in self-talk to internalise positive attitudes towards reading.

Similarly, Didion et al. (2015) found that interventions that incorporated one or more components of self-determination skills positively impacted a range of reading outcomes (i.e., reading fluency, reading comprehension, reading accuracy and vocabulary) for children aged 5-11 with or at risk for learning disabilities. In addition, Berkeley and Larsen (2018) found that reading comprehension interventions that included self-regulation strategies were beneficial in improving reading comprehension skills in adolescents with reading difficulties.

Self-determination skills may involve goal setting, decision-making, self-advocacy, self-regulation, self-monitoring, or self-awareness. In the studies included in Didion et al.'s (2015) review, the most common strategies were goal setting for performance (e.g., such as the number of vocabulary words to learn or comprehension questions to complete) and to self-monitor their progress, often by tracking their results on checklists, graphs, or self-recording tools. Some interventions also included self-evaluation tasks, where students judged their understanding of words or reflected on their on-task behaviour, sometimes reinforced through positive feedback or rewards (e.g., points, free time, or reinforcers). Many interventions used explicit strategy instruction, such as self-questioning or mnemonics (e.g., Think Before Reading, Think While Reading, and Think After Reading for comprehension or identifying main ideas), and guided students through structured steps for using these strategies effectively.

Several approaches also included visual aids or prompts (e.g., checklists or desk cards) that were gradually faded to promote independence. Students were also encouraged to develop attribution statements (e.g., "believe," "stay with it") to support motivational self-talk during reading tasks. Some interventions incorporated self-contracts, choice-making, or reinforcer systems, allowing students to select rewards based on their goal completion. Overall, these strategies emphasised goal setting, self-monitoring, self-reflection, and reinforcement, helping students take more ownership of their learning while building persistence and motivation in academic tasks. However, this review also highlights a significant gap in research on broader self-determination skills for this age group.

Motivational and self-regulation strategies to support literacy summary

- Embedding motivational strategies into reading interventions
- Game-like activities
- Peer collaboration
- Use of rewards
- Goal setting
- Self-talk
- Self-monitoring progress
- Use of feedback
- Check lists or desk cards
- Self-questioning

Numeracy support

Children and young people with general and specific learning disabilities or at-risk for maths difficulties may demonstrate challenges with mathematical facts and applying procedural knowledge. They may struggle with areas such as early number concepts, number combinations, and place value which can lead to errors in procedural computation (i.e., step-by-step problem solving) and higher-level mathematics (e.g., Cirino et al., 2007; Zheng et al., 2011). They may also demonstrate challenges with cognitive processes and executive functions which can further impact their maths skills (e.g., Fuchs et al., 2011). However, research suggests that effective mathematics intervention may help children and young people achieve age-appropriate levels of achievement (Geary et al., 2013; Re et al., 2014).

A synthesis of 15 recent reviews and meta-analyses included in our REA highlight the growing evidence base for effective mathematics interventions for students with general learning difficulties, mathematics difficulties, and other developmental disorders, including intellectual and developmental disabilities. This section is organised thematically, starting with evidence on targeted mathematics instructional approaches from multiple systematic reviews and meta-analyses, then moving to general problem-solving strategies, followed by word-problem solving interventions.

Mathematics instructional approaches

In terms of targeted intervention delivery strategies, a large meta-analysis of 25 studies compared various formats of mathematics instruction, either one-to-one or in small groups, for children with mathematics difficulties (Dennis et al., 2016). The interventions included in this review were designed to improve academic mathematics skills; however, the outcomes varied across studies, and the specific results of each individual study were not reported in detail. Instruction in the studies was provided across a number of domains including algebra, basic facts, computation, early numeracy, fractions, general math proficiency, and word problems. The majority of the intervention studies were for primary-aged students with few studies done at older primary-age (i.e., age 5-6) level and none of the studies at the secondary-level. The findings demonstrated that peer-assisted learning approaches were most effective, followed by interventions using explicit teacher-led instruction. Peer-assisted learning strategies are interventions where a student would help another student or group of students to learn a particular concept. Intervention effects were larger for primary children aged 6 to 11 than those for younger children.

Providing instructional recommendations to teachers (which were not specified in the original study) and providing students with data (e.g., feedback on maths performance), and the use of technology (e-books and computer-assisted instruction) were also effective in improving maths outcomes but to a lesser extent than peer-assisted and explicit teacher-led instruction. Results also suggested that intervention effects were larger when delivered by researchers compared to teachers and teaching assistants, meaning that interventions were more effective when delivered by researchers. However, the review included few studies where teachers and teaching assistants delivered the interventions. This suggests potential challenges in scaling up the interventions, with Dennis et al. (2016) recommending conducting further research on large-scale implementations.

A second systematic review yielded similar findings, showing that peer-assisted learning and explicit teacher-led instruction in mathematics produced strong positive effects. In contrast, approaches such as schema-based instruction (i.e., an instructional approach used to teach mathematical problem solving, particularly word problems, by helping students recognise and apply problem schemas, underlying structures or patterns

common to certain problem types), prompting, and scaffolding were also effective but to a lesser extent (Bowman et al., 2019).

For students aged 11 to 18 with maths difficulties, a systematic review by Myers et al. (2021) found that the most effective instructional techniques in maths included cognitive-based instruction, technology-based interventions, and the use of visual representations integrated with cognitive strategies. Cognitive-based instruction used cognitive or meta-cognitive techniques, such as reasoning strategies, self-monitoring strategies (e.g., think-aloud), or mnemonic devices to solve problems. Visual representation included the use of concrete (e.g., manipulatives), semi concrete (e.g., pictures and diagrams), or abstract (e.g., symbols) representations to learn concepts. In contrast, this study found no positive effect for maths improvements for studies using schema-based instruction. However, this could have been due to the relatively low number of studies using this strategy. The review also found that long-term interventions (i.e., those lasting over 30 sessions) produced larger effects than those implemented for fewer than seven sessions (i.e., short term).

In addition, another systematic review also suggested explicit instruction and the use of heuristics (i.e., general problem-solving strategies or rules of thumb such as simplifying the maths problem) were effective for older students aged 9 to 12 (Stevens et al., 2018). They also found that interventions lasting over 15 hours and those focused on fractions showed significantly better outcomes in maths performance. However, interventions targeting generalised mathematical skills (e.g., basic operations) or algebraic expressions showed less impact, indicating the importance of targeting specific mathematical content for optimal results.

Several other studies suggest digital-based interventions consistently lead to moderate to strong improvements in various mathematics performance measures (Benavides-Varela et al., 2020; Küçükalkan et al., 2019), word-problem solving skills (Kim & Xin, 2022; Myers et al., 2023), and fact fluency among students with mathematics difficulties (Cozad & Riccomini, 2016). These interventions often focus on fluency in basic operations and vary in structure, timing, feedback, and platform (e.g., tablet vs. computer) and can be delivered to studies across various ages from 5 and older. Techniques included videogames, computer-assisted instruction in word-problem solving, and digital-based tutorials/drilling. Games and interactive tools that encourage active reflection, adaptive feedback, and cross-level skill transfer have been particularly beneficial. Given the findings of Dennis et al. (2016), these digital-based interventions may be more effective for older compared to younger students.

Finally, a review by Spooner et al. (2018) found that, similar to children and young people with mathematics difficulties, those with more general learning difficulties also benefit from systematic instruction, instructional procedures of technology-aided instruction, graphic organisers, manipulatives, and explicit instruction (Spooner et al., 2018).

Instructional approaches to support maths summary

- Peer-assisted learning
- Explicit instruction
- Use of technology
- Reasoning strategies
- Self-monitoring strategies (e.g., think-aloud)
- Mnemonics
- Use of visual representations
- Longer interventions (e.g., over 15 total hours)

General maths problem-solving interventions

General problem solving in maths refers to the application of broad, transferable strategies to tackle unfamiliar or non-routine problems, rather than relying solely on memorised procedures or algorithms. It involves skills such as understanding the problem, devising a plan, carrying out the plan, and evaluating the solution. These strategies help learners make sense of problems, think flexibly, and apply reasoning across various mathematical contexts. In terms of problem-solving, representation of problems as an instructional strategy was found to be effective for children and young people with learning difficulties or at-risk for mathematics difficulties in two systematic reviews (Bowman et al., 2019; Jitendra et al., 2016).

1. ‘Representation of mathematical problems’ as a strategy refers to the use of visual, verbal, symbolic, or physical models to represent abstract concepts such as those in mathematics. This may include physical materials that can be manipulated by children and young people, pictures or diagrams, real-life situations, spoken language, or written symbols (Lesh et al., 1987). These strategies help students understand and better interpret mathematical problems in order to solve them. It is particularly useful for students with learning difficulties or those with other types of SEND who may struggle with abstract thinking, such as students with SEMH, dyscalculia, or general learning difficulties. Representations is an effective approach as it helps in reducing working memory and attentional demands to help development of abstract reasoning.

This strategy was most used for word problems but also supported learning of fractions and basic maths facts. This strategy can be delivered to small-groups or one-to-one as a targeted intervention or to the whole class as a universal strategy. While most of the

studies included in this review investigated the use of representation in primary-aged children, there were some studies suggesting this was effective for older children as well. However, interventions that combined visual models with other strategies (e.g., priming problem structures or cognitive scaffolding) produced stronger effects than those using visual models alone for secondary students (Jitendra et al., 2018).

2. Concrete–Representational–Abstract (CRA) is an instructional approach that systematically uses representation. CRA is a three-phase instructional strategy used to teach mathematical concepts by moving from concrete to abstract understanding. First, children and young people are presented with concrete representations such as physical objects to model the concepts. Then they transition to drawings or visual representations and finally they move to working with numbers and symbols at the abstract level.

General maths problem-solving interventions summary

- Representation of mathematical problems
- Concrete-representational-abstract approach

Word-problem solving interventions

Word problem solving involves the use of mathematics knowledge and procedure as well as language and reading skills. All these skills can be difficult for children and young people with different types of cognition and learning challenges.

For secondary students, the most effective interventions found for word-problem solving were those that balance procedural instruction with conceptual understanding, and those that offer opportunities for students to generalise their learning to meaningful, real-world situations (Hwang & Riccomini, 2016; Myers et al., 2023). For both primary and secondary-aged students, explicit strategy instruction, schema-based instruction and model-based problem solving as well as technology-based interventions were effective. Findings from a review by Myers et al. (2023) however, found that direct instruction and diagramming instruction were not effective word problem solving performance. This could be due to the limited number of studies investigating these techniques.

These interventions reduce cognitive load by breaking down the problem-solving process into manageable phases, following a structured approach and explicitly teaching students cognitive and metacognitive strategies. Common steps include stages such as read, paraphrase, visualise, hypothesise, estimate, compute, and check, helping students internalise these processes for automatic use in more complex problems. Strategic prompts such as cue cards, mnemonic devices, and structured worksheets are often used to reinforce the routine. Metacognitive strategies are also integrated to support students in self-monitoring and regulating their thinking.

Word-problem solving interventions summary

- Explicit strategy instruction,
- Schema-based instruction
- Model-based problem solving
- Technology-based interventions
- Reducing cognitive load with metacognitive strategies and mnemonics

Physical activity interventions

Psychomotor skills involve the brain's ability to process information and translate it into coordinated physical actions. They skills are crucial for tasks that require both mental planning and physical execution and are measured by gross motor skills, essential for overall movement, coordination, balance, strength and endurance. A systematic review by Fathi Azar et al. (2023) examined the impact of perceptual-motor exercises and physical activity on the cognitive, motor, and academic skills of children with SpLD or general learning difficulties. The review included ten studies with a total of 483 participants (251 intervention, 232 control) and followed PRISMA guidelines, assessing methodological quality and risk of bias. The findings showed that perceptual-motor interventions had a significant positive impact on cognitive skills, with seven out of eight studies reporting improvements in working memory, attention, and information processing speed. Various intervention types, including music training, aerobic exercises, and perceptual-motor activities, contributed to enhanced executive functions.

Motor skills also showed notable improvements, as all five studies in Fathi Azar et al's. (2023) review assessing this area found significant gains in fine and gross motor skills, postural stability, and dexterity. Activities such as ball skills exercises, occupational therapy interventions, and balance-focused training were particularly effective. In terms of academic performance, four out of five studies demonstrated positive effects, with interventions such as aerobic exercises and occupational therapy-based activities leading to gains in reading, spelling, and mathematics. However, findings related to mental health outcomes were inconsistent, with only one out of three studies reporting improvements in self-esteem and interpersonal relationships following perceptual-motor interventions.

Despite these promising results, the review by Fathi Azar et al. (2023) identified several limitations. The small number of studies, moderate methodological quality, and high risk of bias caution against overgeneralising the findings. Some studies lacked randomisation, control groups, or standardised assessment tools, limiting the reliability of the results. As a result, further high-quality, large-scale studies are needed to confirm the

long-term benefits of PM exercises for children with SpLD and general learning difficulties. Overall, perceptual-motor exercises and physical activity appear to have a positive impact on cognitive, motor, and academic outcomes in children with learning disorders. However, more rigorous research is necessary to strengthen the evidence base and clarify the role of PM interventions in mental health.

Carroll et al. (2017) summarised evidence from four studies that had investigated the benefits of physical activity on attention and behaviour. They found that there was evidence that regular aerobic activity can be effective in reducing poor attention and behavioural difficulties when used alongside other interventions (which were not specified in the original study). However, the use of fiddle toys or exercise balls as seating did not have strong evidence.

Support and intervention summary

Children and young people with cognition and learning needs often face challenges in areas of maths, numeracy, reading, spelling, and writing. These difficulties are compounded by challenges in cognitive processes and executive functions. Research has shown that effective targeted interventions can help students achieve age-appropriate levels of academic proficiency.

Recent reviews and meta-analyses have provided growing evidence supporting the effectiveness of various mathematics instructional approaches for students with learning difficulties. Interventions such as peer-assisted learning, explicit teacher-led instruction, and technology-based approaches have shown significant positive effects. However, some challenges remain, particularly in scaling these interventions for broader implementation, especially when delivered by teachers or teaching assistants.

For older students, cognitive-based and technology-based interventions have been particularly effective, with cognitive-based instruction showing the largest effects. Additionally, long-term interventions tend to yield larger effects than short-term ones. Digital-based interventions, such as those focusing on fact fluency, also demonstrate strong improvements in mathematics performance for students with difficulties, especially for older learners.

Mathematics problem-solving interventions, particularly those using representation strategies, have proven effective for students with learning difficulties. Visual, verbal, and physical models help students better understand and solve mathematical problems, reducing cognitive load and supporting abstract reasoning.

Research highlights the interplay of literacy skills, where struggles in areas like reading fluency can also hinder word recognition, vocabulary development, and comprehension. In practice, it is essential that literacy interventions are tailored to the specific needs of

each learner. Dyslexia, in particular, affects skills such as phonological awareness, decoding, and phonics, which are essential for reading development. Early interventions that target phonological awareness, phonics, and decoding processes are more impactful at the primary level, helping to prevent later difficulties. However, ongoing support for fluency, vocabulary, and comprehension is also necessary, particularly for older learners who may still benefit from phonological-based interventions.

A variety of early interventions have been shown to support decoding and phonological awareness, particularly for younger learners. These interventions often incorporate explicit instruction, modelling, and interactive elements. Multicomponent strategies, which address vocabulary, comprehension, and decoding together, have been found to be particularly effective for older students with reading difficulties.

Emerging strategies, including self-regulation and motivational interventions, can also improve literacy outcomes by fostering goal-setting and self-monitoring, which are essential for long-term progress. Though there is considerable evidence supporting these strategies, further research is needed, especially in understanding the optimal combination of instructional components and exploring the effectiveness of these approaches for different age groups and literacy difficulties.

While much of the current research has been conducted in the USA, there is a need for studies that examine how these interventions work in diverse educational contexts. Furthermore, more high-quality research is needed to address concerns regarding implementation fidelity and the long-term impact of interventions.

For mathematics interventions, there was a wide range of variability in effect sizes across studies. The small sample sizes of the included studies contributed to this variability. Many reviews did not find significant effects when only a limited number of studies investigated a particular intervention. Therefore, more research is needed on these techniques, and more balanced syntheses are required. Additionally, many studies focused on mathematics outcomes aligned with the USA curriculum, which limits the generalisability of the findings.

Executive functioning, particularly working memory, attention, and inhibition is identified as a key area that influences learning. However, direct interventions to improve working memory show limited generalisation, so it is more effective to reduce cognitive load during learning.

More research is needed to understand how to better support teachers in effectively using reading strategies. Studies have shown that interventions tend to be more effective when implemented by researchers rather than teachers, highlighting a gap in real-world application. Factors such as professional development, planning time, curriculum structure, and initial teaching quality may influence how successfully teachers implement

interventions, but these areas require further investigation. Sohn et al. (2023) also argued that more high-quality research is necessary to understand how different reading interventions work across various content areas and text types at the secondary level. Specifically, studies should examine whether certain strategies, such as summarisation or inferencing, are more effective for particular subjects or text structures. This is especially important given evidence suggesting that different metacognitive strategies may have varying impacts depending on students' age and reading needs.

To conclude, targeted and systematic mathematics interventions, particularly those incorporating cognitive, visual, and digital strategies, can significantly improve the mathematics outcomes for children and young people with learning difficulties. However, further research is necessary to optimise these approaches, particularly in terms of scaling interventions and ensuring their sustainability in diverse educational contexts.

Literacy interventions for children and young people with cognition and learning needs should be individualised and dynamic, focusing on the specific needs of each learner. Moreover, future research should continue to refine our understanding of how these interventions can be effectively implemented in diverse educational contexts and across various stages of learning.

Conclusions

This review aimed to identify effective methods for the identification, support, and collaborative practices for children and young people with cognition and learning needs in mainstream education.

The evidence reviewed highlights the crucial role that mainstream educators play in the early identification and support of children and young people with cognition and learning difficulties. While formal diagnosis and complex assessments require trained specialists, classroom teachers are often the first to notice emerging challenges and initiate referrals for further support. Teachers can use accessible screening tools, structured observations, and informal assessments to monitor progress and identify potential needs. However, the effectiveness of this early identification process is limited by several factors, including inconsistent access to practical tools, variability in teacher preparedness, and limited coverage of SEND within initial teacher training programmes. There is a clear need to strengthen teachers' capacity through ongoing professional development and greater access to specialist input. Collaborative working with speech and language therapists, educational psychologists, and other professionals is also critical in forming a complete picture of a learner's needs and tailoring appropriate support.

In terms of intervention, the evidence base supports the use of targeted and structured approaches to improve outcomes in literacy and mathematics for learners with cognition and learning difficulties. In literacy, early interventions that focus on phonological awareness, decoding, and phonics are especially effective at the primary level. For older learners, multicomponent interventions addressing fluency, vocabulary, and comprehension have been shown to improve reading outcomes. Additional strategies such as metacognitive training, self-regulation, and motivational approaches can further enhance literacy development. However, these interventions must be tailored to the learner's individual profile and delivered consistently over time to be effective. There is also a need for more high-quality research that evaluates these approaches across different text types, subject areas, and age groups, particularly at the secondary level.

In mathematics, a range of instructional strategies show promise for students with learning difficulties. Effective approaches include explicit teacher-led instruction, peer-assisted learning, cognitive-based methods, and digital interventions, particularly those focusing on fact fluency and representation strategies. Visual, verbal, and physical modelling of problem-solving steps appears to support learners in navigating abstract mathematical concepts. Nonetheless, evidence also points to persistent challenges in scaling these interventions for widespread classroom use, especially when delivered by non-specialist staff. Many of the available studies are small-scale and USA-based, which limits the generalisability of findings to other contexts, including the UK.

A recurring theme across both literacy and mathematics is the importance of reducing cognitive load during instruction. While interventions targeting executive functions such as working memory have shown limited direct generalisation, strategies that structure learning and provide scaffolding appear more effective. Interventions also tend to yield better outcomes when delivered by researchers or highly trained specialists, rather than general teaching staff, suggesting a need for improved support and training for teachers in implementation.

To conclude, while there is strong evidence supporting a range of structured, targeted interventions for learners with cognition and learning difficulties, effective implementation depends on multiple factors. These include sufficient teacher training, access to appropriate tools and resources, interdisciplinary collaboration, and sustained professional development. Interventions must be individualised, developmentally appropriate, and feasible for use in mainstream settings. Future research should focus on understanding how to optimise the delivery of these strategies in diverse educational environments and across different stages of learning.

Appendices

Appendix A: Search terms (PICOS criteria)

We conducted 15 separate searches across five rapid review categories, each focused on a distinct population: SEMH, SLCN, autism, sensory and/or physical needs, and cognition and learning. For each population, three searches were performed, focusing on: identification terms, support terms, and working with others. The intervention, comparison, and study type remained consistent across all searches, while the population and outcome terms varied to capture the unique characteristics of each group. This approach ensured a comprehensive examination of the research literature across the different populations. PICOS stands for: (1) Population; (2) Intervention; (3) Comparison; (4) Outcomes; and (5) Study type.

Population:

- Population terms: "adolescent" OR child* OR "children and young people" OR kid* OR "post 16" OR pupil* OR "school aged" OR student* OR teen* OR "young learner*" OR "young people" OR "young person" OR youth
- Educational setting terms: "alternat* educat*" OR class* OR "class* setting" OR "comprehensive school*" OR "early year*" OR educat* OR elementary OR "elementary school*" OR "extra-curricular setting*" OR "further educat*" OR "further educat* setting*" OR "grammar school*" OR "high school" OR "higher educat*" OR inclus* OR kindergarten OR "learning environment*" OR mainstream* OR "middle school*" OR nursery OR preschool OR "primary educat*" OR "primary school*" OR reception OR "remedi* class*" OR "school setting" OR school* OR "secondary education*" OR "secondary school*" OR "special educat*" OR "university" OR "whole school" OR "independent school"
- General SEND terms: SEND OR SEN OR "special educat* need*" OR "special need*" OR "learning difficult*" OR "learning disab*" OR "learning difference" OR "additional need*" OR impair* OR disorder* OR neurodivergent OR "additional learning need"
- Cognition and learning terms: DCD OR SpLD OR attention OR "cogniti* difficult*" OR "development* disab*" OR "developmental co-ordination disorder" OR dyscalcul* OR dyslexi* OR dyspraxia OR "general learning difficult*" OR "handwriting difficult*" OR "handwriting impair*" OR "learning difficult*" OR "literacy difficult*" OR "math* anxiety" OR "math* difficult*" OR “mild learning difficult*” "moderate learning difficult*" OR "numeracy difficult*" OR "profound and multiple learning difficult*" OR "reading difficult*" OR "reading impair*" OR "severe learning

difficult*" OR "specific learning difficult*" OR "specific learning disab*" OR "writing difficult*"

Intervention:

- Identification terms: assess* OR "assessment app*" OR "assessment tools" OR "behavio* checklist*" OR checklist OR "class* assess*" OR "classroom observation" OR "cognitive assess*" OR "computer* app" OR "curriculum-based measure" OR diagnos* OR "dynamic assessment" OR "early screening tools" OR "educational assessment tool*" OR evaluate OR "formal assess*" OR "formative assess*" OR "graduated approach" OR identif* OR "informal assess*" OR measure OR "multi-disciplinary assessment" OR MTSS OR "multi-tiered system of supports" OR "neuro* assess*" OR observ* OR "parent* report" OR "pupil observation" OR "response to intervention" OR RTI OR screen* OR "self-assessment" OR "self-report" OR "smartphone app*" OR "standard* test*" OR "student observation" OR "tablet app*" OR "teacher judgment*" OR "teacher observation" OR tool* OR “performance-based”
- Support terms: "classroom environment" OR "SEN support" OR "SEND support" OR SWPBS OR accommodat* OR adaptat* OR approach OR "assistive tech*" OR "classroom interve*" OR "collaborative teach*" OR curriculum OR "curriculum adapt*" OR "differentiat* instruction" OR “digital learning” OR "early interven*" OR "education* program*" OR "education* support" OR "evidence-based interven*" OR "evidence-informed interven*" OR "exam access arrangement*" OR "exam accommodat*" OR "graduated approach" OR "group intervention" OR "high-quality instruct*" OR "high-quality teach*" OR inclus* OR "inclusive education" OR "inclusive practice" OR "individual support" OR "individual* education plan*" OR "instruct*" OR interven* OR integrat* OR "mainstream class* support" OR "mainstream education" OR “mainstream environment” OR “multimedia learning environment” OR "multi-tiered system* of support" OR "one-to-one" OR "parental support" OR pedagog* OR "peer support" OR personali*ed OR provision OR remediat OR "school support service*" OR "school-based" OR "special* interven*" OR "special* support" OR "specialist teach* support" OR support* OR strateg* OR "targeted interven*" OR "target* teach* strateg*" OR targeted OR "targeted support" OR teach* OR "teach* adaptation*" OR "teach* principle*" OR "teach* strateg*" OR "teach* approach" OR therapy OR "tier 1 interven*" OR "tier 1 support" OR "tier 2 interve*" OR "tier 2 support" OR "tier 3 interven*" OR "tier 3 support" OR treat* OR "universal design" OR "universal interven*" OR "universal provision" OR "universal support" OR "whole-class support" OR "whole-class teaching"
- Working with others terms: collabor* OR parent* OR carer OR caregiver OR famil* OR specialist* OR “specialist teacher” OR teacher OR educator OR TA OR “teaching assistant*” OR “support staff” OR “educational psychologist*” OR EP OR

SLT or SLP or “speech and language therapist*” OR “speech and language pathologist*” OR “speech therapist” OR “speech pathologist” OR “health visitor” OR HV* OR “Ed Psych” OR counsel* OR “mental health support workers” OR “child and adolescent mental health service” OR CAHMS OR psychologist* or therapist* OR “learning support assistant” OR LSA OR “communication support worker” OR QTOD OR QTMSI OR QTVI OR “co-production” OR “joint working” OR “healthcare professional” OR “personal carer” OR “occupational therapist” “Inter-professional collaboration” OR IPC OR expert OR clinician OR nurse

Comparison:

- Left blank to include studies without comparison groups

Outcome:

- Identification terms: N/A - Not needed for identification terms as there is not always a specific outcome
- Behavioural, Inclusion, Motivation, and Engagement terms: attendance OR "behavio* outcomes" OR "behavio* regulation" OR "behavio* improvement" OR "cognitive development" OR "communication skills" OR criminal OR economic OR employment OR engage* OR financial OR "functional independence" OR "functional skills development" OR "access to learning" OR "improvement in learning" OR "inclusive classroom" OR "increase* inclusion" OR "independent living" OR independent* OR "mental health outcomes" OR motivate* OR offend OR "prosocial behavio* " OR "reduce* learning barriers" OR “reduce* symptom*” OR "self-regulat*" OR "school performance" OR "school retention" OR "social inclusion" OR "social-emotional development" OR "teacher perceptions of student progress" OR “well-being” OR workplace
- Educational outcomes (General): "academic achievement" OR "academic progress*" OR "academic attainment" OR "academic measure" OR "academic performance" OR “additional learning support*” OR "educat* achievement" OR "educat* assess*" OR "educat* attainment" OR "educat* measure" OR "educat* outcome*" OR "educat* performance" OR "educat* progress" “executive function*” OR "functional skill* develop*"OR "improve* learning" OR learn* OR "learning progress" OR "problem solving" OR "reduced learning barriers" OR "school outcome*" OR "school performance" OR "school retention"
- Literacy outcomes: read* OR literacy OR “letter recognition” OR “letter-sound knowledge” OR “word reading” OR phonic* OR phonolog* OR “reading comprehension” OR “reading accuracy” OR “reading fluency” OR “reading delay*” OR “print knowledge” OR decod* OR “alphabet knowledge” OR “listening comprehension” OR “word recognition” OR “sentence completion”

- Writing outcomes: writ* OR literacy OR punctuation OR spelling OR “sentence writing” OR “free writing” OR “early writing” OR “emergent writing” OR “guided writing” OR “writing fluency” OR handwriting OR “interactive writing” OR “letter typing” OR “sentence completion”
- Mathematics outcomes: math* OR numer* OR numb* “number sense” OR arithmetic* OR geomet* OR shape OR calcul* OR algebra OR counting OR addition OR subtraction OR multiplication OR division OR fractions OR statistics* OR “place value” OR “math* competenc*” OR “math* concept*” OR “math* knowledge”
- Working with others terms: collaboration* or partnership* or co-practice* or multidisciplinary* or transdisciplinary or interdisciplinary

Study type:

- Review type: review OR “systematic review” OR “meta-analysis” OR “narrative review”

References

*Indicated studies retrieved in rapid review

AHMED, Y., WAGNER, R.K. AND LOPEZ, D., 2014. Developmental relations between reading and writing at the word, sentence, and text levels: a latent change score analysis. *Journal of educational psychology*, *106*(2), p.419.

AL OTAIBA, S. AND FUCHS, D., 2002. Characteristics of children who are unresponsive to early literacy intervention: A review of the literature. *Remedial and Special education*, *23*(5), pp.300-316.

*ALQURAINI, T.A. & RAO, S.M., 2020. Developing and sustaining readers with intellectual and multiple disabilities: A systematic review of literature. *International Journal of Developmental Disabilities*, 66(2), pp.91–103.

ANDERSSON, U., 2008. Mathematical competencies in children with different types of learning difficulties. *Journal of Educational Psychology*, *100*(1), p.48.

ANDERSSON, A., 2010. Can a critical pedagogy in mathematics lead to achievement, engagement and social empowerment. *Philosophy of Mathematics Education Journal*, *25*, pp.1-25.

APEL, K., 2014. A comprehensive definition of morphological awareness: Implications for assessment. *Topics in Language Disorders*, *34*(3), pp.197-209.

APEL, K. AND DIEHM, E., 2014. Morphological awareness intervention with kindergarteners and first and second grade students from low SES homes: A small efficacy study. *Journal of Learning Disabilities*, *47*(1), pp.65-75.

ASH, G.E., KUHN, M.R. AND WALPOLE, S., 2008. Analyzing “inconsistencies” in practice: Teachers' continued use of round robin reading. *Reading & Writing Quarterly*, *25*(1), pp.87-103.

BADDELEY, A., 2020. Working memory. *Memory*, pp.71-111.

*BENAVIDES-VARELA, S., ZANDONELLA CALLEGHER, C., FAGIOLINI, B., LEO, I., ALTOE, G. & LUCANGELI, D., 2020. Effectiveness of digital-based interventions for children with mathematical learning difficulties: A meta-analysis. *Computers & Education*, 157, pp.1–15.

*BERKELEY, S. & LARSEN, A., 2018. Fostering self-regulation of students with learning disabilities: Insights from 30 years of reading comprehension intervention research. *Learning Disabilities Research & Practice*, 33(2), pp.75–86.

BERNINGER, V.W. AND AMTMANN, D., 2003. Preventing written expression disabilities through early and continuing assessment and intervention for handwriting and/or spelling problems: Research into practice.

BIANCAROSA, G. AND SNOW, C.E., 2004. *Reading next: A vision for action and research in middle and high school literacy: A report from Carnegie Corporation of New York*. Alliance for Excellent Education.

BISHOP, D.V. AND SNOWLING, M.J., 2004. Developmental dyslexia and specific language impairment: Same or different?. *Psychological bulletin*, *130*(6), p.858.

*BOON, R.T., PAAL, M., HINTZ, A.-M. & CORNELIUS-FREYRE, M., 2015. A review of story mapping instruction for secondary students with LD. *Learning Disabilities: A Contemporary Journal*, 13(2), pp.117–140.

BORMUTH, J.R., 1968. Readability in 1968.

BOTTING, N., SIMKIN, Z. AND CONTI-RAMSDEN, G., 2006. Associated reading skills in children with a history of specific language impairment (SLI). *Reading and writing*, *19*(1), pp.77-98.

*BOUCHER, A.N., BHAT, B.H., CLEMENS, N.H., VAUGHN, S. & O'DONNELL, K., 2024. Reading interventions for students in grades 3-12 with significant word reading difficulties. *Journal of Learning Disabilities*, 57(4), pp.203–223.

*BOWMAN, J.A., MCDONNELL, J., RYAN, J.H. & FUDGE-COLEMAN, O., 2019. Effective mathematics instruction for students with moderate and severe disabilities: A review of the literature. *Focus on Autism and Other Developmental Disabilities*, 34(4), pp.195–204.

*BRADY, S. & MASON, L.H., 2024. A literature review of morphological awareness interventions and the effects on literacy outcomes. *Learning Disability Quarterly*, 47(1), pp.16–29.

*BRAY, L., SKUBIK-PEPLASKI, C. & ACKERMAN, K.B., 2021. A systematic review of the effectiveness of interventions to improve handwriting and spelling in children with specific learning disabilities. *Journal of Occupational Therapy, Schools, & Early Intervention*.

BREADMORE, H.L., VARDY, E., CUNNINGHAM, A.J., KWOK, R.K. AND CARROLL, J.M., 2019. Literacy development: Evidence review.

BRIMO, D., 2016. Evaluating the effectiveness of a morphological awareness intervention: A pilot study. *Communication Disorders Quarterly*, *38*(1), pp.35-45.

BRITISH DYSLEXIA ASSOCIATION. (N.D.). *How to identify dyscalculia and maths learning difficulties*. Retrieved 13 February 2025, from https://www.bdadyslexia.org.uk/dyscalculia/how-can-i-identify-dyscalculia

BUTTERWORTH, B., 2010. Foundational numerical capacities and the origins of dyscalculia. *Trends in cognitive sciences*, *14*(12), pp.534-541.

CARLISLE, J.F., 2000. Awareness of the structure and meaning of morphologically complex words: Impact on reading. *Reading and writing*, *12*(3), pp.169-190.

*CARROLL, J., BRADLEY, L., CRAWFORD, H., HANNANT, P., JOHNSON, H. AND THOMPSON, A., 2017. *SEN support: A rapid evidence assessment*. Department for Education.

CARROLL, J.M., HOLDEN, C., KIRBY, P., THOMPSON, P.A., SNOWLING, M.J., DYSLEXIA DELPHI PANEL, BAGSHAW, S., BRACKENBURY, G., BRIGSTOCKE, S., CASTIGLIONE, L. AND DAULBY, B., 2025. Toward a consensus on dyslexia: findings from a Delphi study. *Journal of Child Psychology and Psychiatry*, *66*(7), pp.1065-1076.

CARROLL, J.M., SOLITY, J. AND SHAPIRO, L.R., 2016. Predicting dyslexia using prereading skills: The role of sensorimotor and cognitive abilities. *Journal of child psychology and psychiatry*, *57*(6), pp.750-758.

CATTS, H.W., HERRERA, S., NIELSEN, D.C. AND BRIDGES, M.S., 2015. Early prediction of reading comprehension within the simple view framework. *Reading and Writing*, *28*(9), pp.1407-1425.

CASTLES, A., RASTLE, K. AND NATION, K., 2018. Ending the reading wars: Reading acquisition from novice to expert. *Psychological science in the public interest*, *19*(1), pp.5-51.

CEPEDA, N. J., PASHLER, H., VUL, E., WIXTED, J. T. & ROHRER, D., 2006. Distributed practice in verbal recall tasks: A review and quantitative synthesis. *Psychological Bulletin*, 132(3), 354–380.

CHARD, D.J., VAUGHN, S. AND TYLER, B.J., 2002. A synthesis of research on effective interventions for building reading fluency with elementary students with learning disabilities. *Journal of learning disabilities*, *35*(5), pp.386-406.

CHATZAKI, A., KARAKOLIDIS, A., TZEKAKI, M. & VOSNIADOU, S., 2024. House of Numbers (HoN): A new tool for assessing symbolic and non-symbolic number sense in early education. Early Child Development and Care. [In press].

*CHO, E., DAHL-LEONARD, K., KEHOE, K., CAPIN, P., HALL, C. & SOLARI, E., 2023. Motivational practices in reading interventions for students with or at risk for dyslexia: Literature synthesis and meta-analysis. *Topics in Language Disorders*, 43(2), pp.119–145.

CHONG, S.L. AND SIEGEL, L.S., 2008. Stability of computational deficits in math learning disability from second through fifth grades. *Developmental Neuropsychology*, *33*(3), pp.300-317.

CIRINO, P.T., FLETCHER, J.M., EWING–COBBS, L., BARNES, M.A. AND FUCHS, L.S., 2007. Cognitive arithmetic differences in learning difficulty groups and the role of behavioral inattention. *Learning Disabilities Research & Practice*, *22*(1), pp.25-35.

*CLARK, G.T. & REUTERSKIÖLD, C., 2021. Orthographic support for word learning in clinical populations: A systematic review. *Language, Speech, and Hearing Services in Schools*, 52(3), pp.937–948.

CLEMENTS, D.H., SARAMA, J.H. AND LIU, X.H., 2008. Development of a measure of early mathematics achievement using the Rasch model: The Research-Based Early Maths Assessment. *Educational Psychology*, *28*(4), pp.457-482.

CLARKE, B., GERSTEN, R.M., DIMINO, J. AND ROLFHUS, E., 2011. Assessing student proficiency of number sense (ASPENS). *Longmont, CO: Cambium Learning Group, Sopris Learning*.

*COLLINS, A.A., LINDSTRÖM, E.R. AND COMPTON, D.L., 2018. Comparing students with and without reading difficulties on reading comprehension assessments: A meta-analysis. *Journal of learning disabilities*, *51*(2), pp.108-123.

*COZAD, L.E. & RICCOMINI, P.J., 2016. Effects of digital-based math fluency interventions on learners with math difficulties: A review of the literature. *Journal of Special Education Apprenticeship*, 5(2).

CRAGG, L., KEEBLE, S., RICHARDSON, S., ROOME, H.E. AND GILMORE, C., 2017. Direct and indirect influences of executive functions on mathematics achievement. *Cognition*, *162*, pp.12-26.

*CRUZ, A.M., RINCON, A.M.R., DUENAS, W.R.R., TORRES, D.A.Q. & BOHORQUEZ-HEREDIA, A.F., 2017. What does the literature say about using robots on children with disabilities? *Disability and Rehabilitation: Assistive Technology*, 12(5), pp.429–440.

DAVID, C.V., 2012. Working memory deficits in math learning difficulties: A meta-analysis. *International Journal of Developmental Disabilities*, *58*(2), pp.67-84.

*DANIEL, J. & WILLIAMS, K.J., 2021. Self-questioning strategy for struggling readers: A synthesis. *Remedial and Special Education*, 42(4), pp.248–261.

*DENNIS, M.S., SHARP, E., CHOVANES, J., THOMAS, A., BURNS, R.M., CUSTER, B. & PARK, J., 2016. A meta-analysis of empirical research on teaching students with mathematics learning difficulties. *Learning Disabilities Research & Practice*, 31(3), pp.156–168.

DENO, S.L., 2014. Whether thou goest... Perspectives on progress monitoring. In *Issues in educating students with disabilities* (pp. 77-99). Routledge.

DEPARTMENT FOR EDUCATION & DEPARTMENT OF HEALTH AND SOCIAL CARE. (2015). *Special educational needs and disability code of practice: 0 to 25 years* (Updated 2020). GOV.UK. Retrieved 13 February 2025, from https://www.gov.uk/government/publications/send-code-of-practice-0-to-25 Department for Education. (2022). *SEND Review: Right support, right place, right time*. UK Government. Retrieved 13 February 2025, from https://www.gov.uk/government/publications

DEPARTMENT FOR EDUCATION. (2024). *Suspensions and permanent exclusions in England: 2023-24 (Autumn term)*. UK Government. Retrieved 13 February 2025, from https://explore-education-statistics.service.gov.uk/find-statistics/suspensions-and-permanent-exclusions-in-england/2023-24-autumn-term

DEPARTMENT FOR EDUCATION. (2025). *Special educational needs in England: 2024-25*. UK Government. Retrieved 13 February 2025, from https://explore-education-statistics.service.gov.uk/find-statistics/special-educational-needs-in-england/2024-25

*DIDION, L., TOSTE, J.R., BENZ, S.A. & SHOGREN, K.A., 2021. How are self-determination components taught to improve reading outcomes for elementary students with or at risk for learning disabilities? *Learning Disability Quarterly*, 44(4), pp.288–303.

*DIXON, C., OXLEY, E., NASH, H. AND GELLERT, A.S., 2023. Does dynamic assessment offer an alternative approach to identifying reading disorder? A systematic review. *Journal of learning disabilities*, *56*(6), pp.423-439.

DIXON, C., THOMSON, J. AND FRICKE, S., 2020. Language and reading development in children learning English as an additional language in primary school in England. *Journal of Research in Reading*, *43*(3), pp.309-328.

DOCKRELL, J.E. AND SHIELD, B.M., 2006. Acoustical barriers in classrooms: the impact of noise on performance in the classroom. *British educational research journal*, *32*(3), pp.509-525.

*DOMÍNGUEZ-GONZÁLEZ, M.A., HERVÁS-GÓMEZ, C. & ROMÁN-GRAVÁN, P., 2023. Technologies as a support resource for people with disabilities: A systematic review. *Journal of Turkish Science Education*, 20(4), pp.619–631.

EHRI, L.C., NUNES, S.R., WILLOWS, D.M., SCHUSTER, B.V., YAGHOUB-ZADEH, Z. AND SHANAHAN, T., 2001. Phonemic awareness instruction helps children learn to read: Evidence from the National Reading Panel's meta-analysis. *Reading research quarterly*, *36*(3), pp.250-287.

ENGELMANN, S., 1983. *Reading mastery IV*. Atlantic Books, Limited.

ERFORD, B.T., BAGLEY, D.L., HOPPER, J.A., LEE, R.M., PANAGOPULOS, K.A. AND PRELLER, D.B., 1998. Reliability and validity of the Math Essential Skill Screener—Elementary Version (MESS-E). *Psychology in the Schools*, *35*(2), pp.127-135.

*FAGGELLA-LUBY, M.N., DREW, S.V. & SCHUMAKER, J.B., 2015. Not such a simple story: Contradictory evidence from a review of story structure research for students at risk. *Learning Disabilities Research & Practice*, 30(2), pp.61–75.

FOGARTY, M., OSLUND, E., SIMMONS, D., DAVIS, J., SIMMONS, L., ANDERSON, L., CLEMENS, N. AND ROBERTS, G., 2014. Examining the effectiveness of a multicomponent reading comprehension intervention in middle schools: A focus on treatment fidelity. *Educational Psychology Review*, *26*(3), pp.425-449.

FUCHS, D. AND FUCHS, L.S., 2006. Introduction to response to intervention: What, why, and how valid is it?. *Reading research quarterly*, *41*(1), pp.93-99.

FUCHS, L.S., FUCHS, D., POWELL, S.R., SEETHALER, P.M., CIRINO, P.T. AND FLETCHER, J.M., 2008. Intensive intervention for students with mathematics disabilities: Seven principles of effective practice. *Learning Disability Quarterly*, *31*(2), pp.79-92.

GARCÍA, J.R. AND CAIN, K., 2014. Decoding and reading comprehension: A meta-analysis to identify which reader and assessment characteristics influence the strength of the relationship in English. *Review of educational research*, *84*(1), pp.74-111.

GARRITTY, C., HAMEL, C., TRIVELLA, M., GARTLEHNER, G., NUSSBAUMER-STREIT, B., DEVANE, D., KAMEL, C., GRIEBLER, U. AND KING, V.J., 2024.

Updated recommendations for the Cochrane rapid review methods guidance for rapid reviews of effectiveness. *bmj*, *384*.

GATHERCOLE, S.E., WOOLGAR, F., KIEVIT, R.A., ASTLE, D., MANLY, T., HOLMES, J. AND CALM TEAM, 2016. How common are WM deficits in children with difficulties in reading and mathematics?. *Journal of applied research in memory and cognition*, *5*(4), pp.384-394.

GEARY, D.C., 1993. Mathematical disabilities: cognitive, neuropsychological, and genetic components. *Psychological bulletin*, *114*(2), p.345.

GEARY, D.C., HOARD, M.K. AND BAILEY, D.H., 2012. Fact retrieval deficits in low achieving children and children with mathematical learning disability. *Journal of learning disabilities*, *45*(4), pp.291-307.

GEARY, D.C., HOARD, M.K., NUGENT, L. AND BAILEY, D.H., 2013. Adolescents' functional numeracy is predicted by their school entry number system knowledge. *PloS one*, *8*(1), p.e54651.

*GOLDFELD, S., BEATSON, R., WATTS, A., SNOW, P., GOLD, L., LE, H.N.D., EDWARDS, S., CONNELL, J., STARK, H., SHINGLES, B., BARNETT, T., QUACH, J. & EADIE, P., 2022. Tier 2 oral language and early reading interventions for preschool to grade 2 children: A restricted systematic review. *Australian Journal of Learning Difficulties*, 27(1), pp.65–113.

GOLDSTEIN, H., KELLEY, E., GREENWOOD, C., MCCUNE, L., CARTA, J., ATWATER, J., GUERRERO, G., MCCARTHY, T., SCHNEIDER, N. AND SPENCER, T., 2016. Embedded instruction improves vocabulary learning during automated storybook reading among high-risk preschoolers. *Journal of Speech, Language, and Hearing Research*, *59*(3), pp.484-500.

GOOD, J.E., LANCE, D.M. AND RAINEY, J., 2015. The effects of morphological awareness training on reading, spelling, and vocabulary skills. *Communication Disorders Quarterly*, *36*(3), pp.142-151.

*GUO, D., FENG, L. AND HODGES, T.S., 2023. Differentiating reading profiles of children with specific comprehension deficits from skilled readers: A systematic review. *Learning Disability Quarterly*, *46*(2), pp.134-146.

HALL, M.S. AND BURNS, M.K., 2018. Meta-analysis of targeted small-group reading interventions. *Journal of School Psychology*, *66*, pp.54-66.

*HALL, C., STEINLE, P.K. & VAUGHN, S., 2019. Reading instruction for English learners with learning disabilities: What do we already know, and what do we still need to learn? *New Directions for Child and Adolescent Development*, 166, pp.145–189.

*HALL-MILLS, S.S. & MARANTE, L.M., 2022. Explicit text structure instruction supports expository text comprehension for adolescents with learning disabilities: A systematic review. *Learning Disability Quarterly*, 45(1), pp.55–68.

HATTIE, J., 2008. *Visible learning: A synthesis of over 800 meta-analyses relating to achievement*. routledge.

HAWES, Z., MOSS, J., CASWELL, B., SEO, J. AND ANSARI, D., 2019. Relations between numerical, spatial, and executive function skills and mathematics achievement: A latent-variable approach. *Cognitive Psychology*, *109*, pp.68-90.

*HOLMAN, K., 2023. Interventions for students with developmental dyscalculia: A systematic literature review. *Insights into Learning Disabilities*, 20(2), pp.135–151.

HOOVER, W.A. AND GOUGH, P.B., 1990. The simple view of reading. *Reading and writing*, *2*(2), pp.127-160.

HOWARD, S.J. AND MELHUISH, E., 2017. An early years toolbox for assessing early executive function, language, self-regulation, and social development: Validity, reliability, and preliminary norms. *Journal of psychoeducational assessment*, *35*(3), pp.255-275.

*HWANG, J. & RICCOMINI, P.J., 2016. Enhancing mathematical problem solving for secondary students with or at risk of learning disabilities: A literature review. *Learning Disabilities Research & Practice*, 31(3), pp.169–181.

*JIANG, Y., WANG, Q. & WENG, Z., 2022. The influence of technology in educating English language learners at-risk or with disabilities: A systematic review. *Center for Educational Policy Studies Journal*, 12(4), pp.53–74.

*JITENDRA, A.K., NELSON, G. & PULLES, S.M., 2016. Is mathematical representation of problems an evidence-based strategy for students with mathematics difficulties? *Exceptional Children*, 83(1), pp.17–25.

*JITENDRA, A.K., LEIN, A.E., IM, S.-H., ALGHAMDI, A.A., HEFTE, S.B. & MOUANOUTOUA, J., 2018. Mathematical interventions for secondary students with learning disabilities and mathematics difficulties: A meta-analysis. *Exceptional Children*, 84(2), pp.177–196.

JOHNSTON, R. AND WATSON, J., 2007. *Teaching synthetic phonics*. Learning Matters.

JORDAN, N.C., GLUTTING, J. & RAMINENI, C., 2010. The Number Sense Screener (NSS): A test for identifying young children at risk for mathematics difficulties. *Journal of Psychoeducational Assessment*, 28(4), pp.295–307.

JORDAN, T.R., THOMAS, S.M., PATCHING, G.R. AND SCOTT-BROWN, K.C., 2003. Assessing the importance of letter pairs in initial, exterior, and interior positions in reading. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *29*(5), p.883.

JUST, M.A. AND CARPENTER, P.A., 1992. A capacity theory of comprehension: individual differences in working memory. *Psychological review*, *99*(1), p.122.

*KALDENBERG, E.R., WATT, S.J. & THERRIEN, W.J., 2015. Reading instruction in science for students with learning disabilities. *Learning Disability Quarterly*, 38(3), pp.160–173.

KELLY, N. AND NORWICH, B., 2013. *Moderate learning difficulties and the future of inclusion*. Routledge.

*KILGUS, S.P., EKLUND, K., MAGGIN, D.M., TAYLOR, C.N. AND ALLEN, A.N., 2018. The Student Risk Screening Scale: A reliability and validity generalization meta-analysis. *Journal of Emotional and Behavioral Disorders*, *26*(3), pp.143-155.

*KIM, S.J. & XIN, Y.P., 2022. A synthesis of computer-assisted mathematical word problem-solving instruction for students with learning disabilities or difficulties. *Learning Disabilities: A Contemporary Journal*, 20(1), pp.27–45.

KIRBY, J.R., DEACON, S.H., BOWERS, P.N., IZENBERG, L., WADE-WOOLLEY, L. AND PARRILA, R., 2012. Children's morphological awareness and reading ability. *Reading and writing*, *25*(2), pp.389-410.

KIRBY, J.R. AND SAVAGE, R.S., 2008. Can the simple view deal with the complexities of reading?. *Literacy*, *42*(2), pp.75-82.

KIRK, C. AND GILLON, G.T., 2009. Integrated morphological awareness intervention as a tool for improving literacy. *Language, speech, and hearing services in schools*, *40*(3), pp.341-351.

KOHNEN, S., NICKELS, L. AND CASTLES, A., 2009. Assessing spelling skills and strategies: A critique of available resources. *Australian journal of learning difficulties*, *14*(1), pp.113-150.

KOVAS, Y., HAWORTH, C.M., PETRILL, S.A. AND PLOMIN, R., 2007. Mathematical ability of 10-year-old boys and girls: genetic and environmental etiology of typical and low performance. *Journal of learning disabilities*, *40*(6), pp.554-567.

*KRANZ, A.E., SERRY, T.A. AND SNOW, P.C., 2024. Twice-exceptionality unmasked: A systematic narrative review of the literature on identifying dyslexia in the gifted child. *Dyslexia*, *30*(1), p.e1763.

*KUCUKALKAN, K., BEYAZSACLI, M. & OZ, A.S., 2019. Examination of the effects of computer-based mathematics instruction methods in children with mathematical learning difficulties: A meta-analysis. *Behaviour & Information Technology*, 38(9), pp.913–923.

*KUDER, S.J., 2017. Vocabulary instruction for secondary students with reading disabilities: An updated research review. *Learning Disability Quarterly*, 40(3), pp.155–164.

LAM, E.A. AND MCMASTER, K.L., 2014. Predictors of responsiveness to early literacy intervention: A 10-year update. *Learning Disability Quarterly*, *37*(3), pp.134-147.

LANDERL, K., BEVAN, A. AND BUTTERWORTH, B., 2004. Developmental dyscalculia and basic numerical capacities: A study of 8–9-year-old students. *Cognition*, *93*(2), pp.99-125.

LANDERL, K. AND MOLL, K., 2010. Comorbidity of learning disorders: prevalence and familial transmission. *Journal of child psychology and psychiatry*, *51*(3), pp.287-294.

*LEE, J. & YOON, S.Y., 2017. The effects of repeated reading on reading fluency for students with reading disabilities: A meta-analysis. *Journal of Learning Disabilities*, 50(2), pp.213–224.

*LEE, Y. & DE LA PAZ, S., 2021. Science writing intervention research for students with and at risk for learning disabilities, and English learners: A systematic review. *Learning Disability Quarterly*, 44(4), pp.261–274.

LESH, R., POST, T.R. AND BEHR, M., 1987. Representations and translations among representations in mathematics learning and problem solving. In *Problems of representations in the teaching and learning of mathematics* (pp. 33-40). Lawrence Erlbaum.

LEVESQUE, K.C., BREADMORE, H.L. AND DEACON, S.H., 2021. How morphology impacts reading and spelling: Advancing the role of morphology in models of literacy development. *Journal of Research in Reading*, *44*(1), pp.10-26.

LIN, X., MULLIGAN, J.T. & MITCHELMORE, M., 2021. Parent Ratings of Numeracy Skills: A questionnaire for parents of preschool children. *Early Childhood Research Quarterly*, 54, pp.75–85.

LONIGAN, C.J. AND PHILLIPS, B.M., 2016. Response to instruction in preschool: Results of two randomized studies with children at significant risk of reading difficulties. *Journal of educational psychology*, *108*(1), p.114.

*LOUICK, R., EMERY, A., MUENKS, K. & O'GRADY, M., 2023. Attending to motivation during vocabulary interventions for students with or at risk for learning disabilities: A review of the literature. *Topics in Language Disorders*, 43(2), pp.97–118.

LOVETT, M.W., BORDEN, S.L., DELUCA, T., LACERENZA, L., BENSON, N.J. AND BRACKSTONE, D., 1994. Treating the core deficits of developmental dyslexia: Evidence of transfer of learning after phonologically-and strategy-based reading training programs. *Developmental psychology*, *30*(6), p.805.

*MAK, C., WHITTINGHAM, K., CUNNINGTON, R. & BOYD, R.N., 2018. Efficacy of mindfulness-based interventions for attention and executive function in children and adolescents: A systematic review. *Mindfulness*, 9(1), pp.59–78.

*MATRE, M.E. & CAMERON, D.L., 2024. A scoping review on the use of speech-to-text technology for adolescents with learning difficulties in secondary education. *Disability and Rehabilitation: Assistive Technology*, 19(3), pp.1103–1116.

MAUGHAN, B., MESSER, J., COLLISHAW, S., PICKLES, A., SNOWLING, M., YULE, W. AND RUTTER, M., 2009. Persistence of literacy problems: spelling in adolescence and at mid-life. *Journal of Child Psychology and Psychiatry*, *50*(8), pp.893-901.

MAZZOCCO, M.M., DEVLIN, K.T. AND MCKENNEY, S.J., 2008. Is it a fact? Timed arithmetic performance of children with mathematical learning disabilities (MLD) varies as a function of how MLD is defined. *Developmental neuropsychology*, *33*(3), pp.318-344.

MCBREEN, M. AND SAVAGE, R., 2021. The impact of motivational reading instruction on the reading achievement and motivation of students: A systematic review and meta-analysis. *Educational psychology review*, *33*(3), pp.1125-1163.

MCINTOSH, K. AND GOODMAN, S., 2016. *Integrated multi-tiered systems of support: Blending RTI and PBIS*. Guilford Publications.

MELBY-LERVÅG, M. AND HULME, C., 2013. Is working memory training effective? A meta-analytic review. *Developmental psychology*, *49*(2), p.270.

MELBY-LERVÅG, M., REDICK, T.S. AND HULME, C., 2016. Working memory training does not improve performance on measures of intelligence or other measures of "far transfer" evidence from a meta-analytic review. *Perspectives on Psychological Science*, *11*(4), pp.512-534.

*MIZE, M., PARK, Y. & MARTIN, M., 2023. Technology-assisted reading fluency interventions for students with reading difficulties: Evidence from a meta-analytic approach of single case design studies. *Disability and Rehabilitation: Assistive Technology*, 18(8), pp.1544–1554.

MORSANYI, K., VAN BERS, B.M., MCCORMACK, T. AND MCGOURTY, J., 2018. The prevalence of specific learning disorder in mathematics and comorbidity with other developmental disorders in primary school-age children. *British Journal of Psychology*, *109*(4), pp.917-940.

*MYERS, J.A., BROWNELL, M.T., GRIFFIN, C.C., HUGHES, E.M., WITZEL, B.S., GAGE, N.A., PEYTON, D. & ACOSTA, K., 2021. Mathematics interventions for adolescents with mathematics difficulties: A meta-analysis. *Learning Disabilities Research & Practice*, 36(2), pp.145–166.

*MYERS, J.A., HUGHES, E.M., WITZEL, B.S., ANDERSON, R.D. & OWENS, J., 2023. A meta-analysis of mathematical interventions for increasing the word problem-solving performance of upper elementary and secondary students with mathematics difficulties. *Journal of Research on Educational Effectiveness*, 16(1), pp.35–55.

NATIONAL READING PANEL (US), NATIONAL INSTITUTE OF CHILD HEALTH AND HUMAN DEVELOPMENT (US), 2000. *Teaching children to read: An evidence-based assessment of the scientific research literature on reading and its implications for reading instruction: Reports of the subgroups*. National Institute of Child Health and Human Development, National Institutes of Health.

NEALE, M. D. (1958). *Neale Analysis of Reading Ability*. London: Macmillan.

NEALE, M. D. (1997). *Neale Analysis of Reading Ability – Revised*. Windsor: NFER-Nelson.

NEALE, M. D., CHRISTOPHERS, U., & WHETTON, C. (1989). *Neale Analysis of Reading Ability –Revised British Edition*. Windsor: NFER-Nelson

*NELSON-STROUTS, K., GILLISPIE, W.M. AND BRIDGES, M., 2020. The Use of Dynamic Assessment in the Evaluation of Early Literacy Skills. EBP Briefs. Volume 14, Issue 4. *EBP Briefs (Evidence-based Practice Briefs)*.

*NILVIUS, C., CARLSSON, R., FÄLTH, L. & NORDSTRÖM, T., 2021. Tier 2 interventions within the RtI-model for developing students' word decoding: A systematic review and meta-analysis. *Cogent Education*, 8(1), p.1939536.

NORBURY, C.F., VAMVAKAS, G., GOOCH, D., BAIRD, G., CHARMAN, T., SIMONOFF, E. AND PICKLES, A., 2017. Language growth in children with heterogeneous

language disorders: a population study. *Journal of Child Psychology and Psychiatry*, *58*(10), pp.1092-1105.

OUTHWAITE, L.A., AUNIO, P., LEUNG, J.K.Y. AND VAN HERWEGEN, J., 2024. Measuring mathematical skills in early childhood: A systematic review of the psychometric properties of early maths assessments and screeners. *Educational Psychology Review*, *36*(4), p.110.

*PARK, J., BOUCK, E.C. & JOSOL, C.K., 2020. Target selection in speech therapy: Is a non-developmental approach more efficient than a developmental approach? *Research in Developmental Disabilities*, 105, p.103747.

PARTANEN, M. AND SIEGEL, L.S., 2014. Long-term outcome of the early identification and intervention of reading disabilities. *Reading and Writing*, *27*(4), pp.665-684.

*PELTIER, C., MORIN, K.L., BOUCK, E.C., LINGO, M.E., PULOS, J.M., SCHEFFLER, F.A., SUK, A., MATHEWS, L.A., SINCLAIR, T.E. & DEARDORFF, M.E., 2020. A meta-analysis of single-case research using mathematics manipulatives with students at risk or identified with a disability. *Journal of Special Education*, 54(1), pp.3–15.

PENG, P. AND FUCHS, D., 2016. A meta-analysis of working memory deficits in children with learning difficulties: Is there a difference between verbal domain and numerical domain?. *Journal of learning disabilities*, *49*(1), pp.3-20.

PERFETTI, C.A., 1985. *Reading ability*. oxford university Press.

PITTAS, E. AND NUNES, T., 2014. The relation between morphological awareness and reading and spelling in Greek: A longitudinal study. *Reading and Writing*, *27*(8), pp.1507-1527.

*PONTIKAS, C.-M., TSOUKALAS, E. & SERDARI, A., 2022. A map of assistive technology educative instruments in neurodevelopmental disorders. *Disability and Rehabilitation: Assistive Technology*, 17(7), pp.738–746.

PRESSLEY, M. AND GASKINS, I.W., 2006. Metacognitively competent reading comprehension is constructively responsive reading: How can such reading be developed in students?. *Metacognition and learning*, *1*(1), pp.99-113.

PURPURA, D.J. AND LONIGAN, C.J., 2015. Early numeracy assessment: The development of the preschool early numeracy scales. *Early education and development*, *26*(2), pp.286-313.

RE, A.M., PEDRON, M., TRESSOLDI, P.E. AND LUCANGELI, D., 2014. Response to specific training for students with different levels of mathematical difficulties. *Exceptional Children*, *80*(3), pp.337-352.

*ROBINSON, K.E., KAIZAR, E., CATROPPA, C., GODFREY, C. & YEATES, K.O., 2014. Systematic review and meta-analysis of cognitive interventions for children with central nervous system disorders and neurodevelopmental disorders. *Journal of Pediatric Psychology*, 39(8), pp.846–865.

*RODGERS, D.B. & LOVEALL, S.J., 2023. Writing interventions for students with intellectual and developmental disabilities: A meta-analysis. *Remedial and Special Education*, 44(3), pp.239–252.

*ROITSCH, J., GUMPERT, M., SPRINGLE, A. & RAYMER, A.M., 2021. Writing instruction for students with learning disabilities: Quality appraisal of systematic reviews and meta-analyses. *Reading & Writing Quarterly*, 37(1), pp.32–44.

*ROJO, M., KING, S., GERSIB, J. & BRYANT, D.P., 2023. Rational number interventions for students with mathematics difficulties: A meta-analysis. *Remedial and Special Education*, 44(3), pp.225–238.

ROSE, J., 2009. *Identifying and teaching children and young people with dyslexia and literacy difficulties*. Nottingham: Department for Children, Schools and Families.

ROSS, H., 2020. 'Review 2: The support systems for individuals with SpLDs' in Council for Science and Technology, Current Understanding, Support Systems, and Technology-led Interventions for Specific Learning Difficulties Evidence reviews commissioned for work by the Council for Science and Technology London: The Council for Science and Technology Available from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/926052/specific-learning-difficulties-spld-cst-report.pdf [Accessed 13 February 2025]

RYDER, J.F., TUNMER, W.E. AND GREANEY, K.T., 2008. Explicit instruction in phonemic awareness and phonemically based decoding skills as an intervention strategy for struggling readers in whole language classrooms. *Reading and Writing*, *21*(4), pp.349-369.

*SADDLER, B., ELLIS-ROBINSON, T. & ASARO-SADDLER, K., 2018. Using sentence combining instruction to enhance the writing skills of children with learning disabilities. *Learning Disabilities: A Contemporary Journal*, 16(2), pp.191–202.

SAVE THE CHILDREN., 2019. *International Development and Early Learning Assessment (IDELA) – Emergent Numeracy*. London: Save the Children.

*SCAMMACCA, N.K., ROBERTS, G., VAUGHN, S. & STUEBING, K.K., 2015. A meta-analysis of interventions for struggling readers in grades 4-12: 1980–2011. *Journal of Learning Disabilities*, 48(4), pp.369–390.

SCARBOROUGH, H.S., NEUMAN, S. AND DICKINSON, D., 2009. Connecting early language and literacy to later reading (dis) abilities: Evidence, theory, and practice. *Approaching difficulties in literacy development: Assessment, pedagogy and programmes*, *10*, pp.23-38.

SCHWENK, C., SASANGUIE, D., KUHN, J.T., KEMPE, S., DOEBLER, P. AND HOLLING, H., 2017. (Non-) symbolic magnitude processing in children with mathematical difficulties: A meta-analysis. *Research in developmental disabilities*, *64*, pp.152-167.

SHALEV, R.S. AND VON ASTER, M., 2008. Identification, classification, and prevalence of developmental dyscalculia. *Encyclopedia of language and literacy development*, pp.published-online.

SHEA, B.J., REEVES, B.C., WELLS, G., THUKU, M., HAMEL, C., MORAN, J., MOHER, D., TUGWELL, P., WELCH, V., KRISTJANSSON, E. AND HENRY, D.A., 2017. AMSTAR 2: a critical appraisal tool for systematic reviews that include randomised or non-randomised studies of healthcare interventions, or both. *bmj*, *358*.

SNELLING, M., DAWES, A., BIERSTEKER, L., GIRDWOOD, E. AND TREDOUX, C., 2019. The development of a South African Early Learning Outcomes Measure: A South African instrument for measuring early learning program outcomes. *Child: Care, Health and Development*, *45*(2), pp.257-270.

SNOWLING, M., BISHOP, D.V.M. AND STOTHARD, S.E., 2000. Is preschool language impairment a risk factor for dyslexia in adolescence?. *The Journal of Child Psychology and Psychiatry and Allied Disciplines*, *41*(5), pp.587-600.

SNOWLING, M.J., GALLAGHER, A. AND FRITH, U., 2003. Family risk of dyslexia is continuous: Individual differences in the precursors of reading skill. *Child development*, *74*(2), pp.358-373.

SNOWLING, M.J. AND MELBY-LERVÅG, M., 2016. Oral language deficits in familial dyslexia: A meta-analysis and review. *Psychological bulletin*, *142*(5), p.498.

*SNYDER, S.M. AND AYRES, K., 2020. Investigating the usage of reading curriculum-based measurement (CBM-R) to formatively assess the basic reading skills of students with intellectual disability. *Education and Training in Autism and Developmental Disabilities*, *55*(1), pp.60-74.

*SOHN, H., ACOSTA, K., BROWNELL, M.T., GAGE, N.A., TOMPSON, E. & PUDVAH, C., 2023. A meta-analysis of interventions to improve reading comprehension outcomes for adolescents with reading difficulties. *Learning Disabilities Research & Practice*, 38(2), pp.85–103.

*SPOONER, F., ROOT, J.R., SAUNDERS, A.F. & BROWDER, D.M., 2019. An updated evidence-based practice review on teaching mathematics to students with moderate and severe developmental disabilities. *Remedial and Special Education*, 40(3), pp.150–165.

STANOVICH, K.E. AND SIEGEL, L.S., 1994. Phenotypic performance profile of children with reading disabilities: A regression-based test of the phonological-core variable-difference model. *Journal of educational psychology*, *86*(1), p.24.

*STEVENS, E.A., RODGERS, M.A. & POWELL, S.R., 2018. Mathematics interventions for upper elementary and secondary students: A meta-analysis of research. *Remedial and Special Education*, 39(6), pp.327–340.

*STEVENS, E.A., AUSTIN, C., MOORE, C., SCAMMACCA, N., BOUCHER, A.N. & VAUGHN, S., 2021. Current state of the evidence: Examining the effects of Orton-Gillingham reading interventions for students with or at risk for word-level reading disabilities. *Exceptional Children*, 87(4), pp.397–417.

SUMNER, E., CONNELLY, V. AND BARNETT, A.L., 2013. Children with dyslexia are slow writers because they pause more often and not because they are slow at handwriting execution. *Reading and writing*, *26*(6), pp.991-1008.

SUMNER, E., CONNELLY, V. AND BARNETT, A.L., 2014. The influence of spelling ability on handwriting production: children with and without dyslexia. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *40*(5), p.1441.

SUMNER, E., CONNELLY, V. AND BARNETT, A.L., 2016. The influence of spelling ability on vocabulary choices when writing for children with dyslexia. *Journal of learning disabilities*, *49*(3), pp.293-304.

SUMNER, E. AND CONNELLY, V., 2020. Writing and revision strategies of students with and without dyslexia. *Journal of Learning Disabilities*, *53*(3), pp.189-198.

SWELLER, J., 2011. Cognitive load theory. In *Psychology of learning and motivation* (Vol. 55, pp. 37-76). Academic Press.

TANAKA, H., BLACK, J.M., HULME, C., STANLEY, L.M., KESLER, S.R., WHITFIELD-GABRIELI, S., REISS, A.L., GABRIELI, J.D. AND HOEFT, F., 2011. The brain basis

of the phonological deficit in dyslexia is independent of IQ. *Psychological science*, *22*(11), pp.1442-1451.

TILSTRA, J., MCMASTER, K., VAN DEN BROEK, P., KENDEOU, P. AND RAPP, D., 2009. Simple but complex: Components of the simple view of reading across grade levels. *Journal of research in reading*, *32*(4), pp.383-401.

TORGESEN, J.K., ALEXANDER, A.W., WAGNER, R.K., RASHOTTE, C.A., VOELLER, K.K. AND CONWAY, T., 2001. Intensive remedial instruction for children with severe reading disabilities: Immediate and long-term outcomes from two instructional approaches. *Journal of learning disabilities*, *34*(1), pp.33-58.

VAN BERGEN, E., VAN DER LEIJ, A. AND DE JONG, P.F., 2014. The intergenerational multiple deficit model and the case of dyslexia. *Frontiers in human neuroscience*, *8*, p.346.

VAN HERWEGEN, J., THOMAS, M., GORDON, R., MARSHALL, C., DOCKRELL, J. AND MASTERMAN, T., 2023. MetaSENSe: Raising educational outcomes for pupils with special educational needs and disabilities.

VESSONEN, T., WIDLUND, A., HAKKARAINEN, A. AND AUNIO, P., 2023. Validating the early numeracy teacher rating scale for preschoolers (TRS–EN). *European Early Childhood Education Research Journal*, *31*(2), pp.205-224.

*VICO-QUESADA, R., MARTÍN-MARTÍN, J. AND GONZÁLEZ-SÁNCHEZ, M., 2023. Functional Assessment of Handwriting Among Children: A Systematic Review of the Psychometric Properties.

*WANZEK, J., STEVENS, E.A., WILLIAMS, K.J., SCAMMACCA, N., VAUGHN, S. & SARGENT, K., 2018. Current evidence on the effects of intensive early reading interventions. *Grantee Submission*.

WEILAND, C., WOLFE, C.B., HURWITZ, M.D., CLEMENTS, D.H. & SARAMA, J., 2012. The effectiveness of a short form of the Research-Based Early Mathematics Assessment (REMA-SF). *Early Childhood Research Quarterly*, 27(3), pp.541–554.

WILLBURGER, E., FUSSENEGGER, B., MOLL, K., WOOD, G. AND LANDERL, K., 2008. Naming speed in dyslexia and dyscalculia. *Learning and individual differences*, *18*(2), pp.224-236.

WILLCUTT, E.G., MCGRATH, L.M., PENNINGTON, B.F., KEENAN, J.M., DEFRIES, J.C., OLSON, R.K. AND WADSWORTH, S.J., 2019. Understanding comorbidity between specific learning disabilities. *New directions for child and adolescent development*, *2019*(165), pp.91-109.

WOLTER, J.A. AND DILWORTH, V., 2014. The effects of a multilinguistic morphological awareness approach for improving language and literacy. *Journal of Learning Disabilities*, *47*(1), pp.76-85.

WOODCOCK, R. AND BATTERY, J.M.W.J.P., 1989. Revised. *DLM Teaching Resources*.

ZHENG, X., SWANSON, H.L. AND MARCOULIDES, G.A., 2011. Working memory components as predictors of children's mathematical word problem solving. *Journal of experimental child psychology*, *110*(4), pp.481-498.

*ZOLKIPLI, N.Z., RAHMATULLAH, B., MOHAMAD SAMURI, S., ÁRVA, V. & SUGIYO PRANOTO, Y.K., 2023. 'Leave no one behind': A systematic literature review on game-based learning courseware for preschool children with learning disabilities. *Southeast Asia Early Childhood*, 12(1), pp.79–97.

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